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CAMP LONELY SITE CLEANUP PLAN (LANDFILLS AND ASSOCIATED PAD)

Final

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Prepared for:

Husky Oil Operations Limited
707 8th Ave. SW, Box 6525, Station "D"
Calgary, Alberta, CANADA T2P 3G7

This document has been prepared by SLR International Corp. The material and data in this cleanup plan were prepared under the supervision and direction of the undersigned.

Wendy Hansen
Quality Assurance Reviewer

Bret Berglund, C.P.G.
Project Manager

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ACRONYMS

AAC	Alaska Administrative Code
ADEC	Alaska Department of Environmental Conservation
ADNR	Alaska Department of Natural Resources
AST	aboveground storage tank
AWQS	Alaska Water Quality Standards
bgs	below ground surface
BLM	Bureau of Land Management
BTEX	benzene, toluene, ethylbenzene, and xylenes
CFR	Code of Federal Regulations
CIRI	Cook Inlet Region, Incorporated
COC	Contaminant of Concern
CY	cubic yards
DRO	diesel range organics
EM	electromagnetic
EPA	Environmental Protection Agency
FS	feasibility study
ft	feet
ft/yr	feet per year
GRO	gasoline range organics
Husky	Husky Oil Operations Limited (HOOL)
LCS	laboratory control sample
LCSD	laboratory control sample duplicate
LCY	loose cubic yards
mg/Kg	milligrams per kilogram
MS	matrix spike
MSD	matrix spike duplicate
NPRA	National Petroleum Reserve-Alaska
NSB	North Slope Borough
PAH	polynuclear aromatic hydrocarbon
PCB	polychlorinated biphenyls
PCS	petroleum contaminated soil
PID	photoionization detector
PPE	personal protective equipment
ppm	parts per million
QA	quality assurance
QAPP	Quality Assurance Project Plan
QC	quality control
RCRA	Resource Conservation and Recovery Act
RRO	residual range organics
RSD	relative standard deviation
SLR	SLR International Corp
SRRS	short range radar station
SWPPP	Storm Water Pollution Prevention Plan
TAH	total aromatic hydrocarbons

TAqH	total aqueous hydrocarbons
TSD	treatment, storage, and disposal
USAF	U.S. Air Force
USGS	U.S. Geological Survey
VOC	volatile organic compound

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1. INTRODUCTION

This Cleanup Plan describes the approach and methods for performing remedial actions at Camp Lonely Site. The cleanup is being performed under the regulatory requirements of Title 18, Chapter 75, Article 3, of the Alaska Administrative Code (AAC) Discharge Reporting, Cleanup, and Disposal of Oil and Other Hazardous Substances regulations for the State of Alaska. The lead regulatory agency responsible for oversight and approval of the cleanup is the Alaska Department of Environmental Conservation (ADEC). For the purposes of this Cleanup Plan, the Camp Lonely site consists of the gravel pad, including the associated landfills and contaminated soil.

Camp Lonely is situated in the Arctic on the Beaufort Sea in northern Alaska (Figure 1). It is about 3.5 miles west of Pitt Point between Smith and Harrison Bays and approximately 120 miles west-northwest of Prudhoe Bay, Alaska. It is approximately one mile northwest of the inactive Point Lonely Short Range Radar Station (SRRS), managed by the U.S. Air Force (USAF). The nearest communities are Nuiqsut (75 miles southeast) and Barrow (85 miles northwest). Geodetic coordinates for Camp Lonely (center of the pad) are 70.9092 N latitude, 153.2995 W longitude. The site is located in Section 18 of Township 18N, Range 5W, Umiat Meridian. It is located within the U.S. National Petroleum Reserve-Alaska (NPRA), which is managed by the U.S. Bureau of Land Management (BLM).

Camp Lonely was a former base of operations for drilling in the NPRA. Currently, Camp Lonely has no buildings, structures, or facilities and is inactive. There has been little activity at the site since the 1980s except for surface cleanup and occasional environmental investigations. The structures and materials formerly on the Camp Lonely pad were removed during the summer of 2005. The most notable feature now is the gravel pad, which is approximately 15 acres in size.

Camp Lonely is not connected to the Alaska road system. Overland access is possible in the winter, and sea access can occur during the summer. The nearest airstrip is located at the Point Lonely SRRS. There is no longer a road between Camp Lonely and Point Lonely SRRS due to coastal erosion.

The Point Lonely SRRS was constructed as an auxiliary DEW Line Station in 1953 and was active until 1989. In 1993, the Point Lonely installation was converted to an SRRS, which operated until 2005. This station is presently undergoing an independent response action managed by the USAF. Freshwater for the station and Camp Lonely have traditionally been obtained from a freshwater lake accessible by road from the SRRS (Figure 2).

1.1 OBJECTIVES

The objective of the cleanup is to achieve the status of cleanup complete in accordance with 18 AAC 75.380(d) (1). This cleanup complete status may initially be issued as cleanup complete with administrative (institutional) controls if the monitoring program is still ongoing. Post closure monitoring and reporting will continue as needed until the conditions for their termination are reached, at which time the site status will be cleanup complete, without further institutional controls or actions. In addition, portions of the remaining pad, impacted by cleanup activities, will be returned to a compacted, graded, usable condition after cleanup activities are complete.

1.2 SCOPE OF WORK

This Cleanup Plan consists of four primary steps: (1) Excavation of contaminated soil above site-specific cleanup levels and excavation of solid waste; (2) Offsite disposal of solid waste and quantities of hazardous substances previously identified or assumed to be present that are not suitable for onsite treatment by landfarming; (3) Onsite landfarming of petroleum contaminated soil (PCS) to reduce concentrations below cleanup levels; and, (4) Post-closure (cleanup) surface water monitoring.

Cleanup activities will include the excavation of buried solid waste within two landfill areas and excavation of other areas with PCS on the pad. Solid waste and contaminated soil will be segregated. Solid waste will be shipped offsite for disposal. The PCS at the site is predominantly sandy gravel in texture. It will be treated on the existing pad through landfarming. Landfarming will consist of spreading the soil on the interior portion of the pad approximately 1 to 1.5 feet (ft) thick and tilling it periodically to promote biodegradation of the petroleum hydrocarbons. All work is anticipated to occur within the boundaries of the existing pad.

This Cleanup Plan covers the removal actions and landfarming portions of the project. The post removal action Monitoring Plan will be submitted separately. Other plans to be prepared under separate cover include a Site Operations Plan, which will cover camp operations, mobilization and demobilization activities, and a Health and Safety Plan.

1.3 PROJECT ORGANIZATION AND SCHEDULE

As stated previously, the lead regulatory agency responsible for oversight and approval of the cleanup is the ADEC. The cleanup is being managed and coordinated by Husky Oil Operations Limited (HOOL), (Husky), on behalf of the Potentially Responsible Parties. The Site Project Manager will be Husky employee Steve Kullman or his designee. SLR International Corp (SLR) will serve as an onsite representative for Husky and provide technical services on the project, including field screening, analytical sampling, waste characterization, and agency reporting. The prime cleanup contractor will be responsible for executing the onsite cleanup activities under the direction of Husky and in accordance with this Plan. Laboratory analysis of samples will be provided by an ADEC approved laboratory.

Figure 3 provides and an organizational chart for the project listing the primary parties involved in the work, along with their primary roles and points of contact. Some of the contractors to provide services are still to be determined (TBD) by Husky. The cleanup and sampling will be conducted or supervised by ADEC qualified persons as defined in 18 AAC 75.990(100). An updated organizational chart will be provided to ADEC prior to conducting fieldwork, along with the names and resumes of the qualified persons. A copy of the ADEC approval letter for the laboratory will also be provided. The Husky Project Manager, or his representative (SLR), will be the point of contact for communication and coordination with the ADEC.

During the implementation of field work, a teleconference will be held approximately every two weeks between Husky, ADEC representatives, and others as needed. The primary purpose of the teleconference will be to review project progress and discuss any issues that need resolution or approval. Relevant preliminary data and photographs will be provided on an ongoing basis as information becomes available.

The project is anticipated to start in the spring or summer of 2013. Field work will mainly occur during the summer months (June-August) but some work may occur in the spring, fall, or winter of the initial year (2013 or Year One). Some equipment and materials will be mobilized overland to the site in the spring of 2013 to enable excavation activities to start by mid June. Removal actions will occur during Year One, followed by one to two years of landfarming. In addition, after the removal action is completed, annual surface water monitoring will occur to verify water bodies adjacent to the pad are in compliance with Alaska Water Quality Standards (AWQS). Monitoring is estimated to occur for 3 to 5 years after excavation and landfarming have been completed. Husky will provide a more detailed schedule to ADEC prior to conducting field work, which will be updated annually until cleanup and monitoring is complete. Schedule updates will also be provided to ADEC as part of the regularly scheduled teleconferences cited above.

Offsite shipments of waste will commence in the summer or fall of 2013. Priority will be given to shipping offsite hazardous waste or other hazardous substances. All hazardous waste and hazardous substances will be shipped offsite during the same field season it is generated, unless the quantity is significantly more than anticipated (Table 3) and appropriate regulatory approval is obtained for storing the waste onsite (see Section 6 for further details). Non-hazardous solid waste will be shipped offsite in the late summer or fall of 2013 or in 2014. If it is deemed necessary to store inert waste onsite for more than two years, a request will be submitted to ADEC in writing with the associated justification. Waste will not be stored onsite for more than two years without ADEC approval.

At the conclusion of the removal activities, a cleanup report will be prepared documenting the activities and final site conditions. Offsite disposal activities will be documented in this report to the extent they are completed. Subsequent status reports will be completed documenting landfarming and offsite disposal activities, when applicable.

1.4 PERMITTING AND OTHER AGENCY AUTHORIZATIONS

Required permits and other agency authorizations will be obtained by Husky or the prime construction contractor prior to commencing field activities. Husky and its subcontractors will follow prescribed work procedures and comply with permit requirements. Copies of required permits and authorizations will be on file at the project site. Anticipated applicable permits and approvals required for the project include:

- ADEC Contaminated Sites Department approval of this Cleanup Plan;
- ADEC Stormwater Permit (General Construction);
- ADEC Temporary Camp Permit
- Alaska Department of Fish and Game Brown Bear Interaction Plan (anticipated to be included in Wildlife Interaction Plan);

- Alaska Department of Natural Resources (ADNR) Land Use Permit for Use of Marine Waters (Tide & Submerged Lands), applicable to possible use during barge landings and ATV travel to Point Lonely;
- ADNR Temporary Water Use Permit;
- BLM Right of Way Authorization;
- North Slope Borough (NSB) Development Permit;
- U.S. Fish & Wildlife Service Letter of Authorization for Intentional Take of Polar Bears and Wildlife Interaction Plan; and
- USAF Civil Aircraft Landing Permit (for use of Point Lonely runway).

ADEC approval for excavation dewatering discharges will be via approval of this Cleanup Plan (Section 3.7). In addition to the above permits and authorizations, if mobilization of heavy equipment and camp facilities is conducted overland by cat train in winter the following will be required:

- ADNR Land Use Permit for Off-Road Travel, for State lands east of the Coleville River.

A BLM winter tundra permit for lands within the NPRA may also be needed.

2. BACKGROUND

The following section provides pertinent background information regarding the Camp Lonely Site.

2.1 REGIONAL SETTING

The site is located in the Arctic within a zone of continuous permafrost which extends down to a depth of 650 to 1,300 ft based on the regional geology (Lachenbruch 1982, BLM 2005). Potable groundwater is not present beneath the continuous permafrost. Groundwater below the permafrost is typically saline. Average precipitation at Point Lonely is approximately four inches per year. The mean annual temperature is 18 degrees Fahrenheit (-8 degrees Celsius). Strong winds are common from the west in the winter, while milder winds are common from the east in the summer (WRCC 2005).

2.2 SITE DESCRIPTION

The Camp Lonely site consists of an approximately 15 acre gravel pad. The pad contains two inactive landfills, referred to as the “Western” and “Northeast” Landfills. The Western Landfill is located along the western edge of the Camp Lonely gravel pad (Figure 4). It is covered by gravel and comprises the western four acres of the pad. The Northeast Landfill lies in the northeast corner of the pad. It is approximately two-tenths of acre in size and a presumably older area of deposited waste. Other areas on the pad have also been identified as containing PCS (gravel). These locations tend to be where diesel fuel was presumably stored or handled.

The Camp Lonely gravel pad is relatively flat and slopes gently to the southwest. Surface water drainage from the pad is generally west towards brackish wetlands and a lagoon connected to the Beaufort Sea. The drainage patterns appear to change periodically, depending on whether the low-lying land west of the site is inundated by the sea during high tides or storms.

Surface soil surrounding the gravel pad consists of a peaty tundra mat on top of organic rich sandy gravel. The upper limit of permafrost ranges from one to two ft below ground surface (bgs) in the tundra areas and three to five ft in the gravel pad (HCG 2006 and 2007b).

Water also flows in the unsaturated soil or gravel above the permafrost on a seasonal basis. This seasonal groundwater, referred to as “active zone” or “pore” water, flows in the same general direction as the surface water. However, the lateral movement of active zone water is typically slow because of the low gradients and short thaw period. Test pits on the gravel pad in 2005 tended to encounter water within 1 to 2.5 ft bgs (HCG 2006).

The shoreline along the Beaufort Sea in the vicinity of Camp Lonely is eroding. Based on a review of aerial photos from 1979 to 2002, the shoreline has eroded approximately 3 ft per year (ft/yr). Site observations indicate there is also minor erosion of the pad along its western edge where the Western Landfill is located. However, aerial photographs of the Camp Lonely pad in 1992 and 2002 do not show any significant erosion of the pad along its western edge, suggesting the rate of erosion is very slow (< 0.5 ft/yr), (HCG 2006). However, it could accelerate if the frequency of large storms in the Beaufort Sea increases.

2.2.1 LAND OWNERSHIP AND SITE USE

Camp Lonely is located on federal land managed by the BLM. The pad is currently leased by Cook Inlet Region, Incorporated (CIRI) from the BLM.

Currently, Camp Lonely is inactive and has no buildings, structures, or facilities (Figure 5). Current uses of nearby lands include subsistence hunting and recreation (BLM 2005). However, this use is infrequent due to the area's remote location. Future land use of the site may include commercial activities associated with supporting oil and gas exploration and production.

2.3 SITE HISTORY

Portions of the Camp Lonely pad originally were constructed in 1974 to support NPRA exploration activities. A camp and associated infrastructure was operated at the site by Husky until December 5, 1981 (HCG 2006). Facilities included living quarters, warehouses, shops and fuel storage. In 2005, CIRI removed the surface structures, materials and debris at Camp Lonely and disposed of the waste offsite. During the surface removal actions, clean gravel from berms and other surface features was stockpiled in two locations, one along the northern edge of the pad and the other along the southern edge (Figure 4).

The Western Landfill was active from approximately 1977 until 1986. Available information suggests that the northern portion of the landfill was constructed first and that construction of the southern portion of the landfill was initiated sometime between 1979 and 1981. In 1977, Husky obtained solid waste permit NR-32-77 for the placement of waste in the landfill. In August 1978, that landfill permit was amended and transferred to the U.S. Geological Survey (USGS). The permit included authorization to deposit “small metal wastes” and other “non-hazardous materials” on the site. At that time the landfill was being used in part “to extend the size of the storage pad” with a “constructed area … capable of supporting heavy loads, such as drilling pipe and casing.” Husky ceased using the landfill on December 5, 1981. However, from the late 1970's to 1986 the Camp Lonely landfill was used for disposal of solid waste from the DEW Line Station at Point Lonely. Aerial photographs indicate that the southwest portion of the landfill was further expanded between 1981 and 1992. CIRI obtained ADEC landfill permit number 8331-BA001 in 1983 and that permit expired in 1988.

Wastes disposed in the Western Landfill included incinerated domestic (camp) and industrial waste residuals. Based on observations from test pits within the landfill area, industrial waste was more prevalent, consisting of such items as wire, cable, piping, landing mats, and empty drums. The domestic waste consisted of small cans, kitchen waste and the residues of incinerated garbage associated with camp operations (HCG 2006). In some areas, cleaned and crushed drums were reportedly placed over the native ground surface and covered with gravel to expand the pad (HCG 2006). Nonetheless, the metal may be intermingled with other waste and it is possible that the drums contained some residual product. Statements by USGS, USAF, and Husky employees indicate that hazardous wastes and larger solid wastes were regularly "retrograded" (shipped offsite) and were not disposed at Camp Lonely (USGS 1988 and HCG 2006, Appendix D).

There is no documentation on origin or contents of the smaller Northeast Landfill. Test pits excavated in the area in 2005 indicated it predominantly contained crushed drums (HCG 2006).

2.3.1 PAST INVESTIGATIONS AND STUDIES

Several environmental investigations have been conducted at the site starting in 1986, with most of the effort focused on the landfill area on the southwest side of the pad (Dames & Moore 1986, Dames & Moore 1988, Woodward-Clyde 1990).

Two geophysical surveys were performed on the Camp Lonely pad in 2005. The first was an electromagnetic (EM) induction survey performed by GAEA Environmental Solutions in July (GAEA 2005). This survey was conducted over the entire pad but was limited to areas not covered by structures, equipment, and stacked salvage and demolition materials (Appendix A, Figure 1). This geophysical survey indicated that there were two primary areas on the pad where metallic objects were buried, referred to as the Western and Northeast Landfills (Figure 4). The presence of buried debris was verified by an extensive test pit program, consisting of 55 excavations into the pad (HCG 2006).

A second geophysical survey consisting of both a magnetic and EM survey was performed by the USGS in August 2005, after all of the facilities and materials had been removed from the pad surface (USGS 2006 and Appendix A). The cleared pad enabled survey coverage in areas not available during the July survey. The second survey found a similar pattern of geophysical anomalies in the areas previously surveyed (Western and Northeast Landfills). It also identified a couple of additional areas near the center of the pad with significant magnetic anomalies (Appendix A, Figure 2). Based on the development history of the pad, these anomalies did not appear to be associated with the Western Landfill (HCG 2007b). The anomalies corresponded to former building footprints, i.e. the Vehicle Maintenance Shop, Incinerator/Utility Building, Communication Shop, and the Loading Dock Area. The anomalies were potentially the result of steel pilings that were driven through the pad to serve as foundational support for these ground-level buildings. Remnants of these pilings were observed by HCG in the loading dock area during 2005 demolition activities (HCG 2006). At that time, the pilings were being excavated and cut off a few ft below the pad surface. Similar piling remnants are expected to exist beneath the other former buildings. A linear, low resistivity anomaly was also noted during the EM survey on the southeastern portion of the pad (Appendix A, USGS Report Figure 3.2.5.1). Because it was not detected in the magnetic survey its source was attributed to a non-ferrous source.

The most detailed site investigation coincided with the first geophysical survey of the pad in July 2005 (HCG 2006). It included the test pit program, and soil and water sampling. The site characterization focused on the landfill area on the western portion of the pad. Test pits on the pad tended to encounter water within 1 to 2.5 ft bgs, and frozen conditions 2.5 to 3.5 ft bgs. (HCG 2006) Figure 6 shows a conceptual cross-section of the Western Landfill based on the 2005 investigations. Petroleum hydrocarbons [gasoline range organics (GRO), diesel range organics (DRO), and residual range organics (RRO)] were detected in the soil above ADEC Method One cleanup levels with the DRO being the most common exceedance. DRO, RRO, total xylenes, naphthalene, chromium, and arsenic exceeded ADEC Method Two cleanup levels for the Arctic Zone. The high concentrations of chromium and RRO were detected in areas coinciding with surface staining and were localized in extent. The highest total xylene and naphthalene concentrations were co-located within a single sample collected from a test pit within the Western Landfill area.

Sampling of surface water bodies in the wetlands adjacent to the pad did not identify detectable levels of chlorinated compounds, phenols, or benzene, toluene, ethylbenzene, or xylenes (BTEX) compounds. One sample collected in July 2005 exceeded 18 AAC 70 AWQS for benzene and total aromatic hydrocarbons (TAH). However, subsequent sampling in August 2005 did not detect any exceedances.

Interim removal actions were also conducted during July 2005. These consisted of removing two buried, uncrushed, leaking drums containing product (oil) from the subsurface of the Western Landfill, and placing sorbent booms around these and other potential release areas to prevent the migration of any remaining residual product (HCG 2006). The drums were encountered during the test pit program. Product recovered during the interim removal actions was containerized and shipped off site to an ADEC-approved treatment, storage and disposal (TSD) facility. The oil recovered met Resource Conservation and Recovery Act (RCRA) used oil burn specifications and did not contain compounds beyond those typically associated with lubricating oil.

An environmental assessment of the pad other than the landfill (burial) areas was conducted in 2005 by ENSR Corporation (ENSR 2005). Seven areas were identified that contained soil with DRO exceeding ADEC Method One cleanup levels for the Arctic Zone (Figure 4). The maximum concentration of GRO, DRO, and RRO for each area is depicted on Figure 4. One sample exceeded the Method Two cleanup level for DRO (12,500 milligrams per kilogram [mg/Kg]). This sample contained DRO at a concentration of 14,700 mg/Kg, and was collected at the 1,300 Gallon AST Area just south of the former Vehicle Maintenance Shop. One sample exceeded the Method Two cleanup level for total xylenes (63 mg/Kg). This sample contained total xylenes at a concentration 80.3 mg/Kg, and was collected at the former Fuel Tank Area in the southeast corner of the pad. Copies of the drawings from the ENSR report are contained in Appendix B.

Additional site characterization of the Western Landfill area was conducted in 2006 which included soil, surface water and pore water sampling and analysis (HCG 2007b). The results indicated that contaminants associated with petroleum hydrocarbons were migrating from the pad into adjacent surface water bodies. BTEX compounds were detected in the pore water and in one small pond next to the landfill at levels which exceeded the AWQS for TAH and total aqueous hydrocarbons (TAqH). The TAqH exceedance was due almost entirely to the BTEX concentrations. Polynuclear aromatic hydrocarbons (PAHs) were not detectable or were very low. The source of the elevated BTEX compounds was attributed to a localized source within the interior of the landfill (e.g., a drum leaking fuel) as opposed to leachate from the soils. Additional surface water monitoring conducted in 2008, which produced similar results to 2006 monitoring (HCG 2008).

A Feasibility Study (FS) was conducted after the 2006 investigation to identify and evaluate environmental remediation alternatives for the Camp Lonely landfills and associated pad (HCG 2007a). The study determined that the preferred alternative was removal of the buried waste and contaminated soil within the landfill areas followed by offsite disposal of the solid waste, including any hazardous waste. The petroleum-impacted soil within the landfills and pad was recommended for onsite treatment via landfarming.

This Cleanup Plan is based on the implementing the preferred alterative of the FS with some minor modification.

2.4 CLEANUP CRITERIA

2.4.1 SOIL

The soil contaminants of concern (COCs) and associated cleanup levels are listed in Table 1. The cleanup levels for the site are ADEC Method Two soil cleanup levels for the Arctic Zone (18 AAC 75.341 Tables B1 and B2; April 8, 2012). Method Two cleanup levels are considered sufficiently protective of human health and the environment under situations where the petroleum contaminated soil is not directly exposed to surface water. However, due to the potential for long-term coastal erosion, site specific soil cleanup levels were negotiated for GRO, DRO, and RRO to provide additional protection of surface water. These site specific levels address the concern that if Arctic Zone Method Two cleanup levels are used, the residual concentration of petroleum hydrocarbons in the soil could potentially cause sheen if the soil eroded and came in contact with surface water. Although these sheens are unlikely to pose significant human health or ecological risk (HCG 2006, ENSR 2001), they may result in an exceedance of the narrative “oil and grease” water quality standard for marine waters set forth in 18 AAC 70.

The DRO soil concentration that may cause sheen was conservatively estimated to be 500 mg/Kg based on background research and site specific sheen tests (HCG 2007). Therefore, this concentration was selected as the target cleanup level for DRO near the edge of the pad or water. The target cleanup levels for GRO and RRO were set at 100 and 2,000 mg/Kg, respectively, which are the same as ADEC Method One cleanup levels for the Arctic Zone (18 AAC 75.341, Table A2). The GRO and RRO impacted soil is typically co-located with the DRO impacted soil. So in most locations, cleanup of DRO to the target cleanup level should remove elevated levels of GRO and RRO as well.

In addition, as noted in Table 1, the petroleum hydrocarbon cleanup level for soils in more inland locations are less stringent than near the water or edges of the pad because the petroleum hydrocarbons will have more time to naturally attenuate should erosion occur. Therefore, the target cleanup level for interior portions of the pad are set at 1,000 mg/Kg DRO and 150 mg/Kg GRO. For purposes of applying these cleanup levels, the interior of the pad is defined as: (1) 25 ft from the toe of the pad on the eastern, western, and southern edges of the pad, provided, however, that for areas where standing water persists after excavation, the interior of the pad begins 25 ft onto the pad from the areas where the standing water exists; and (2) 300 ft from the Beaufort Sea on the seaward (northern) edge. In addition, the pad edge is based on the "new" pad edge after the removal actions and backfilling is complete.

It is possible, higher concentrations of petroleum hydrocarbons in the soil than cited above may not result in exceedances of AWQS, especially if the hydrocarbons are weathered. This may be demonstrated as part of the surface water monitoring program which will be implemented after the removal action is complete. It is acknowledged that there are uncertainties regarding the nature of the buried waste in the landfill areas, and additional contaminants may be present. The COCs listed are the ones identified in investigations and associated risk evaluations to date. If other hazardous substances are identified in the soil during the course of the cleanup, they will be cleaned up to Method Two cleanup levels. During removal actions, a continual inspection and assessment of the waste will be made to determine if there is potential for contaminants to be present in the soil that were not previously identified based on the types of waste encountered. As a precaution, the excavated soil intended for landfarming will be sampled to verify there are not contaminants present in the soil that are unsuitable for landfarming (i.e., will not naturally attenuate over time). The primary focus will be on verifying polychlorinated biphenyls (PCBs) are not present. However, sampling and analysis will be performed for other contaminants if wastes likely to contain other COCs (hazardous substances) are encountered. For example, if lead acid batteries are observed, soil from that area will be analyzed for lead; if a drum marked as containing chlorinated cleaning solvents is observed with fluids, analysis will be performed for volatile organic compounds (VOCs).

The cleanup levels listed in Table 1 apply to gravel pad and landfill areas within the pad. Native soils and tundra adjacent to, or beneath, the gravel fill are not planned for removal, except for potentially small isolated “hotspots.” Significant contamination of the underlying native soils is not anticipated because the presence of frozen soils (permafrost) should have prevented the vertical migration of petroleum hydrocarbons and other contaminants. Significant quantities of contaminated native soil have not been identified. However, ADEC retains the authority specified in 18 AAC 75.380(d) (2) to reassess the need for additional action.

Following removal of overlying solid waste and contaminated pad material, the bottom of the excavation or exposed ground surface, which may consist of native soil, will be sampled and analyzed for COCs to characterize the final site conditions. If contaminants above 18 AAC 75.341 Method Two or One cleanup levels are detected in the native soil, the site conditions will be evaluated to determine if further action is warranted to ensure protection of human health or the environment. For contaminants in the native soil the anticipated (target) cleanup level is Method Two (Arctic Zone), unless there are mitigating circumstances approved by ADEC.

With respect to petroleum hydrocarbons, a risk based approach will be used to determine if the native soil requires removal to protect human health and the environment. At concentrations below Method Two human health risks are negligible. Therefore, the primary factor to be used in determining whether native soil with petroleum hydrocarbon contamination needs to be removed is whether its removal is necessary to protect surface water quality. Surface water sampling in the water bodies adjacent to the pad do not suggest that PCS, either in the pad gravels or native soils, are resulting in AWQS exceedances, except on a localized and intermittent basis on the west side of the pad (see Section 2.3.1). These localized exceedances are attributed to localized “hotspots,” either leaking drums and/or petroleum saturated soil leaching into the pad and ultimately migrating to the adjacent surface water. Therefore, removal of these “hotspots” should eliminate the AWQS exceedances. It is not anticipated that significant volumes of native soil will need to be removed to project surface water quality. If native soil contains petroleum hydrocarbons, its removal will largely depend on the soils location in relation to surface water. Contaminated soil that creates a persistent sheen or causes surface water to exceed AWQS is a violation of water quality standards, and such soil will be considered for removal. Section 2.4.2, below, discusses COCs for surface water. Localized, intermittent, and temporary petroleum sheens may be allowed, if these can be managed with sorbent booms and mitigation measures, and are anticipated to generate sheen only for a short period (1-2 years) following landfill removal. Surface water quality monitoring, as discussed in Section 2.4.2, will be conducted until native soil conditions have stabilized and it can be demonstrated that water quality standards are being met.

Conditions under which native soils could be removed are: (1) if the soil is saturated with fuel or oil and there is the potential for free flowing product; (2) there are hydrocarbon contaminants that are causing and may continue to cause violations of AWQS in adjacent water bodies; (3) there are contaminants which are persistent and bioaccumulates, such as PCBs, which are present above ADEC Method Two cleanup levels.

When evaluating analytical results of samples collected from native soils, the potential effects of biogenic interference on the reported hydrocarbon concentration will be considered. If the detected DRO/RRO is attributed to biogenic material the need for action will be mitigated. Potential biogenic interference will be evaluated in confirmation samples for DRO/RRO in areas where there appears to be peaty (organic) soils following the guidance in the ADEC Technical Memorandum for Biogenic Interference and Silica Gel Cleanup (ADEC 2006). In these areas, standard analysis and analysis with silica gel cleanup of the sampled extract will be performed. The silica gel cleanup will be requested at the discretion of the field sampler based on visual observations of the site conditions where the samples are collected. Background samples on tundra soils in undisturbed areas will also be analyzed for DRO/RRO using standard analysis and analysis with silica gel cleanup, and total organic carbon, per the memorandum specifications. Chromatograms may be reviewed to evaluate whether the DRO/RRO is from a petroleum distillate, biogenic material or combination of the two. During the 2005 site characterization, three “background” soil samples were collected in the tundra 600 to 900 ft south (upgradient) of the Camp Lonely pad. The maximum DRO and RRO concentration detected was 1,410 and 8,820 mg/Kg, respectively. The average concentration detected was 727 and 4,850 mg/Kg, respectively.

2.4.2 WATER

The water COCs are listed in Table 2, along with the applicable regulatory criteria. The regulatory criteria are AWQS (18 AAC 70; May 26, 2011).

Surface water in the adjacent wetlands will not be actively cleaned up or treated, except for the use of sorbent boom, to be placed prior to excavation to remove possible sheen emanating from cleanup activities. The surface water contamination detected along the western side of the pad was localized and attributed to the leaking of petroleum hydrocarbons (fuel or oil) from a buried drum(s), or fuel saturated soil adjacent to such a drum. Removal of the buried waste and associated contaminated soil should lower the concentration of COCs in the water to acceptable levels. Water management and treatment will also be conducted during the excavation of waste (Section 3.7). Therefore, the regulatory criteria listed in Table 2 are considered action levels that may trigger continued surface water monitoring, additional soil excavation, or investigations to identify the source of these contaminants.

Following excavation of solid waste and soil above cleanup levels, a surface water monitoring program will be conducted to verify that there are no exceedances of AWQS in the wetlands (small ponds) adjacent to the pad (Table 2). The details of the surface water monitoring program will be provided in a separate plan. It is anticipated this plan will be prepared and approved the winter preceding Year 2 of the Cleanup (landfarming phase).

2.4.3 SOLID WASTE

Cleanup goals for non-hazardous solid waste are based on solid waste regulations (18 AAC 60) and sound engineering principles regarding pad stability and reuse. The objective is to remove the solid waste to the maximum extent practicable such that when the cleanup is complete, the site poses no significant physical or chemical hazards due to solid waste, is no longer considered a landfill or dump site, and is visually free of litter, especially plastic and metal. It will be recognized that the intended use of the pad is a commercial site that will revert to non-commercial use within the Teshekpuk Lake Special Use Area when it is not leased for commercial purposes. Small pieces (bits) of solid, inert waste may remain.

At the conclusion of the cleanup and landfarming, the ground surface will be inspected and handpicked to remove solid waste so that the site is visibly clean and free of litter. The excavated solid debris and hazardous substances not suitable for onsite landfarming will be shipped offsite to a TSD facility permitted to accept the waste.

Depending in part on their location, former building and facility structures may be left in place within the pad subsurface, if present. These items could include pilings, foundations or conduit. The decision on whether these items will be left onsite will be made following notification and consultation with ADEC, BLM and CIRI.

2.5 NATURE AND EXTENT OF CONTAMINATION AND ESTIMATED QUANTITIES

Most of the soil COCs are associated with diesel fuel, motor oil, or other petroleum products. DRO is the most widespread contaminant to exceed ADEC Method One or Two cleanup levels. Areas containing soil estimated to exceed a concentration of 500 mg/Kg DRO are depicted on Figure 4. The locations with elevated BTEX or PAH compounds in the soil are very localized and co-located with elevated DRO.

The highest RRO and chromium concentrations were detected in areas with surface staining, and represent relatively localized impacts. Significant offsite migration of contaminants from the landfill is not evident. The contaminated areas are located primarily within the interior of the pad and are not immediately threatened by erosion. Contaminated tundra has not been identified.

The types of waste, and their respective volumes, estimated to be present and remediated are listed in Table 3. Detailed calculations of the primary waste streams are provided in Appendix C. The estimated extent of contamination is illustrated on Figure 4. The cleanup team (Site Project Manager and associated contractors) will be prepared to remove, treat or dispose of these volumes of contaminated soil and solid waste. It is noted that Table 3 includes waste types or volumes beyond which has currently been identified. This is included as contingency given the uncertainties associated with historical landfills and the remote location of the work.

However, if the quantities of waste encountered during remedial actions, other than non-hazardous solid waste or soil suitable for landfarming, are significantly more than listed in Table 3, additional evaluation and planning may be necessary before cleanup is completed. In these circumstances, the Site Project Manager will evaluate the situation and determine the appropriate response actions. As a precaution for such contingencies, work will be prioritized and proceed from high risk (landfill) areas to low risk (petroleum contaminated only) areas. Landfill removal will begin in the southern portion of the Western Landfill, where it is considered there is the highest potential for hazardous waste or substances to be present. Priority will be given to removing and shipping offsite hazardous waste as opposed to removal of petroleum contaminated soil or inert waste. Removal of native soil at the base of the pad will be the lowest priority. In addition, work will typically be completed in one area before starting excavation in another. This will reduce the possibility of only partially excavating an area in the first field season in the event that waste volumes are significantly larger than anticipated. If an area is partially excavated in the first field season, attention will be given to secure the site for safe and stable over-wintering. If erosion is likely, the excavation will be partially backfilled and contoured with clean fill and a marker (tape or permeable liner) used to delineate the boundary between the original soil and new fill. If contaminated soil or waste is left onsite until the next shipping season, it will be properly containerized or otherwise secured to prevent it from posing a hazard to humans or wildlife, or migrating (spreading). Excavated contaminated soil to be shipped offsite will be placed in super sacks or equivalent and not left onsite in stockpiles. All liquid wastes requiring offsite disposal or treatment will be shipped offsite the year it is removed.

In the event an unforeseen hazard such as unexploded ordnance is encountered, it may need to be left temporarily in-place and its location documented for later remedial action. If a large volume of soil with previously unidentified hazardous substances is encountered, it may be left in place so long as the area can be stabilized in a condition which will not allow for the release or migration of contaminants. Regardless of the approach used, all contaminated soil and solid wastes exposed or excavated within the current pad boundaries, including the landfills, will be managed onsite in a manner to prevent the release of hazardous substances to the environment until the appropriate final remedy can be determined and implemented.

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3. WORK PLAN

The currently selected remedial action for addressing the Camp Lonely site is excavation of buried solid waste and contaminated soil above cleanup levels. Excavation and removal will be performed in all known or suspected areas where solid waste has been discarded or contaminated soil is present (Figure 4). PCS suitable for landfarming will be landfarmed onsite. The excavated solid debris and hazardous substances not suitable for onsite landfarming will be shipped offsite to a TSD facility permitted to accept the waste. The main components of the remedy are summarized below.

- Excavation of the Western and Northeast Landfills, estimated at 34,958 and 1,764 loose cubic yards (LCY) in size, respectively (i.e., the areas within the yellow dotted lines in Figure 4), including the associated gravel, PCS, hazardous substances or waste, and any solid waste;

- Excavation of the PCS in the six areas depicted on the pad in Figure 4: (1) 65,000 Gallon Aboveground Storage Tank (AST); (2) Incinerator/Utility Building Area, (3) Vehicle Maintenance Shop, (4) 1,300 Gallon AST, (5) Loading Dock Area, and (6) Communication Shop AST;

- Shipping solid waste and hazardous substances not suitable for landfarming off site for treatment or disposal (estimated quantities listed on Table 3). Scrap metal may be recycled if practicable;

- Onsite landfarming of the petroleum-contaminated soil (approximately 7,200 in-place cubic yards or 9,000 excavated cubic yards) to reduce the concentration of DRO in the soil to a target cleanup level of 1,000 mg/Kg. The estimated landfarm area is shown on Figure 7;

- Natural attenuation of the residual DRO in the soil (<1,000 mg/Kg) to a concentration at which there is a negligible risk of an AWQS exceedance due to sheening should the soils come in contact with surface water. This threshold concentration is estimated to be 500 mg/Kg DRO;

- As a contingency, possible excavation and treatment/disposal of 500 LCY of petroleum-contaminated native soil, not suitable for landfarming, from excavation footprints (treatment/disposal options could include offsite shipment, landfarming, or onsite biopile); and

- Surface water monitoring of the wetlands (small ponds) bordering the former landfill area for petroleum sheens and BTEX concentrations to verify compliance with AWQS (18 AAC 70). The details of monitoring will be submitted in an addendum to this Cleanup Plan (or equivalent) after the removal actions are completed.

- Following successful completion of landfarming activities, and a period for adequate natural attenuation of residual hydrocarbons to occur, the landfarm will be deactivated and the footprint returned to commercially useable pad.

These components are described in the remainder of this section. A list of the primary work elements associated with the cleanup is presented in Table 4. This table will be used as a checklist to monitor progress and document the completion of tasks. The sample collection and analysis procedures are described in Section 4, the Field Sampling Plan (FSP) and Section 5, the Quality Assurance Project Plan (QAPP). Waste management procedures are described in the Waste Management Plan (Section 6).

3.1 PREPARATORY ACTIVITIES

Prior to conducting cleanup work the necessary personnel and equipment will be mobilized to the site. A temporary camp will be set up. The planned location for the camp is the northeast corner of the pad as depicted on Figure 7. In addition, temporary staging areas will be designated on the pad for materials and waste. The primary staging area for wastes to be shipped offsite is an area located west of the Northeast Landfill (Figure 7). In addition, there will be two staging areas for clean gravel; one for existing clean gravel and one for clean gravel generated during the excavation of the landfill areas (see Section 3.6). Further details regarding these activities will be contained in the Site Operations Plan to be prepared. In addition, areas planned for excavation will be located and marked as needed to plan their removal.

3.2 EXCAVATION OF LANDFILL AREAS

The buried solid waste and contaminated soil above cleanup levels will be excavated within the two landfill areas. This will require excavation of the landfill areas in their entirety. The estimated boundaries of the landfills are shown in yellow on Figure 4. The landfills will be removed with heavy equipment, principally an excavator(s). The onsite Environmental Specialist (SLR scientist or engineer) will continually observe and monitor the removal process, and identify contaminated soil and wastes that required special handling. As part of the process, the gravel will be field screened with a photoionization detector (PID) to help guide the excavation.

The excavated soil and solid waste will be segregated into appropriate categories for subsequent re-use, treatment, or disposal. The primary categories will be (1) clean gravel, (2) PCS suitable for onsite landfarming, and (3) contaminated soil and other wastes requiring offsite disposal or treatment.

Excavation is planned to start in the southwest corner of the Western Landfill, and progress to the north and east. The Northeast Landfill will be removed after the Western Landfill. To facilitate the tracking and sampling of soil and waste removed from the landfill, the landfill areas will be divided into 20 by 20 foot grid squares as shown on Figure 8. As noted on the figure, each grid square will have a unique identification number (e.g., A-1). As soil is excavated and stockpiled, the location (grid squares) from which it originated and depth will be documented to the extent practical. A single stockpile may consist of soil from multiple grid squares to less than one grid square. Each stockpile will be assigned a unique identification number and tracked on a soil stockpile log through the screening/testing process. A typical identification number will be WLSPA-1 (Western Landfill, Stockpile A-1, with the “A-1” corresponding to the grid square designation from which it originated). As work progresses, its classification will be documented on the stockpile log (e.g., clean gravel suitable for fill; petroleum contaminated gravel suitable for landfarming, contaminated soil/gravel requiring offsite disposal), along with its destination (e.g., placed in clean fill stockpile, spread in landfarm area, containerized and shipped offsite).

Representative samples of the excavated and stockpiled soil from the landfill (excluding the cap) will be sampled and analyzed for PCBs and lead prior to using as fill or landspreading. This analysis is being performed as a contingency. PCBs were not detected in soil and recovered product (oil) samples collected during the 2005 site characterization of the Western Landfill (HCG 2006). Nor were they detected in a 1986 investigation of the landfill (Dames and Moore 1986). However, there is concern about PCBs because they do not naturally attenuate, and have been identified in significant quantities in a landfill at the nearby Point Lonely facility used during the 1950s to 1970s when the DEW Line Station was active (HCG 2010). Similarly elevated lead concentrations have not been detected at the site. However, ADEC expressed concern that lead above Arctic Zone method Two cleanup levels was detected in other historical landfills operated by the USAF on the North Slope (e.g. Point Lay Long Range Radar Station).

The area of the Camp Lonely pad considered to have the highest potential to contain PCBs or lead is the southwest portion of the Western Landfill because it reportedly received waste from the former Point Lonely DEW Line Station after 1981 (HCG 2006, and Appendix D). Initial removal actions will be conducted in this area, and the results of PCB analysis reviewed to evaluate the need for continued testing or modification of procedures. If no PCBs are detected above 0.75 mg/Kg, and no lead is detected above 400 mg/Kg, in the soil stockpiles from the southwest quadrant of the Western Landfill, PCB and lead sampling and analysis may be eliminated or reduced in frequency in other areas. In addition, if PCBs are only detected in the southwest quadrant of the Western Landfill they may be eliminated from sampling and analysis at the Northwest Landfill. ADEC will be notified of PCB and lead sample results on a periodic basis while work is occurring. ADEC concurrence will be obtained prior to eliminating or reducing the frequency of PCB or lead analysis of excavated soil.

Even if routine PCB or lead analysis of excavated soil is eliminated, the solid waste will still be inspected for PCB or lead containing materials. If inspection of the waste indicates the potential for PCBs or lead to be present (e.g., a buried transformer or batteries encountered, respectively), the recovered waste (discarded materials) will be sampled to verify the presence or absence of PCBs or lead. If leakage or dispersion of these contaminants into the adjacent soil is suspected, the soil in the immediate areas will be segregated and sampled for PCBs or lead.

3.2.1 GRAVEL CAP REMOVAL

Prior to excavating the solid waste within the landfill, the approximately 1-foot clean, gravel cap will be removed and stockpiled for later use as backfill material or pad cover. During this process it will be inspected and sampled as necessary to verify it is clean.

If previously identified or visible surface contamination is present, such as stained soil, it will be removed first, segregated from the suspected clean cap material, and managed based on the contaminants present. For example, the previously identified tar-like material with chromium in the Western Landfill (Figure 4) will be excavated and containerized for offsite disposal prior to excavation of surrounding soil (cap or landfill). This contamination appears to be localized, estimated to be 7 square ft with a volume less than 4 cubic yards (CY), (Figure 4). Using the previous data and visual observations, the tar-like material and associated chromium contaminated soil will be removed. Discrete confirmation soil samples will then be collected and analyzed for chromium as described in the FSP (Section 4). If sample results are above the Method Two cleanup level for chromium of 410 mg/Kg, additional excavation will be performed to remove the remaining contaminated soil. Once the chromium concentrations in the soil are confirmed to be below 410 mg/Kg, then the surrounding cap and landfill material will be removed as described below and in Section 3.2.2. Areas where there may be near surface petroleum hydrocarbon contamination are the two locations where interim actions were performed in 2005 in the Western Landfill (HCG 2006). If present, this and other PCS will be segregated from the clean cap material and landfarmed (Section 3.8).

The suspected clean cap material will be removed and staged in stockpiles approximately 100 LCY in size. The clean cap material will be identified based on the lack of solid waste (including small inert waste such as plastics, glass, etc.), stained soil, petroleum odor or elevated PID readings. The classification will be conservative and any suspected contaminated soil or soil mixed with solid waste will be placed in separate stockpiles 35 CY or less (segregated from suspected clean fill) for further management as described in Section 3.2.2. If solid waste is located very close to surface, removal of the clean cap will not be considered practical in those locations. In these circumstances, the surface cover will be considered landfill material (waste) and handled as discussed in Section 3.2.2.

Discrete samples will be collected from the presumed clean cap stockpiles for analysis following the ADEC *Draft Field Sampling Guidance* (May 2010) and project specific procedures described in the FSP (Section 4.2.2) to confirm the material is clean. Ten discrete samples will be collected from each 100 LCY stockpile at evenly distributed intervals for PID headspace analysis. If the PID readings are $\leq$ 10 parts per million (ppm), the stockpile will be assumed to contain DRO $\leq$ 500 mg/Kg and RRO $\leq$ 2,000 mg/Kg, and it will be categorized as clean with respect to petroleum hydrocarbons. If one or more PID readings are > 10 ppm, the discrete sample with the highest PID reading may be analyzed for DRO/RRO at the discretion of the Environmental Specialist, to verify the concentrations (analytical results will take precedence over screening results). If the soil is classified as clean, the soil will be consolidated into a larger stockpile(s) for use as unrestricted fill. If the soil has DRO between 500 and 1,000 mg/Kg, it will be managed and stockpiled separately because its use will be restricted to spreading or filling in the interior portion of the pad (Figure 4). If DRO concentrations are > 500 mg/Kg or RRO > 2000 mg/Kg, the cap material will be considered petroleum contaminated and placed in the landfarm area.

3.2.2 WASTE AND CONTAMINATED SOIL REMOVAL

Once the cap has been removed to the extent practical in the area to be excavated, the landfill (buried solid waste) and associated contaminated soil will be removed. During the removal action, care will be taken to avoid the potential of causing a release of hazardous substances or petroleum products from containerized waste (e.g., puncturing a drum with product), or the mixing of gravel potentially suitable for landfarming with other soil. The Environmental Specialist will serve as a spotter and will be present at all times during the excavation process to assist the equipment operator in identifying wastes which require special handling. If drums are located with liquid contents, the contents will be pumped from the drum prior to moving it, unless it can be safely removed without risk of spilling the contents. The drum will be overpacked prior to moving out of the excavation area if its integrity is poor and there is risk of leakage (in addition, see Section 3.7 discussing handling of water filled drums). Large items (e.g., drums or beams) will be removed from the excavated gravel by hand or with mechanical equipment. If petroleum hydrocarbon-saturated soils are encountered (for example from a punctured container that had contained product), they will be super sacked immediately or placed on a liner, and ultimately processed with other contaminated soil unsuitable for landfarming (Section 6.2).

Once excavated, the removed material (gravel mixed with solid waste) will be taken to the soil processing area, located on the pad. The soil processing area will ideally be located either on a portion of the landfill not yet removed, or within the designated landfarming area. If not located in either of these areas, the pad (ground) surface in the processing area(s) will need to be cleaned up by the end of the project to remove solid waste, staining and contaminated soil. Therefore, the footprint of these areas will be minimized and, to the extent practicable, excavated material processing will be conducted within the landfill areas or within the designated landfarm area (Figure 7). If soil processing is conducted within the landfarm area, any remaining petroleum-contaminated soil from soil processing does not need to be cleaned up from the ground surface.

The excavated material will not be mixed with material from other areas prior to inspection and sampling. Typically, the material will be placed in stockpiles of about 35 LCY (20 ft by 20 ft by two ft in-place volume). Potentially hazardous materials visible in the stockpile, for example batteries, paint cans, or solvent containers, will be removed for subsequent characterization and disposal. After the initial inspection, discrete samples will be collected from each gravel stockpile and screened and analyzed to verify there are no contaminants present that are not suitable for landfarming as described in the FSP (Section 4.2.2). All piles will be sampled and analyzed for PCBs and lead, unless results from the southwest quadrant of the Western Landfill indicate it is not warranted as discussed in Section 3.2. In addition, if other wastes are found in the excavated soil which may have contaminants other than petroleum hydrocarbons, lead or PCBs, analysis will also be conducted for those contaminants on a per stockpile basis. For example, if a drum is encountered with potential solvents, analysis will be conducted for VOCs. In addition, if the excavated soil is suspected of being suitable for fill or cap material without treatment for petroleum hydrocarbons, it will be screened and analyzed as described for the cap material to verify it is clean (see Section 3.2.1, although the stockpiles size will be smaller, 35 LCY).

Stockpiles that do not contain PCBs or other non-petroleum contaminants above Method Two Arctic Zone cleanup levels will be classified as suitable for landfarming or clean fill depending upon the petroleum concentrations. Soil which is not suitable for landfarming will be segregated and containerized for offsite disposal. Prior to shipping soil offsite, it will be further characterized to determine the appropriate handling and disposal method as discussed in the Waste Management Plan (Section 6).

Following sampling, excavated landfill material (gravel) considered suitable for landfarming or clean fill will be processed through a screen plant (rock sorter, aka Grizzly) with a 1-inch screen to separate the gravel from solid waste. Solid waste will be inspected for potentially hazardous substances, segregated based on items encountered, and stored for future offsite disposal.

Once screened, the gravel will be staged on the pad in consolidated stockpiles or moved to the designated landfarm area. Details regarding the operation of the landfarm are discussed in Section 3.8.

Due to the presence of permafrost, the excavation of the landfill areas may need to be conducted in progressive stages (lifts) to permit the exposed permafrost to progressively thaw. Alternatively, the frozen material will be removed and thawed on the pad in the designated landfarm area. Removal of the landfills will continue until there is no longer visible solid waste, which is estimated to be at or near the original grade (native soils).

When excavation in an area is concluded, confirmation sampling and analysis of the soil will be performed to verify site conditions meet the cleanup levels established in Table 1. Discrete samples will be collected from excavation floors and sidewalls 3 ft or taller as described in the FSP (Section 4.2.1). Sampling will be conducted using a 20 X 20 foot grid. Samples for PID headspace analysis of volatiles will be collected at all the axis points of the grid squares (e.g. one sample per 400 square ft). Samples for laboratory analysis will be collected at every other sampled point (e.g. every 40 ft on the grid square axis, or one sample every 1,600 square ft) and analyzed for GRO/BTEX and DRO/RRO. In addition, 20% of the samples will be analyzed for PAHs by selecting the sample with the highest PID readings per consecutive sets of 20 screening samples. Thus, there will be co-located PID and analytical results every 40 ft with an intermediate sample point having a PID headspace result. The PID readings in conjunction with the analytical results will be used for characterization of the intermediate areas. Upon review of this data set, the intermediate areas may be sampled for laboratory analysis if deemed necessary to make cleanup or closure decisions.

In addition, following landfill removal, the excavation floor will be analyzed for PCBs in locations where excavated soil stockpiles contained PCBs > 0.75 mg/kg. In such cases, four discrete samples will be collected and analyzed for PCBs from each 20 X 20 foot grid square where stockpiles with PCBs > 0.75 mg/Kg originated. Each grid square will be divided into four quadrants, approximately 100 square ft each. One discrete surface sample will collected for analysis from the middle point of each quadrant following the procedure in the FSP (Section 4.2.1).

If there is no solid waste and the soil cleanup levels are met, cleanup in the subject area will be concluded. Confirmation sample locations will be surveyed for documentation purposes.

If contaminants are present in excess of cleanup levels, subsequent rounds of excavation and confirmation sampling will be performed as appropriate. If the contaminated media consists of native soils and contamination is limited to petroleum hydrocarbons (below AWQS sheening criteria if adjacent to surface water), the Site Project Manager (or his representative) may elect to inform ADEC that further cleanup is not warranted and seek concurrence (See Section 2.4.1). As a contingency, a possible removal volume of 500 LCY of contaminated native soil is included in Table 3. This volume is based on an assumption that removal of contaminated native soil, if conducted, will be limited to "hot spots" where the removal of the petroleum hydrocarbons is deemed necessary to protect water quality and prevent an AWQS exceedance. It should be noted that if removal of petroleum-contaminated native soil is determined to be necessary in the Western Landfill footprint, such excavation may need to be conducted during frozen conditions, due to the potential for water saturated and/or soft soil conditions during the summer months.

Winter excavation of native soil could be performed during early winter of the first field season, or late winter of the second field season. Treatment and disposal options once removed for contaminated native soil would be determined dependant on the soil characteristics and volume, but may include landfarm blending for minor amounts of mineral soil, onsite biopile treatment for peat tundra, or offsite shipment to a thermal treatment facility or landfill.

3.3 EXCAVATION OF PETROLEUM-CONTAMINATED AREAS

Excavation of the PCS (gravel) will be completed in six areas separate from the landfills: (1) 65,000 Gallon AST; (2) Incinerator/Utility Building Area, (3) Vehicle Maintenance Shop, (4) 1,300 Gallon AST, (5) Loading Dock Area, and (6) Communication Shop AST. The planned removal areas are depicted on Figure 4 (red outlined areas and red and blue outlined at Loading Dock Area). The DRO cleanup level for these locations is 1,000 mg/Kg, except for the areas that are within 25 ft of the “new” pad edge, in which case the DRO cleanup level is 500 mg/Kg. Based on the projected pad edge after the Western Landfill is removed, the DRO cleanup level at the Loading Dock Area and possibly the Communication Shop Area will be 500 mg/Kg. Note that no cleanup is required at the Pump House Area because DRO is less than 1,000 mg/Kg and it is not located within 25 ft of the pad edge. However, the Site Project Manager may optionally decide to excavate and landspread a portion of the gravel in this area to facilitate the natural attenuation process.

Determining the extent of contaminated gravel to be removed will initially be made using existing data, supplemented with field observations and qualitative screening of the soil with a PID. During excavation, this screening may occur *in-situ,* at a rate judged appropriate by the Environmental Specialist based on field observations. When the removal of contaminated soil is estimated to be near completion, samples will be collected for *ex-situ PID screening* at a frequency comparable to ADEC guidance (ADEC 2010). For excavations less than 250 square ft, one screening sample will be collected for every 25 square ft, and for excavations greater than 250 square ft, one screening sample will be collected for every 100 square ft. One sidewall screening sample will be collected for every 10 linear ft. Section 4.1, FSP, presents further discussion of field screening methods.

When soil removal is concluded in an excavation area based on inspection and screening, discrete soil samples will be collected and analyzed to confirm the remaining soil meets cleanup criteria (Table 1). The confirmation sampling will be based on ADEC guidance (ADEC 2010), occurring at a rate of 2 samples per the first 250 square ft of excavation, and one sample for each additional 250 square ft, or part thereof. Samples will be analyzed for DRO/RRO and GRO/BTEX, plus one PAH analysis per removal area. Excavation sidewalls 3 ft or greater in height will also be sampled at frequency of 1 per 20 linear ft, focused on the soil horizon(s) suspected of being most contaminated based on field screening. The sample collection is detailed in the FSP. If areas are detected above cleanup levels (Table 1), additional gravel will be removed and the area sampled again to confirm that cleanup levels have been met. Once it is verified that the cleanup levels have been met the excavation areas will be backfilled with clean fill. A few of the PCS areas are located where the landfarm is going to be constructed. These areas will be excavated and backfilled prior to landfarm construction.

The excavated petroleum contaminated gravel will be spread in the designated landfarm area as discussed in Section 3.8. No sampling and analysis of the excavated gravel is required or planned prior to spreading of the gravel. However, as with the landfill areas, if gravel in any of these areas is suspected of having contaminants not suitable for landfarming, the gravel (or soil) will be segregated and sampled to verify the appropriate disposal or treatment option. The SLR Environmental Specialist will be present at the excavation area to guide excavation, observe the site conditions, and evaluate the need for special gravel handling.

3.4 INVESTIGATION OF GEOPHYSICAL ANOMALIES, SOUTHEAST PORTION OF PAD

As noted in Section 2.3.1, the EM survey of the pad in 2005 identified low resistivity, linear anomalies on the southeastern portion of the pad (see Appendix A, USGS Report Figure 3.2.5.1). The cause of these anomalies was not known. However, it appeared to be from a non-ferrous source. Therefore, it is unlikely to be a fuel pipeline. These anomalies may be the result of soil characteristics or compaction that is different from the surrounding pad. As precaution, three test pits will be dug in the location of the anomalies to attempt to verify their source and determine if further action is warranted. If a visible inspection of the test pit, supplemented with PID screening of the soil, indicates a potential concern, analytical sampling and/or removal actions will be taken as warranted to meet the objectives of this Cleanup Plan. If the source is attributed to wood debris or soil properties, no further action will be taken.

3.5 BACKFILLING AND PAD RESTORATION

Once cleanup work concludes based on site observations and sample results, the Northeast Landfill excavation and petroleum contaminated pad excavations will be backfilled and compacted to pad grade using clean gravel fill. There are currently stockpiles onsite with sufficient quantities of gravel to meet the projected backfill needs. In addition, gravel removed from excavations meeting Table 1 cleanup levels may also be used for backfill material. The only excavation area (footprint) not planned for backfilling is the Western Landfill, which borders the western edge of the pad. In this area, fill will primarily only be placed along the “new” pad edge following landfill removal in sufficient quantities to provide a stable slope that is not susceptible to sloughing. Final pad side slopes will be no steeper than 2:1 in this area. Furthermore, the native soils left exposed by the landfill removal will be re-contoured to approximate the surrounding natural landforms. To assist with the grading, small quantities of clean fill may be used to fill in low lying areas or potential drainage pathways (gullies or rivulets) in the former landfill footprint area based on the inspection of the site conditions and judgment of the Site Project Manager, in consultation with BLM. Fill placement and contouring may also occur along the upper beach face where the beach transitions into the former landfill area to eliminate any manmade embankments. The projected pad boundary along the western edge after cleanup is complete is shown on Figure 7. It is estimated 1,000 to 1,500 yd^3 of clean gravel will be needed for backfill of the pad excavation and contouring of the new pad edge.

In addition, the portion of the pad used for landfarming activities will be graded and compacted following an adequate period of tilling and natural attenuation as discussed in Section 3.8.

3.6 CLEAN GRAVEL MANAGEMENT

Clean gravel will be managed so it is used efficiently and not compromised by mixing with contaminated gravel. In addition, clean gravel existing prior to the start of the cleanup will be kept separate from clean gravel generated in course of removing the landfills (e.g., cap material). The northeast corner of the pad is the designated area for clean gravel existing prior to the cleanup (Figure 7). The northwest corner of the pad is the primary designated area for clean gravel generated during the cleanup (Figure 7).

As shown on Figure 4, there are two existing clean gravel stockpiles on the pad. The smaller pile is located along the northern edge of the pad. It is approximately 13 ft tall with a radius of 14 ft, and contains approximately 100 yd^3 of gravel. The southern stockpile is approximately 8.5 ft tall, 50 ft wide, and 165 ft long, and contains approximately 1,300 yd^3 of gravel. These piles will be used as backfill to the extent needed as discussed in Section 3.5.

The large, southern, stockpile of gravel is located within the planned landfarm area (Figure 7). Prior to landfarm construction in this area, the clean gravel will be moved and either used as fill on the pad excavations or taken to the designated clean gravel storage area on the northeast corner of the pad (Figure 7). If used for pad excavations of the petroleum contaminated areas, the clean gravel may be temporarily stockpiled near the planned excavation area until it is needed.

3.7 WATER MANAGEMENT AND EROSION CONTROL

Water and erosion control practices will be put in place to manage surface and pore water runoff from the pad during excavation and landfarm activities. Project activities will be conducted under the guidelines outlined in a Storm Water Pollution Prevention Plan (SWPPP), developed under the State of Alaska Construction General Permit. The SWPPP will address protection of nearby surface water during landfill excavation, management of excavation dewatering, and control of surface water run-off from landfarming activities.

Surface water runoff from rainfall events should be minimal due to the small quantity of precipitation that occurs in the summer months. The region's average precipitation in July and August is 0.91-1.04 inches per months (WRCC 2005), so the rain water should generally infiltrate the pad and not cause sheet flow. As discussed in the Section 3.8, the landfarm soil will be setback from the top of the pad edge a minimum of 25 ft to prevent surface water runoff from being capable of transporting the landfarm soils off the pad. Excavations within the interior of the pad will be backfilled to prevent surface water ponding and the pad side slopes along the western edge will be contoured to minimize erosion (Section 3.5)

Management of pore water will also be performed. Based on test pits and well points installed in the landfill during the 2005 and 2006 investigations (HCG 2006 and 2007b), it is very likely that water will be encountered at depths between 1.5 to 3 ft below the pad surface in most areas during the summer thaw (late June to September). Permafrost will be present at similar or slightly greater depths. The removal actions are expected to be conducted in the summer months, and the following additional water management procedures will be put in place (subject to minor modifications based on site conditions):

1. When removing the Western Landfill, the removal will start at the southwest edges of the pad and proceed progressively to the east and north. Active zone water flow is estimated to be towards the northwest so this should reduce the potential for pad pore water to pool in the excavation area. Sorbent booms will be placed along edges of the landfill to prevent potential petroleum sheen from reaching adjacent surface water bodies. A double row of booms will be placed areas where the excavation face is in standing water, as may occur in the southwest edge. As the landfill is removed, additional booms will be placed in the excavated area(s) if pooled or draining water with sheens are present. The boom will be checked daily or more frequently if necessary based on the site conditions to ensure they are functioning properly and still in good working condition. The booms will be replaced if they become visibly saturated with oil, or other petroleum products. The booms will be removed at the end of the removal action unless there is visible sheening. If sheening is localized, boom will only be left where sheen is observed or where considered likely. The booms will be replaced with new booms the following year if sheening is still present and removed when no longer necessary.

   In addition, silt fences or equivalent will be placed along the west and south perimeter of the Western Landfill to minimize the movement of suspended sediment. Silt fences will be replaced as needed. The booms and silt fence will be set prior to the start of excavation. If drainage channels form in native soil areas following excavation, straw wattles or equivalent will be placed perpendicular to the channels. The wattles help to slow surface runoff and control soil erosion. The wattles will be staked in place and can be left to biodegrade.

2. When removing areas within the interior of the pad, such as the Northeast Landfill or petroleum contaminated areas (Figure 4), excavation dewatering may be required to effectively remove soil and landfill debris below the water table. If excavation dewatering is necessary, the water will pumped into a temporary storage vessel (e.g., fold-a-tank(s) with baffles), which will serve as an oil/water separator. If product, including sheen, is present, sorbent booms or pads will be used to remove the product. Water will be pumped continuously from the bottom of the storage vessel and will be discharged on the pad in the designated landfarm area at least 100 ft from the pad edge. The discharge will be dispersed over the pad surface by means of a sprinkler system or other slow discharge outlet to prevent ponding or sheet flow. This process will aerate the water, promoting volatilization and degradation of any dissolved phase hydrocarbons, and keep the discharge on the pad where any residual hydrocarbons can attenuate. Typically, and preferably, this water discharge will occur onto excavated PCS already spread on the pad for landfarming. Excavation activities will start on the Western Landfill area, and at least a portion of these soils will be spread on the pad before work at the areas where dewatering is potentially needed commences. The discharge will be monitored to ensure the soils are not too wet or to dry in any given area (see Section 3.7).

   As a precaution, prior to initially discharging water onto the landfarm soil, a water sample from the northeast landfill excavation will be collected from the oil/water separator device and analyzed for chlorinated solvents and PCBs. If the water sample meets drinking water standards for those analytes it will be discharged as described above. If these discharge criteria are exceeded, the water will be treated onsite using an activated carbon system until discharge criteria are met.

3. Drums or other types of containers located below the seasonal water table may be partially filled with water that has seeped into openings (e.g., holes, cracks or open bungs). Inspections of drums in test pits conducted in 2005 indicated that a significant percentage of the drums had been mechanically crushed and buried. This is consistent with the site history which indicated drums were cleaned and crushed and then buried, sometimes as base material for the pad (HCG 2006). Drums which are crushed to less than 25% their original size will be considered sufficiently free of residual product and any water present will be allowed to drain in the immediate work area or on the pad in the designated landfarm area. If a drum is not crushed but has poor integrity or opening (holes or open bung) it will be inspected to determine if it contains water or oily water. If the drum has sufficient integrity that it can be moved without leaking, it will be removed from the excavation (ground) and placed in an overpack. If a drum cannot be moved without significant leakage, the water will be removed from the drum by pumping directly from the buried drum into a new container (e.g., new drum). The containers (drums) of water, or oily water, will then be transported to a processing area, where the water will be run though an oil/water separator and then discharged to the landfarm area as described above (item 2). The processing areas will be located within the designated landfarm areas.

   If a drum or container appears to contain a hazardous substance that is not fuel or oil-related, based on the products appearance, color, specific gravity, or other attributes, the drum and associated product will be segregated and the product tested to determine the appropriate handling and disposal options (see Section 6). While in storage awaiting analytical results, the original drum will be overpacked or its contents placed in a new drum which is stored in secondary containment (e.g., temporary lined storage area). These drums will be stored in the staging area designated for wastes being shipped offsite (Figure 7).

3.8 LANDFARMING OF PETROLEUM CONTAMINATED SOIL (GRAVEL)

After excavation and segregation of soil (gravel) from solid waste, estimated to take one field season, the PCS will be treated onsite by landfarming. The landfarm area will be located in the designated landfarm area (Figure 7), at least 25 ft from the pad edge on the eastern, western and southern sides (post-excavation), and approximately 300 ft from the coastline (northern edge). These setbacks are intended to ensure the soil is not susceptible to dispersion off the pad due to surface water runoff, erosion, or wind dispersion. The contaminated soil will be spread to a thickness of up to 1.5 ft thick on the pad, or thinner if space permits. The planned landfarm area (7 acres) is shown on Figure 7 (red hashed area), assuming a soil volume of 13,964 LCY and average thickness of 1.25 ft. If the soil volume to be landfarmed is greater than planned, the landfarm area will be built up vertically above the anticipated 1.25 ft. The landfarm will not be extended laterally beyond 7 acres. In general, soils will be placed on the southern portion of the pad and progress to the north.

Nutrients (fertilizer) will also be applied to the soils prior to treatment to promote bioremediation. A slow release 20-10-10 formulation of fertilizer (20% nitrogen, 10% phosphorus, 10% potassium) will be soil applied at a rate of about 1 pound per LCY to soil as it is being spread or as soon as practicable afterwards.

The spreading of soil may start progressively during the first field season (Year 1), or be completed at the start of the second field season (Year 2). After spreading of the soil, the landfarm area will be tilled to homogenize and aerate the soils, thereby creating uniform contaminant concentrations, and stimulating volatilization and bioremediation of hydrocarbons. During each tilling event, the objective will be to mix the entire depth of the soil in place in the landfarm, while minimizing entrainment of the underlying pad material. Watering of the landfarm soils in not anticipated being necessary to promote bioremediation or control dust. Soil samples collected from test pits at Camp Lonely had measured percent solids in the range of 85-95% (HCG 2006). This falls within the optimal moisture content for biological activity when landfarming of soils in the Arctic, 92-94%, or 30-40% of the gravel's water holding capacity, based on previous Arctic landfarming projects (Chatham 2003). The region's average precipitation in July and August, 0.91-1.04 inches per month (WRCC 2005), is anticipated to provide enough moisture to maintain the soils in an adequate moisture range for natural attenuation to occur and dust to be suppressed. In addition, the periodic tilling of the soil will help homogenize the moisture content in the landfarm soils. For example, if the upper landfarm horizon becomes too dry or the lower portion of the landfarm becomes too wet, the tilling will redistribute the moisture content. However, in the event additional water is needed, irrigation water for the landfarm will be derived from the excavation dewatering described previously (Section 3.7, item 2) or the permitted camp water supply (fresh water lake).

Visual monitoring will be the primary method of evaluating if the soils are too dry or wet. However, moisture content of the landfarm soil will be measured using field methods after each tiling event. In addition, when analytical samples are collected to determine petroleum concentrations (discussed below), percent moisture will be determined as part of the analysis. However, as indicated above, maintaining the soil moisture range between 92-94% is not a requirement for successful landfarm operation.

Once soil has been spread in the landfarming area, and prior to tilling, MI soil samples will be collected to determine the initial (baseline) concentrations of petroleum contaminants in the landfarm soil. Samples will be analyzed for DRO/RRO and GRO/BTEX. MI samples will be collected in accordance with the FSP (Section 4.2.2). Fifty decision units are planned for sampling purposes as shown on Figure 8. If the soil volume and resulting landfarm area is less than planned, the number of decisions units may be reduced accordingly. Further details regarding sampling approach is contained in the FSP (Section 4) and Table 5.

Landfarming (tilling or mixing of the gravel) is anticipated to be conducted from late June to early September when temperatures are consistently above freezing. Landfarming is anticipated to take one or two field seasons. Tilling will be performed on an as needed basis that will be primarily dependent on the starting DRO concentration and target cleanup level. A minimum of three tilling events will be performed, separated by a time interval of at least 14 days, in addition to the initial spreading event. The perimeter of the landfarm area will also be inspected to ensure the PCS is staying at least 25 ft away for the edge of the pad. Where necessary, the soil will be pushed pack from the edges of the pad to maintain the proper separation distance. In addition, the perimeter of the landfarm will be monitored for signs of surface water drainage from the landfarm area. If surface water drainage is observed, drainage patterns will be filled and graded to impede channelization, and if necessary, adjacent surface waters will be silt-fenced and boomed as a precaution.

A second round of MI sampling for DRO/RRO analysis, no GRO/BTEX, will be collected in the approximate middle of the field season. This data will be used to evaluate progress, and the need to modify the tilling frequency.

A third round of MI soil samples will be collected at the end of the field season to determine if the target cleanup level of 1,000 mg/Kg DRO has been met. The post treatment confirmation samples will all be analyzed for DRO/RRO and GRO/BTEX. In addition, 20% of the samples will be analyzed for PAHs. This event will also include samples collected in triplicate for QC purposes following ADEC guidance (ADEC 2009).

If the DRO concentration in the landfarm soil has not come to within 20% of the target cleanup level (1,200 mg/Kg or less), landfarming will be continued for another field season following the same approximate steps described above (except for baseline sampling). If procedures are modified, a Cleanup Plan addendum will be provided to ADEC for review and approval.

After the soils have met the target cleanup level of 1,000 mg/Kg DRO, active landfarming (tilling) may stop. At that point, the treated soil will be left on the surface of the pad to allow the residual petroleum hydrocarbons to naturally attenuate to a DRO concentration of 500 mg/Kg (or level at which significant sheening is judged improbable if the treated soil is exposed to surface water at a later date through erosion).

The estimated time frame for natural attenuation to reduce the residual hydrocarbons to the concentration of 500 mg/Kg is 3 to 5 years after active tilling has occurred. Sampling and analysis of the landfarm area for DRO will occur at least once during this period as part of the post cleanup monitoring (method to be described in the associated plan). After the soil in the landfarm has reached a concentration below or close to 500 mg/kg, the soils in the landfarm area will be compacted and graded as needed to return the pad to a usable condition. Pad compaction will take place within two years following attainment of a 500 mg/Kg target cleanup level for DRO unless the Site Project Manager is able to show, with objectively reasonable evidence, that more cost effective compaction is foreseeable within an additional two years (e.g., evidence that a barge is scheduled to be operated in the vicinity of the camp), in which case the act of compaction may be postponed for up to an additional two years.

In summary, the target DRO concentrations for landfarm activities are as follows:

- Discontinuing active tilling of soil ≤ 1,000 mg/Kg
- Conditions acceptable for compaction of landfarm soil ≤ 500 mg/Kg

In the event there is a need to move the treated soil outside the designated landfarm area, ADEC will be contacted for approval prior to any such movement.

3.8.1 CHARACTERIZATION OF PRE AND POST PAD CONDITIONS IN LANDFARM AREA

Prior to spreading the landfarm soils, samples will be collected in the designated landfarm area and analyzed for DRO/RRO, GRO, PCBs, VOCs, and metals to document the pad baseline conditions. These will be collected at a depth of approximately 0.5 to 2 ft bgs. Eight decision units are planned for sampling purposes in the landfarm area as shown on Figure 8 and discussed above. The pad baseline samples will be grab samples collected from the approximate center of each planned decision unit. These samples will be grab samples because post landfarm samples will be collected from the same approximate location and will need to be subsurface samples, making MI sampling impractical. When collecting these baseline samples, the areas of documented contamination planned for cleanup (Figure 4) will be avoided unless they have already been removed and backfilled with clean fill.

After tilling is stopped, the pad material (gravel) below the landfarm soils will be sampled to document the post landfarming site conditions. The samples will be collected approximately between 0.5 and 2 ft below the pre-landfarm ground surface and analyzed for the same analytes (DRO/RRO, GRO, PCBs, VOCs, and metals). These samples will be collected by hand auguring down through the landfarm soil and then approximately 0.5 to 2 ft into the original pad material. These results will be used for management and documentation purposes. It is probable there will be some leaching of petroleum hydrocarbons into the pad material. So long as contaminant levels do not exceed the designated cleanup levels (Table 1), no action will be taken. If contamination is detected above cleanup levels, the Site Project Manger will determine the appropriate actions necessary, in consultation with the ADEC and BLM.

3.9 SURVEYING

Surveying will occur at the beginning of the project as needed to orient site workers to planned excavation areas on the current gravel pad. Following excavation, confirmation sample points will be surveyed. The extent of landfarmed soil and current pad edge following removal actions and grading will also be surveyed. The approximate excavation boundaries will also be marked and surveyed for mapping purposes. The survey data will be included in the final cleanup report for this project.

3.10 DEMOBILIZATION AND FINAL INSPECTION(S)

Following the completion of cleanup and landfarm activities all materials, equipment and project generated wastes will be removed from the site. Waste will be managed and shipped per the Waste Management Plan (Section 6). Once temporary facilities are removed, those areas and the entire pad will be inspected by the Site Project Manager (or designee), along with a designated BLM representative, to ensure there are no unauthorized materials or wastes, including stained or contaminated soil. Corrective actions will be completed as necessary by the Cleanup Contractor. Further details regarding demobilization are included in the Site Operations Plan (to be provided under separate cover).

As discussed in Section 2.4.3, cleanup objectives include making the pad visually free of litter to the extent practical. During landfarm activities, the soils will be inspected and remaining visible solid waste, if found, will be removed by hand picking. The periodic tilling of the soil will bring solid waste to the surface and facilitate this process. In addition, a magnet will be dragged over the pad to remove small pieces of ferrous metal in the landfarmed soils, if visible metal is present on the surface. A final inspection of the pad with BLM will be performed at the conclusion of the landfarming phase to evaluate whether cleanup objectives have been met with respect to solid waste removal. Representative photographs of the pad surface will be taken to document the site conditions. If necessary, incidental surface debris cleanup will continue in the monitoring phase.

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4. FIELD SAMPLING PLAN

This section of the Cleanup Plan describes the approach and field sampling methods that will be used to acquire the necessary data to meet the data quality objectives for this project. The methods substantially follow ADEC guidance (ADEC 2009a and 2010) with minor variances to accommodate project specific objectives and conditions. The field sample team will be proficient in the implementation of the applicable procedures. Some variances in the sample approach or methods may occur in response to field conditions. These variances will be documented in the field notes and will be included in the final report.

A variety of sample collection and analytical methods will be necessary to complete the cleanup activities at Camp Lonely. Samples will be collected to characterize site conditions, confirm that cleanup levels have been met and characterize waste for offsite disposal. Table 5 lists the sampling approach (method) and estimated number of soil samples to be collected at each area. Table 6 contains additional analyses to be conducted as needed for the purposes of waste characterization. Table 7 lists the sample containers and preservatives to be used per analysis type.

Sampling activities will be documented in field logs or notebooks, which will be retained for a minimum of five years after the events. Copies of field logs and notes documenting the sampling will also be provided with the Cleanup Report.

4.1 FIELD SCREENING

Field screening for volatile compounds will be used to guide the excavation and management of petroleum hydrocarbon contaminated soil and assist with identifying appropriate sample locations for analytical sampling. It may also be performed for health and safety monitoring. Field screening for volatile compounds will be performed with a PID. PID readings will be recorded in a project field notebook of logs.

The field screening procedure may be performed on soils *in-situ* or *ex-situ*, using qualitative to semi-quantitative methods based on the data need and judgment of the field sampler (Environmental Specialist). When semi-qualitative data is desired, procedures will follow the heated head space method outlined below:

- The field sampling personnel will calibrate (or verify calibration of) the PID at the beginning of each day. The instrument will be calibrated to yield “total organic vapors” in ppm to a benzene equivalent (e.g., isobutylene). If significant drift in the instrument is suspected or observed, proper calibration will be verified. Operation, maintenance, and calibration will be performed in accordance with the manufacturer’s specifications. All calibration information will be recorded in a calibration notebook that accompanies the PID.
- The field sampling personnel will fill a plastic re-sealable bag approximately 40 percent full with the soil to be analyzed, ensuring that there is sufficient headspace to allow vapors to accumulate. For characterizing soil within excavation (sidewalls or floor), the bag will be filled with freshly exposed soil by digging 2 to 6 inches into the subsurface of the soil. If the

soil has been exposed for over 24 hours, the sample will be collected 6 to 12 inches below the surface (unless permafrost or the water table is shallower than this depth, in which case the sample will typically be collected directly above permafrost or water table). Stockpile samples will be collected 12-18 inches below the surface of the pile.

- Headspace vapors will be allowed to develop in the bag for at least 10 minutes and no longer than one hour. The bag will be shaken or agitated for 15 seconds at the beginning and end of the headspace development period to assist volatilization. The temperature of the headspace will be brought to at least 40 degrees Fahrenheit.
- Subsequent to headspace development, the field sampling personnel will insert the instrument probe into the bag to a point about one-half the headspace depth. Following probe insertion, the highest meter reading will be recorded in the field notebook.
- Erratic meter response may occur at high organic vapor concentrations or conditions of elevated headspace moisture, in which case a note to that effect will accompany headspace data.

The heated headed space method will be used when PID screening is being used to screen potentially clean soil (e.g., gravel cap stockpile), and determine whether an analytical sample for DRO/RRO is required. In such cases, a sample aliquot for PID screening will be collected and analyzed as described above, and a separate aliquot will be collected for a lab sample as described in Section 4.2. However, if the sample is to be analyzed for non-volatile analytes (PCBs or metals), the soil sample may be collected directly from the same aliquot (bag) as the screening sample.

In some cases, the soil will be screened directly from a sample core or scoop to obtain a more rapid indication of the presence of volatiles. Such screening is less quantitative but does provide a relative indication of volatile concentrations which can be used to prioritize sample locations, or quickly identify potentially impacted soil when excavating. When it is necessary to verify that areas meet cleanup criteria, any screening data will be verified with analytical data (samples sent for laboratory analysis).

4.2 SOIL SAMPLING

Discrete, composite and MI (ADEC 2009a) soil sampling techniques will be utilized on the project as discussed in the Work Plan (Section 3). Discrete sampling will be used for characterizing soil stockpiles and excavated areas (e.g., floor and sidewall confirmation samples). An MI sampling approach will be used to characterize the landfarm soils, because it is a large area and should be relatively homogenous after tilling. Composite sampling will only be used to characterize containerized waste being shipped offsite for disposal. The sample method utilized will be documented in the field notes and associated reports.

Soil sampling activities will typically be performed in accordance with the following procedures:

- New disposable nitrile gloves will be donned before collecting samples from each core or new sampling location;

- Sample aliquots will be collected in the order of most volatile (i.e., GRO, VOCs [including BTEX]) to least volatile;
- If field replicate samples or multiple analyses are required from one location, non-volatile samples will be homogenized in a stainless steel bowl prior to placing the soil in the sample container;
- Field replicates for volatile samples will taken from soil co-located with the primary sample; and
- Samples collected for laboratory analyses will be placed in a pre-chilled cooler immediately after sample collection.
- At each sample location, characteristics such as color, soil classification, and the presence of contamination (stain or odor) will be recorded in the field logbook.

For site characterization and confirmation samples, field replicates will be collected for discrete samples at an approximate frequency of one field replicate per ten primary samples or less. For confirmation samples where an MI sampling approach is used, triplicate samples will be collected at a frequency of one per ten MI samples per decision unit to enable calculation of the 95% UCL concentration per ADEC guidance (See Table 5 and Section 4.2.2.3 for specifics). Matrix spike (MS) and matrix spike duplicate (MSD) samples will each be collected at an approximate frequency of one per twenty samples or less for discrete samples. No MS/MSD samples are collected during MI sampling. MS and MSD samples will be analyzed using the same aliquot of soil provided for the primary analysis, for volatiles analysis. For non-volatiles analyses, triplicate sample volume will be collected to ensure that adequate soil is provided to the laboratory for this purpose. MS/MSD samples must be identified on the chain-of-custody paperwork by placing "MS/MSD" in the comments section. Field replicates will be submitted as blind samples to the laboratory (Section 4.4.1). No QA/QC samples (i.e., field replicates, MS/MSD, etc.) will be collected for the purpose of waste characterization (this includes sampling of soil stockpiles, and drum sampling) or intermediate (screening) sampling. Reference Table 5 for further detail regarding QA/QC samples for each area, or sample type.

4.2.1 SITE CHARACTERIZATION AND CONFIRMATION SAMPLING

Discrete samples will collected for the purposes of site characterization and confirming excavated areas meet cleanup levels. Surface soil samples (0-6 inches bgs) will be collected using a decontaminated hand auger or a decontaminated, or disposable, stainless steel spoon which will be used to directly fill the sample container. A minimum of one equipment blank will be collected when using non-disposable equipment (e.g., hand auger, decontaminated spoon, etc.). If a hand auger is used, a soil (sample) core will be placed in a decontaminated stainless steel bowl and homogenized prior to transferring to a sample container for non-volatile analyses. If VOC samples are required, the VOC aliquot will be taken prior to this procedure. Surface samples will either be a composite of the first 6 inches of soil or specific depth interval (e.g., 2-4 inches). Depths greater than 6 inches bgs will be recorded in the field logbook. The depth will also be included as part of the sample identification number (Section 4.4.1). It is not anticipated that any samples will be collected from vegetated tundra. However, if the situation arises, samples will be collected from the upper soil horizon as opposed to the organic, vegetative mat. If the ground surface (~upper inch) consists of coarse gravel (> ¼ inch), this sample will be collected from the finer grained matrix below, if present. A decontaminated hand auger or shovel may be used to assist with sample collection by clearing vegetation or coarse grained gravel. The presence of organic matter in the sample media will be noted on the sample log.

Subsurface soil samples (> 6 inches bgs) will generally be collected either using a clean hand auger or directly from the floor or sidewall of an excavation using a decontaminated, or disposable, stainless steel spoon. Soil will be placed directly into sampling jars, using a stainless steel spoon. Sample logs will be completed detailing the type of soil encountered, depth to active zone water and permafrost, and other pertinent details.

4.2.2 STOCKPILES

The soil within the stockpiles of landfill cap material and underlying landfill waste which may remain onsite for eventual reuse (before or after onsite treatment) will be characterized using discrete samples, following the ADEC *Draft Field Sampling Guidance* (May 2010), and as summarized in Table 8. As indicated in Table 8, the procedures vary for the landfill cap and landfill material waste (solid waste mixed with interstitial soil).

The cap material (suspected clean soil without solid waste) will be placed in stockpiles about 100 CY in size. Ten (10) discrete samples will be collected for PID headspace analysis from each pile, at least 12 inches below the surface of the pile and distributed evenly around the pile. If no PID readings are greater than 10 ppm, no laboratory analysis for petroleum hydrocarbons will be performed and the pile will be considered clean with respect to petroleum hydrocarbons. If one or more PID readings are greater than 10 ppm, then a discrete sample will be collected from the screening location with the highest PID reading and analyzed for DRO/RRO to determine the classification of the soil (clean or petroleum contaminated).

The landfill soil will be placed in stockpiles of about 35 CY in size or less. Four (4) discrete samples (or a minimum of 1 sample per 10 CY) will be collected for PID headspace analysis from each pile as described above. If all PID readings are less than 10 ppm, then 1 discrete sample will be collected from the location where solid waste appears to be most concentrated or suggestive of potential contamination and analyzed for lead and PCBs. If 1 or more PID readings are greater than 10 ppm, then a discrete sample will be collected and analyzed for PCBs and lead from the screening location with the highest PID reading. As discussed in Section 3.2, the lead and PCB analysis may be reduced in frequency or eliminated based on the results from the southwestern portion of the Western landfill.

DRO/RRO will not be analyzed on the landfill soil if it is considered petroleum contaminated based on the PID screening results or general observations. Once the solid waste is removed and PCB and lead concentrations determined to be acceptable, this soil will be placed in the landfarm area. However, if there is the potential that soil will be considered clean once the solid waste is removed, and PID readings are > 10 ppm, then a sample will be collected and analyzed for DRO/RRO. Other analyses may be performed as well, on a case by case basis, based on the type of waste found mixed with the soil.

4.2.3 MULTI-INCREMENT (MI) SOIL SAMPLING

MI sampling will be performed on landfarm soil to determine if it has met target cleanup levels. Sample collection will follow the ADEC *Draft Guidance on Multi-Incremental Soil Sampling* (ADEC 2009a).

4.2.3.1 Decision Unit Determination

Each excavated area will be comprised of at least one decision unit. The number of decision units anticipated for each site is specified in Table 5, and schematically shown on Figure 8. A MI sample will be collected from each of the decision units (Section 4.2.2.2). Samples will also be collected in triplicate at a rate of 10% for each area where MI sampling methods are used for confirmation sampling (Section 4.2.2.3) Adjustments may be made in the field based on actual site conditions and observation, including final excavation size.

Each decision unit will be divided into at least 50 equal sized areas (subunits). From each of these subsample units, an increment sample will be collected. Each decision unit will be staked in the field, measured and sketched in the field notebook. Calculations will be made to ensure subsample areas are equal in size, particularly for irregularly-shaped excavation areas. Subsample area boundaries will then be marked with pin flags to guide field personnel during sample collection.

From each of the 50 subunits, an increment sample will be collected. The increment location in the subsample area will be determined by rolling a die twice, once to determine the x-coordinate and once to determine the y-coordinate. The remaining increment samples for the decision unit will all be collected from the same x and y coordinate in each of the remaining subsample areas (Figure 9). For triplicate sample sets, the primary, duplicate, and triplicate increment samples will not be co-located. The primary, duplicate, and triplicate samples will each be a minimum of ½ the grid distance away from each other. The duplicate and triplicate locations will be determined based on where the initial sample location is located to allow for sufficient room. For example, if the primary point is located in the lower left, the duplicate and triplicate samples will be located in the lower right and the upper portion of the subsample area in order to assure the required minimum separation distance. Likewise, if the primary sample location is located in the lower right, the duplicate and triplicate samples will be located in the lower left and upper portion of the subsample area. Refer to Figure 9 for an example.

This will result in a systematic random pattern because the decision unit boundaries will be determined in the field based on the dimensions of the area to be sampled, which is not biased by the sampler. The triplicate samples cannot be co-located and must be spaced sufficiently apart from the initial (primary) sample to have variability. For a triplicate samples, the second and third subsample within each subunit will be collected by moving from the primary sample location one half the distance to the border of the subunit. The second sample will be collected to the north of the primary sample location, and the third sample to the south.

4.2.3.2 MI Sample Collection

MI samples will be collected with a stainless steel spoon or similar instrument. Caution will be taken to ensure the same volume and weight for each subsample. Samples for volatile analyses will be collected before non-volatiles to reduce possible contaminant losses from volatilization. Prior to initial sample collection, sampling instruments will be calibrated with site soils to determine the approximate volume of soil to be collected from each increment location. At least 30 grams of soil must be collected in one MI volatile sample, approximately 1 gram per increment. The upper 6 inches of soil will be removed and the increment sample will be collected into a pre-weighed sample container containing methanol. The minimum ratio of soil to methanol is 1:1. If more than 30 grams of soil is collected, only one laboratory provided volume of methanol is necessary as long as the soil remains completely submerged. All increment samples from a single decision unit will be placed into the same container. To the extent practical, increment samples for volatile analyses will consist of particles smaller than 2 millimeters.

Increments collected for non-volatile analyses will be 30-60 grams each to provide an adequate final volume of soil (500 to 1,000 grams). The actual mass will be approximately the same for all increments within a decision unit. The soil subsamples will be sieved through a 2 millimeter (#10) sieve as they are collected. The sieve will be located on top of a clean container and each increment will be poured through the sieve. Alternatively, the soil will be collected into a container and then sieved. Once all the increments have been collected, the sieved material (<2mm) will be poured onto a flat metal sheet (e.g., cookie sheet) covered with clean aluminum foil and evenly smoothed to a maximum depth of ½ inch. The metal sheet will then be divided into a grid containing 30 squares. A small flat spatula will be used to collect an approximately 1 gram subsample from each square (for a total of 30 to 35 grams of soil per analysis), which will be placed into the appropriate laboratory-provided sample container (Table 7). Because fine particles have the tendency to settle to the bottom, the subsample will be collected such that the spatula contains a representation of the vertical soil distribution.

A minimum of two sample jars will be submitted to the laboratory for each non-volatile analytical method. At least one additional jar will always be submitted for total solids. All aliquots will be taken from the cookie sheet following the same procedure, as outlined above. This will ensure consistency. The purpose of the second sample jar for each analytical method is to provide adequate volume in case re-extraction is necessary. For non-volatile analyses, the laboratory will analyze the entire volume (30-35 grams) of sample within a jar. If the total solids jars have approximately 40 grams of soil (rather than 30-35 grams) but still contain equal increments from each subsample location, it will be possible to use it as a second backup after removing soil (generally 7 to 10 grams) for total solid determination, in the event a second re-extraction is necessary. Only one sample aliquot is required for volatile organics analyses. However, a total solid jar is still required in order to provide a non-preserved aliquot of sample.

4.2.3.3 Multi-Increment Triplicate Samples

For MI sampling, triplicates must be collected to verify that an MI sample adequately represents the decision unit from which it was collected. A triplicate sample allows a relative standard deviation (RSD) calculation to be performed. Triplicate samples involve the collection of three distinct (not co-located) samples within the same decision unit. As per section 4.2.2.1, to determine the second and third MI sample locations in a triplicate, a die will be rolled as it was for the original sample to determine the starting location for the increments (at least half the grid size distance from each other). Data for all three samples will be reported in the cleanup report.

Triplicate samples are typically collected at an approximate frequency of 10% for each area investigated. RSDs will be calculated for each triplicate set. ADEC guidance requires an RSD of 30% or less to consider the data representative (ADEC 2009a). The triplicate results will also be used to calculate the 95% upper confidence limit (UCL) using the following equation:

$$95\%\ UCL = x + \frac{ts}{\sqrt{n}}$$

where:
x = mean
t = 95% one-side student t factor (e.g., for n=3, t=2.92)
s = standard deviation
n = number of samples

The 95% UCL will be calculated for each decision unit. If multiple decision units are present at one site and only one triplicate is performed, the $ts/\sqrt{n}$ factor calculated for the triplicate MI results will be utilized to find the 95% UCL for each decision unit.

Table 5 identifies the anticipated locations and sample events where triplicates will be collected. In cases where a triplicate set from one area is being used to determine the $ts/\sqrt{n}$ factor used at another area, it is assumed that the areas being sampled share similar soil characteristics (sandy gravel with little organics) and site conditions. If field observations indicate that this is not the case, a triplicate sample will either be collected from each of the sites, or other triplicate data (if appropriate) will be applied.

4.3 SAMPLING WASTE FOR OFFSITE

Waste which requires complete characterization in order to be shipped offsite, will be sampled using either discrete of composite sampling. Discrete sampling will be used on liquids and in some case solids. However, soil which is containerized will generally be composite sampled. Methods will be tailored to the type of waste and will be documented on sample logs and field notebooks.

Drums and other waste containers will be staged so they can be sampled and tracked by SLR field personnel. Parameters to be sampled will depend upon the suspected contents and will be agreed upon in advance. Field personnel will maintain an inventory of drums and other waste containers. Each container will be assigned a unique identification number. This number will also correspond to the laboratory identification number (Section 4.4.1) that will be used for tracking drum sample results for ultimate waste disposal. Containers will be clearly numbered using paint markers, spray paint, or other permanent device.

Following sample collection, samples will be submitted to an ADEC-approved laboratory according to the procedures outlined in Section 4.4. Analyses will be performed and reported in accordance with the QAPP, Section 5.

4.3.1 DRUMS WITH LIQUIDS

Drums with liquids wastes will generally be sampled as follows. A discrete sample will be extracted from the drum using a drum thief, or equivalent. The sample will be placed in the appropriate sample container (Table 7) provided by the analytical laboratory. Unless field observations indicate that other testing is appropriate, drum samples will initially be tested for RCRA Oil Burn Specifications, which includes flash point (ignitability), total halogens, metals (arsenic, chromium, cadmium, and lead), and PCBs. Additional testing may be performed as determined necessary, based on the results of these tests, observations made by the laboratory, or other factors.

Sorbent pads will be placed around the open bung of the drum while sampling to catch any drips. After sampling, the bung will be placed back on the drum and the top of the drum wiped clean of any liquids (drips).

4.3.2 CONTAINERS OF SOIL

Supersacks or other containers with soil will typically be sampled using a composite sampling technique, either by:

1) Collecting multiple subsamples (typically 3-5) from a single container and compositing into a sample for laboratory analysis. The subsamples should be distributed through the container to the extent practical. It is preferable to collect the subsamples as the container is being filled. However, they can be collected afterwards using an auger of shovel to reach lower portions of the container.

2) Collecting a single subsample from multiple containers of a similar waste stream and compositing into a sample for laboratory analysis. If this technique is used there should generally be at least three laboratory samples of the waste stream (three composite samples).

The subsamples will be composited by placing an equal portion of the each subsample into the specified laboratory container for volatile analysis, or mixing equal subsample portions in a decontaminated stainless steel bowl for analysis of non volatiles.

4.4 SAMPLE MANAGEMENT

Samples collected for laboratory analysis (soil, waste, and field QC) will be managed from the time of collection until analysis. At the time of collection, sample containers appropriate for the specified analysis will be filled and sealed. Labels indicating sample identification, date, time and the sampler’s initials will be affixed on the sample container (except for methanol-preserved samples for which the label will be affixed to the plastic bag). A summary of required sample containers and preservatives is provided in Table 7. For analyses performed due to anomalies observed in the field, the containers and preservatives specified by the appropriate analytical methods will be used.

The possession and handling of individual samples must be traceable from the time of sample collection until the time the analytical laboratory reports the results of chemical analysis to the appropriate parties. The following sections present the sample handling procedures and documentation.

A bound and sequentially numbered field logbook will be maintained daily to document all field activities, including the collection of each sample. Field notes in indelible ink will provide a record of information such as team members, sample locations, field screening results, site observations, and work directives.

4.4.1 SAMPLE DOCUMENTATION AND NUMBERING

Samples will be assigned a unique identifier. A common nomenclature will be used for labeling samples when practical, that includes information such as the sample area, type, number and depth, if applicable. A typical format is as follows:

WLGS03

In general, the first two digits will represent the general area from which the sample was collected or the waste originated (e.g., WL = Western Landfill). The third and forth digits represent the type of sample (e.g. MI = multi--increment sample; GS = grab sample). The fifth and six digits represent the sample number for the area or container type (e.g., 03 is the third sample in the area or the third stockpile. A grid square designation may also be used). Other codes or numbering may be utilized at the discretion of the field team and will be documented in the field notebook and sampling logs, as appropriate. Examples of area codes are listed below:

Area Codes	Code[1]
Western Landfill	WL
Northeast Landfill	NL
Land Farm	LF
Communication Shop	CS
Loading Dock	LD
Incinerator Building	IB
Vehicle Maintenance Shop	VM
3,500 gal AST	3A
65,000 gal. AST	6A

A hyphen may be placed after the sixth digit and additional information added. For example, the sample collection depth, if applicable, can be denoted in ft bgs after the hyphen (“WLGS03-3” indicates a depth of 3 ft bgs from the ground or pad surface). The number indicates the bottom of the sample interval. The top and bottom of the sample interval will be recorded in the field logbook, along with the reference point (pad surface or natural grade). If the sample is a surface sample (0 to 0.5 ft bgs), a depth clarification is not required. A “FS” or “SW” can be added for indicating a floor sample or sidewall sample in lieu of the depth. For the Western Landfill, sample depth will not be listed for floor confirmation samples because the pad surface will be removed and not backfilled. For the PCB samples collected from grid squares, the grid square will be included along with the sub-quadrant designation (WLGS4K-NE = grid square four K, northeast quadrant). Field logs will record additional information on the sample and sample locations (discrete or MI) will be surveyed so the sample codes are in part a field management tool.

Waste samples will contain the site name where the waste originated (if applicable) and the unique container or stockpile number. For example, “NLSP05” indicates stockpile (SP) number 5 from the Northeast Landfill. Other common container designations are drum (DM) and super sack (SK).

An artificial sample designation will be used (e.g., GS93) for replicate samples, where the digit “9” replaces the first digit of the sample number. The collection time for a replicate sample will correspond with the collection time of the primary sample. A record of the replicate sample and corresponding primary sample will be recorded in the field logbook. Triplicate MI samples will be labeled as A, B, and C (e.g., WFMI03B).

Trip blanks will be assigned a unique identifier in a similar manner as the samples collected at the site (e.g., WLTBmmdd). The first two digits are the same as for primary samples represent the area. The next two digits are “TB” and the last four digits represent the month (mm) and the day (dd). The sample collection time for the trip blank will correspond with the sample collection time of the first sample collected of the day.

The numbering system may be modified slightly at the discretion of the field team provided the changes are thoroughly documented in the field logbook and the traceability of analytical results to the actual sample and its location is not impacted.

4.4.2 SAMPLE CUSTODY

Procedures to ensure the custody and integrity of the samples begin at the time of sampling and continue through transport, sample receipt, preparation, analysis and storage, data generation and reporting, and sample disposal. Records concerning the custody and condition of the samples will be maintained in field and laboratory records.

Chain-of-custody records will be maintained for all primary and QA/QC samples. A sample is defined as being under a person’s custody if any of the following conditions exist: (1) it is in their possession; (2) it is in their view, after being in their possession; or, (3) it is in a designated secure or locked area.

The following information concerning the sample will be documented on each of the laboratory chain-of-custody forms used for this project:

- Unique sample identification

- Date and time of sample collection
- Sample description (including name, location, and sample type)
- Preservative used
- Analyses required
- Name of collector(s)
- Pertinent field data (high field screening result, etc.)
- Serial numbers of custody seals and transportation cases (if used)
- Custody transfer signatures and dates and times of sample transfer from the field to transporters and to the laboratory or laboratories
- Bill of lading or transporter tracking number (if applicable)

The chain of custody will contain other pertinent information regarding the sample delivery, including:

- SLR contact information; Project and task number for invoicing (105.00617.12001);
- Deliverable requirements (i.e., Level II for all samples, characterization, waste characterization, and confirmation);
- Requested turn-around time; and
- EDD requirements (i.e. electronic data compatible with MS Access and MS Excel, including both sample results and QC sample results and recoveries).

4.4.3 SAMPLE PACKAGING AND SHIPPING

Samples required to be maintained at cool temperatures (e.g., not frozen to 6ºC) will be placed in coolers with frozen cold packs. The cold packs will be replaced as needed to maintain the required temperature until the samples arrive at the laboratory. The samples will be shipped to arrive at the analytical laboratory with sufficient time allowed for the laboratory to extract the sample within the holding time requirements of the test methods, to the extent possible.

The sample coolers will be sealed and shipped under proper chain-of-custody documentation. In most cases, the coolers will be shipped directly to the laboratory. Alternatively, the coolers may be picked up by an SLR representative and hand-carried to the designated laboratory. In general, samples will be packaged and shipped according to the following procedures.

- Samples will be transported in hard plastic ice chests or coolers with similar durability. The coolers must be able to withstand a 4-foot drop onto solid concrete in the position most likely to cause damage.
- Inert cushioning material will be placed in the bottom and sides of the cooler.
- Samples will be labeled with a unique identification number in accordance with Section 4.4.1. Field personnel will verify that all sample container caps are tight.

- Samples will be placed in zip top bags (where practical), wrapped in bubble wrap and placed upright in the cooler.
- One trip blank will accompany each cooler based on VOC analysis.
- One temperature blank will accompany each cooler.
- Frozen ice packs or cubitainers will be placed around, among, and on top of the sample containers to maintain a temperature of not frozen to 6ºC.
- Additional inert absorbent packing material will be placed around and on top of the containers to prevent breakage.
- The chain-of-custody for each cooler will be filled out in accordance with Section 4.4.2. The original will be placed in a zip top bag and taped to the inside top of the cooler.
- The cooler drain will be taped shut.
- The cooler lid will be secured with tape. The cooler will be wrapped with strapping tape, or equivalent, at a minimum of two locations, without obscuring any labels.
- The completed shipping label will be affixed to the top of the cooler.
- Labels indicating which side should be up will be displayed on four sides and “Fragile” labels will be displayed on at least two sides.
- Numbered, signed, and dated custody seals will be adhered to the front right and back left of the cooler. The date and time will match the chain-of-custody.
- Coolers will not exceed the weight limits set by the shipper.

A guideline summarizing the proper shipment of preserved samples and containers containing preservatives is included in Appendix E.

5. QUALITY ASSURANCE PROJECT PLAN

The QAPP presents a system for planning, monitoring, assessing, and improving the quality of field and laboratory analytical data obtained for the remedial action. This QAPP adheres to the ADEC Technical Memorandum on Environmental Laboratory Data and Quality Assurance (ADEC 2009b) requirements. QA procedures may change based on site-specific instructions from the project manager or in consultation with the ADEC and Husky. To supersede this QAPP, changes must be more stringent or restrictive; otherwise, it must have been determined that the change will not impact the data quality or usability. Changes to the QAPP will be documented.

QC procedures routinely implemented in the field and at the laboratory are discussed in the QAPP to illustrate how data of known and accepted quality will be produced. The QC procedures discussed in this QAPP support the field and analytical procedures described in site-specific sampling.

5.1 QUALITY ASSURANCE OBJECTIVES

Field and laboratory QC procedures are established to help achieve QA objectives of precision, accuracy, representativeness, completeness, comparability, and sensitivity (PARCCS) established for a project. These parameters are measured and evaluated in order to help determine the acceptability or usability of field and laboratory in making decisions. PARCCS objectives are defined below, along with a discussion of project-specific QC for each. Evaluation criteria are provided in Section 5.2, Quality Control.

5.1.1 PRECISION

Precision is a measure of the agreement or repeatability of a set of replicate results obtained from analyses made under common conditions. Precision is estimated from analytical data and can be expressed as the relative percent difference (RPD) or RSD. Variability is commonly attributable to site heterogeneity, sampling, or analysis procedures. The analysis of laboratory control samples and laboratory control sample duplicates (LCS/LCSD) serve to measure the precision of laboratory procedures. MS/MSD samples may be used for this purpose. However, MS/MSD recoveries may also be impacted by sample matrix. Field replicates measure the precision of sample collection and analysis procedures. Laboratory duplicates measure the precision sample homogeneity and the precision of analytical procedures.

For this project, precision will be assessed by analyzing LCS/LCSD, MS/MSD, field replicates for discrete samples, and triplicates for MI samples. An LCS/LCSD pair will be analyzed with each batch of twenty samples or less for petroleum hydrocarbon methods (AK 101, 102, and 103). Field replicate samples will be collected for discrete characterization and confirmation purposes, but not for waste characterization. The target frequency is one per ten samples or less, per similar matrix for each method. Triplicate samples will be collected for MI sampling at a target frequency of 10%. MS/MSD pairs will be requested for discrete confirmation samples at a target frequency of one per twenty samples or less, per similar matrix for each method. MS/MSD samples will not be collected for MI. Laboratory replicates will be analyzed at the discretion of the laboratory; the laboratory will be responsible for compliance with the analytical methodology. The RPD will be calculated for LCS/LCSD, MS/MSD, field replicates, and laboratory duplicates (where applicable). The RSD will be calculated for triplicates.

5.1.2 ACCURACY

Accuracy is a measure of the error between reported test results and the true sample concentration. Because true sample concentrations are not known, accuracy is estimated from recovery data resulting from spiking known reference materials into known matrices (continuing calibration verification [CCV], LCS, MS, internal standards and surrogates) and sample matrices (MS, internal standards and surrogates). MS/MSD, internal standard and surrogate accuracy is affected by the sample matrix and matrix interferences that may be present in the sample.

For this project, accuracy will be assessed by means of percent recoveries (%R). Recovery limits are variable and specific to each analytical method and target compound. Recovery goals for this project are ADEC requirements followed by laboratory standards.

5.1.3 REPRESENTATIVENESS

Representativeness is a measure of how closely the samples represent the site-wide population from which they were obtained. Representativeness is accomplished by (1) choosing the number of samples, sample location, and sampling procedures that will produce results showing as accurately and precisely as possible the matrix and site conditions being measured; and (2) using documentation methods to assure that sampling protocols have been followed and that samples are properly identified to maintain their integrity.

Samples are considered representative of typical site conditions when the selection of sampling locations is unbiased and standard field and analytical procedures are followed. The objective for this project with respect to the analytical data is to determine the concentration of contaminants within the subject matrices. Unusual field conditions or observations will be documented in field notebooks specific to the project. This information will supplement the analytical data in evaluating analytical results.

5.1.4 COMPARABILITY

Comparability is a qualitative evaluation of how the data obtained for one set of samples can be compared to data obtained from another set, from another laboratory, or at another time. To achieve comparability, SOPs and similar units of measure will be consistently used during sample collection, preservation, and analysis. Sampling and laboratory reports and procedures will be checked for conformity with these standard procedures and reporting formats. When non-standard procedures are used, data comparability will be addressed in the report of results. For this project, the same laboratory will be utilized to the extent practicable. Samples will be analyzed using common methods, including ADEC and Environmental Protection Agency SW846 analytical methods.

5.1.5 COMPLETENESS

Completeness is defined as the total number of samples collected for which QC objectives are achieved, divided by the total number of samples analyzed, and multiplied by 100. Under perfect conditions, completeness would be 100 percent. The data quality objective for completeness is 85 percent (ADEC 2009b). The completeness goal for this project is 85%

5.1.6 SENSITIVITY

Sensitivity is a measure of the concentration at which an analytical method or procedure can positively identify and report analytical results. The sensitivity of a procedure is commonly referred to as the detection limit.

For this project, the Detection Limit (DL) will be defined as the smallest analyte concentration that can be demonstrated to be different from zero or a blank concentration at the 99% level of confidence. In other words, if a substance is detected at or above the DL, it can be reliably stated (with 99% confidence) that the analyte is present and there is a 1% chance that the analyte is not present (a false positive). The Limit of Detection (LOD) is the smallest amount or concentration of a substance that must be present in a sample in order to be detected at a 99% confidence level. In other words, if a sample has a true concentration at the LOD, there is a minimum probability of 99% of reporting a detection (a measured value greater than or equal to the DL) and a 1% chance of reporting a non-detect (a false negative). The Limit of Quantitation (LOQ) is the lowest concentration of a substance that produces a quantitative result within specified limits of precision and bias.

The LOQ will be set at or above the concentration of the lowest initial calibration standard. Results equal to or above the LOQ will be reported without qualification. Quantitative results can only be achieved at or above the LOQ. Results between the DL and the LOQ assure the presence of the analyte with confidence, but their numeric values are estimates and will be flagged as estimated. Non-detects will be reported as “<LOD” because the false negative rate at the LOD is 1% and the false negative rate at the DL is 50%.

Sensitivity will be measured by evaluating whether the laboratory LOQs and DLs (quantitation and detection limits) are less than the regulatory cleanup levels or other project required goals. Additionally, sensitivity may be evaluated by determining whether analytes are detected in method blanks or trip blanks. The reporting limits for the laboratory will be evaluated by the SLR Project Chemist prior to contract award to determine whether the facility is capable of meeting project goals.

Applicable clean up requirements for this project are presented in Section 3. In cases where the reported LOQ is above the target LOQ for non-detects, the data will be considered usable provided the DLs are reasonably less than the cleanup levels (as determined by professional judgment and, if necessary, consultation with the project team [i.e., Project Manager and/or ADEC]).

The collection of waste characterization samples is anticipated. For waste characterization samples, laboratory LOQs should be less than the 40 Code of Federal Regulations (CFR) 279 oil burn specification criteria and 40 CFR 261 toxicity characteristic leaching procedures regulatory levels. It may not be possible to meet the target LOQs for all waste characterization samples due to the nature of the matrices. In cases where the laboratory DL is not below the regulatory level, it is not possible to determine whether an impacted target analyte is present in the sample above allowable limits. This should be considered when making decisions regarding the transport and disposal of the subject waste stream.

5.2 QUALITY CONTROL

Both field and laboratory QC measures will be in place. These QC parameters are discussed below. In cases where project specific criteria are not specified, the analytical methods and laboratory criteria will apply (in that order).

Field QC samples include the following:

Trip Blanks - Trip blanks, samples of analyte-free media prepared by the laboratory, are transported to the sampling site with each batch of sampling containers. They are handled like an environmental sample and returned to the laboratory with associated samples for analysis. A trip blank will be used to assess the potential introduction of contaminants from sampling containers, or during transportation and storage. Where a trip blank is required, at least one trip blank will accompany each set of containers in the field. For this project, each cooler of samples sent to the laboratory for VOC analysis will contain one trip blank except for product samples. Trip blanks will be assigned unique sample identifiers as described in Section 4.4.1. When an analyte is detected in the trip blank, the appropriate data flag will be applied to associated sample results, as described in Section 5.6.

Field Replicates – For discrete samples, field replicate samples (also known as field duplicates) will be collected for laboratory analysis at a target rate of one per every ten primary samples or less, per matrix and method (for non-waste characterization samples). Replicate samples provide a measure of precision of the entire data collection efforts, including sampling, analysis and site heterogeneity. Refer to the Section 4.2 and Table 5 for field replicate sampling guidelines. All field replicates will be blind samples, given unique sample numbers just like any other field sample (see Section 4.4.1). For sample replicates, the RPD will be calculated. Results will be flagged according to the criteria specified in Section 5.6.

Field Triplicates – For MI samples, triplicate samples will be collected for laboratory analysis at a target rate of one per every ten MI samples or less, per matrix and method for each Site (area) being sampled. Triplicate samples provide a measure of precision of the entire data collection efforts, including sampling, analysis and site heterogeneity for MI sampling. Refer to the Section 4.2.2.3 and Table 5 for field triplicate sampling guidelines. For sample triplicates, the RSD will be calculated. Results will be flagged according to the criteria specified in Section 5.6.

Hold Times - Sample preparation and analysis shall be completed within the method-required holding times. The holding time for a sample begins at the time of sample collection. Some methods have more than one holding time requirement. The preparation holding time is calculated from the time of sample collection to the time of completion of the sample preparation process as described in the applicable method, prior to any necessary extract cleanup and/or volume reduction procedures. If no preparation (e.g., extraction) is required, the analysis holding time is calculated from the time of sample collection to the time of completion of all analytical runs. Table 7 indicates the hold times for different analytes and media. If holding times are exceeded and the analyses are performed, the results shall be flagged appropriately according to the guidelines of Section 5.6.

Temperature Blanks - Every cooler shipped to the laboratory will be required to have a temperature blank, unless the method does not include temperature preservation as a requirement. This is a durable plastic bottle filled with water and sealed. The temperature requirements upon arrival at the laboratory are “not frozen” to 6°C. Temperature blanks will not be removed from their respective coolers. Icing the cooler on the day that it is to be filled and keeping the cooler in a refrigerated environment (ambient conditions on the Alaska North Slope) while filling and throughout shipment will achieve the temperature goals. The cooler will also be replenished with ice as needed during onsite storage and prior to shipment. If coolers are received by the laboratory with temperature blanks outside the required limits, data associated with samples within the cooler requiring thermal preservation will be flagged appropriately, as described in Section 5.6.

Laboratory QC tests will be performed in accordance with this QAPP and the laboratory QA/QC Plan. QC tests include the following parameters:

Surrogates - A surrogate will be added to every sample analyzed for organics, including QC samples, before sample analysis. Surrogate recoveries will be evaluated and data flagged when appropriate according to Section 5.6.

Laboratory Control Sample and Laboratory Control Sample Duplicate (LCS/LCSD) – An LCS sample or LCS/LCSD pair will be analyzed with each set of 20 samples or less. For State of Alaska petroleum hydrocarbon methods AK 101, 102, and 103, an LCS/LCSD will be analyzed with each analytical batch to ensure that method precision is established. LCS and LCSD samples provide a measure of analytical batch accuracy. The RPD between an LCS/LCSD pair provides a measure of analytical batch precision. For LCS/LCSD analysis, a predetermined concentration of target analyte is added to a contaminant-free matrix prior to preparation and analysis. LCS and LCSD recoveries and RPD will be evaluated and data flagged when appropriate according to Section 5.6.

Matrix spike and matrix spike duplicate samples (MS/MSD) - MS/MSD samples will be analyzed with each set of 20 samples or less, where required by the method. MS/MSD samples may provide a measure of precision and accuracy of the analytical results as related to a project specific matrix. For MS/MSD analysis, a predetermined concentration of target analyte is added to a field sample prior to preparation and analysis.

MS/MSD analyses on project specific samples will be requested at a target rate of 5% for each matrix and method (except for MI and waste characterization samples) in order to generate site specific data. However, the data quality and usability decisions will not weigh strongly on the frequency of site specific MS/MSD samples. MS/MSD results from non-project samples may be used to indicate analytical batch precision. Whenever practicable, project specific MS/MSD samples will be selected for samples that are expected to be contaminated, but not at high levels. MS/MSD recoveries and RPD will be evaluated and data flagged when appropriate according to Section 5.6.

Calibration Verification - With each analytical batch a calibration check sample will be analyzed, as required by the analytical method. The data quality objectives of the calibration verification or CCV are laboratory control limits, as determined in accordance with the analytical method. CCV failures will be noted in the final report, based on a review of the laboratory's case narrative.

Blanks - A method blank will be prepared and analyzed with every batch of twenty samples or less, as required by the analytical method. The method blank will be carried through the same procedures as the samples. It is used to evaluate potential contamination introduced during the analytical process. When an analyte is detected in the method blank, the appropriate data flag will be applied to associated sample results where applicable, as described in Section 5.6.

5.3 CORRECTIVE ACTION

Deviations from the procedures listed in this QAPP will be evaluated and control will be reestablished as necessary. Corrective action will be initiated when conditions are identified that may affect the completeness or quality (usability) of the analytical data in an adverse manner. Examples of events that might require corrective action are:

- Identification that analytical protocols (i.e., sample collection, transport or preservation criteria; QC limits; etc.) have not been met;
- Audits; and
- Laboratory data comparison studies.

All situations identified as potentially "out of control" will be investigated. Corrective action will depend on the circumstances and may take several forms. Depending on the situation it could involve only the Subcontract laboratory and the Project Chemist, or it could also include project and site management personnel, or even a regulatory agency (e.g., ADEC). The corrective action may be immediate or long-term. Immediate corrective action is typically applied to spontaneous, non-reoccurring problems. An example of an immediate corrective action would be re-calculating, re-analyzing, re-extracting, or re-collecting a sample or qualifying data. Long-term corrective action may be modifying a standard operating procedure or providing additional training.

The SLR Project Manager will be notified of any deviation from this Cleanup Plan that may affect data usability or the objectives of the investigation such that project goals may not be satisfied. The project manager will review the deviation in light of the project objectives and determine the corrective action necessary.

5.4 SAMPLE RECEIPT DOCUMENTATION

The laboratory will prepare a cooler receipt form for each cooler of samples received. The laboratory shall inspect each shipment to ensure that proper packaging, labeling, and preservation practices were followed. Discrepancies will be documented on a cooler receipt form. The laboratory shall include the form with the data package.

5.5 DATA REPORTING

A laboratory report is required for each sample delivery group. A level II data package will be requested for all samples.

The laboratory reports will include QA/QC results and will meet the requirements of the ADEC Technical Memorandum *Environmental Laboratory Data and Quality Assurance Requirements* (ADEC 2009b). In addition, the following electronic deliverables are required:

- An EDD compatible with Microsoft Access and Excel

All reported data shall reflect dilutions and/or concentrations. Dilution factors shall be noted on the analytical report and reflected in the reporting limits. All dilutions and re-runs shall be included in the report. Raw data will be maintained by the laboratory for at least ten years after the analysis date, as required by the ADEC.

5.6 DATA REVIEW

The analytical data shall be reviewed by the Subcontract laboratory prior to release in accordance with this QAPP and the facilities internal QA/QC procedures. The laboratory criteria will be defined in the laboratory's QAPP and analytical standard operating procedures. The Subcontracted laboratory will be informed as to the project-specific requirements prior to sampling.

Once the data report package has been received from the laboratory, the SLR project chemist, or qualified designee, will evaluate the data for compliance with the project-specific data quality objectives. A data quality assessment will be performed which will include a QA summary and ADEC Data Review Checklists, as required by ADEC (ADEC 2009b), for all samples used for site characterization and closure (e.g., confirmation samples). Data used for waste characterization will not be reviewed. The QA summary will describe data with regard to project PARCCS goals. A review of the following will be included in the data assessment process:

- Chain of custody forms, custody seals on coolers, and arrival temperatures (cooler and temperature blank) to ensure that the samples were securely transported and thermally preserved;
- Chemical preservation;
- Completeness (85%);
- Hold times (not applicable to PCBs);
- Blanks (including method blanks, trip blanks, and (where applicable) instrument and equipment blanks);
- CCVs (as noted in the case narratives);
- Internal standards (as noted in the case narratives);
- Surrogate recoveries;

- LCS/LCSD recovery (as %R) and precision (as RPD);
- MS/MSD recovery (as %R) and precision (as RPD);
- Precision between primary samples and field replicates (as RPD) and triplicates (as RSD); and
- Detection and quantitation limits.

Data qualifiers will be assigned, as applicable, for the analytical results. These data flags will be discussed in the QA summary and included in the final data reporting. Typical data qualifiers are defined in Table 9. Additional flags may be used based on project specific circumstances. Acceptance (QC) criteria are by ADEC criteria, laboratory criteria, and best professional judgment (in that order).

For waste characterization samples, a cursory review will be performed upon receipt of the data to ensure that all laboratory QC parameters (i.e., method blank, LCS, matrix spikes, and surrogates) are within limits such that the data is usable. High detection limits will identified for consideration when making decisions. Waste characterization data will be included in the final report for the project, but will not otherwise be evaluated.

6. WASTE MANAGEMENT PLAN

This Waste Management Plan covers procedures for handling, treating and disposing of wastes or contaminated soil other than petroleum contaminated gravel suitable for onsite landfarming. Soil suitable for landfarming will be managed as discussed in Section 3.6. This section only covers wastes derived directly from the cleanup activities. Procedures for waste generated from equipment maintenance and camp operations (including food waste and sewage), are specified in the Site Operations Plan. A waste determination will be made on all cleanup derived waste using generator knowledge and analytical testing as needed to determine its classification, and the corresponding manifest, transportation, and disposal requirements. Waste characterization will be performed by SLR.

6.1 ONSITE DISPOSAL AND TREATMENT

Wood, paper, and similar combustible wastes recovered from the landfill areas may be open-burned on-site in accordance with applicable ADEC and NSB regulations and codes (e.g., 18 AAC 50.065). The open burning will occur in a designated area of the pad under controlled conditions. Ash remaining at the end of the burning will be containerized and shipped offsite for disposal as non-hazardous waste.

Oily waste, such as spent boom or personal protective equipment (PPE), may also be burned onsite in a Smart Ash® burner. Only non-hazardous waste will be burned. The PPE and sorbent pads will be placed in plastic bags until being burned. The plastic bags will be labeled with their contents (e.g., Oily waste - spent boom from Western Landfill).

Used oil for energy recovery will be managed according to the requirements of the used oil regulations, 40 CFR 279. Used oil or fuels recovered from drums may also be burned onsite for energy recovery, if sampling and analysis determines oil meets RCRA burn specifications. However, the volume of used oil is anticipated to be small so used oil will most likely be shipped offsite for energy recovery. If the oil is not suitable for energy recovery, it will be handled and disposed of as RCRA hazardous waste.

6.2 OFFSITE DISPOSAL AND TREATMENT

Wastes not suitable for onsite treatment will be transported to TSD facilities in Alaska or the Lower 48 States permitted to accept the waste. The wastes shipped offsite will be manifested or placed on a bill of lading as appropriate to track and document the shipment. Logs will be used to track the generation, characterization, shipment and disposal of wastes. With respect to shipping, hazardous waste and any liquid waste with hazardous substances will be prioritized for offsite shipment to the extent practical, over other waste. RCRA hazardous waste will be shipped offsite within 90 days of generation (180 days if a criterion for small quantity generator status is met), unless an accumulation time limit extension is received from the EPA. Unless quantities are significantly greater than listed on Table 3, all hazardous waste will be shipped offsite the year it is excavated or otherwise generated. RCRA hazardous or Toxic Substance Control Act (TSCA) waste will most likely be sent to the Waste Management operated TSD in

Arlington Oregon, which has a permitted Subtitle C Landfill (EPA Part B Permit # ORD089452353).

6.2.1 NON-HAZARDOUS SOLID WASTE

Non-hazardous solid waste excavated from the Camp Lonely landfills will be barged to Prudhoe Bay, Alaska for disposal in an ADEC permitted Class I Municipal Solid Waste Landfill. The probable landfill is the Oxbow Landfill in Deadhorse, Alaska which is operated by the NSB. Removal from the site will take place within two years following excavation unless the Site Project Manager is able to show, with objectively reasonable evidence, that more cost effective removal is foreseeable within an additional two years (e.g., evidence that a barge is scheduled to be operated in the vicinity of the camp), in which case storage may continue for up to an additional two years.

Non hazardous solid waste not acceptable for disposal in Alaska will be shipped to a TSD in the lower 48 states. The most likely TSD to be utilized is the Chemical Waste Management operated Columbia Ridge Landfill in Oregon. This landfill is also a RCRA subtitle D, Class 1 landfill [Oregon Department of Environmental Quality Solid Waste Permit #391].

In addition, metal removed from the landfill areas may be recycled if practical and cost effective. During the removal process, metal that is potentially acceptable for recycling will be segregated from the non-hazardous waste, when considered practical. This will generally be limited to metal objects (e.g., drums, rods, beams, cable). The metal will need to meet the recycler's acceptance criteria, including being free of soil or liquids to the extent practicable. The most likely recycler will be C&R Pipe located in Fairbanks, Alaska. This metal for recycling will be shipped in bins (to be provided by C&R Pipe if utilized).

The non-hazardous waste will be staged on the pad prior to shipment. Waste which may become windblown will be containerized or covered. The non-hazardous solid waste will be containerized in metal bins or other suitable containers prior to shipment. These containers will be transported to the site during the initial mobilization in limited quantities and replenished as needed with the barge shipments removing the waste. Therefore, the loading of waste into bins may not occur until immediately prior to shipment.

6.2.2 OTHER WASTES FOR OFFSITE DISPOSAL

Table 3 lists potential wastes likely to be encountered and probable disposal or treatment locations. All waste requiring shipment offsite will be containerized and shipped in containers meeting Department of Transportation (DOT) regulations for the type of waste being shipped. If containers will be shipped via barge, they will also meet U.S. Coast Guard shipping regulations and comply with the barging company's policies. Most waste other than the non-hazardous waste that is shipped offsite will ultimately be disposed or treated at a TSD in the lower 48 states. In most cases, wastes shipped offsite will require a primary and secondary container for shipment. The secondary container may be a bulk container (e.g., connex) or overpack.

Hazardous waste will be kept in designated areas within the waste staging area. Hazardous waste will typically be containerized in drums or other leak-proof containers compatible with the type of waste. Hazardous waste will not be comingled with non-hazardous waste. Initially each waste container (e.g., drum or super sack) will be labeled with an I.D. number, date of containerization, contents (e.g., used oil, petroleum saturated contaminated soil), and hazard class (hazardous or non-hazardous, if known). If the waste has been sampled, it will be labeled as “analysis pending.” Final labeling will be performed prior to shipment offsite after the waste has been adequately characterized (profiled). Drums with fluids that will be shipped off site for disposal or energy recovery will be stored on site in secondary containment. When shipped offsite, the drums will be overpacked. Contaminated soil will generally be placed in shipping containers once it is determined the soil is not suitable for onsite landfarming. RCRA Hazardous waste will be containerized immediately upon being encountered. However, soil not classified as a RCRA hazardous waste may be stored in stockpiles, so long as it is in conformance with the soil storage requirements of 18 AAC 75.370. Shipping and labeling information for some expected wastes are detailed in the following sections.

A hazardous waste manifest signed by Husky will be required prior to the shipment of hazardous waste offsite. All hazardous waste will be shipped in a secondary container to prevent a release should the primary container be ruptured. Liquids shall be shipped in a primary container and overpack. Hazardous waste will be shipped to a RCRA permitted facility in the Lower 48.

6.2.2.1 Chromium-Contaminated Soil

The previously identified chromium-contaminated soil will be assumed to be RCRA hazardous waste based on the prior sampling (HCG 2007b), unless further testing is performed. The chromium-contaminated soil will be containerized in super sacks, or equivalent, and labeled as hazardous waste.

6.2.2.2 Lead Acid Batteries

Lead acid batteries that are going to a recycling facility are not considered to be hazardous waste. Therefore, a hazardous waste manifest is not necessary for transport. The container should be marked “Lead Acid Batteries, Recycling Exemption” and numbered appropriately. The container must be included on a cargo manifest. DOT regulations must be followed for the container requirements and labeling requirements.

If the batteries are being sent for disposal then they are RCRA hazardous waste. They must then be labeled and shipped as “Universal Waste, Lead Acid Batteries” and comply with DOT regulations regarding hazardous waste shipment. A hazardous waste manifest will be required.

6.2.2.3 Oily Sorbents and Filters

Oily wastes will be placed in leak-proof containers to prevent leakage during handling and transportation. The containers may be 55-gallon drums, portable tanks, tank trucks, roll-off boxes, dumpsters, storage barges, or containers that can be sealed and covered to prevent spillage. It is anticipated the majority of oily sorbents and filters will be burned on site as described in Section 6.1. If they must be shipped offsite for disposal, they can be containerized and shipped as non-hazardous waste. The container should be labeled “Oily Sorbents and/or

Oily Filters, Non-hazardous Waste" and also have the container number displayed on it. The container must be included on a cargo manifest. DOT regulations must be followed for the container requirements and labeling requirements.

6.2.2.4 Petroleum-Contaminated Soil

Petroleum-contaminated soil that is not suitable for landfarming (gravel saturated with heavy-weight oil or petroleum-contaminated peat) will be shipped offsite for thermal treatment or landfilling. This soil will be containerized in super sacks.

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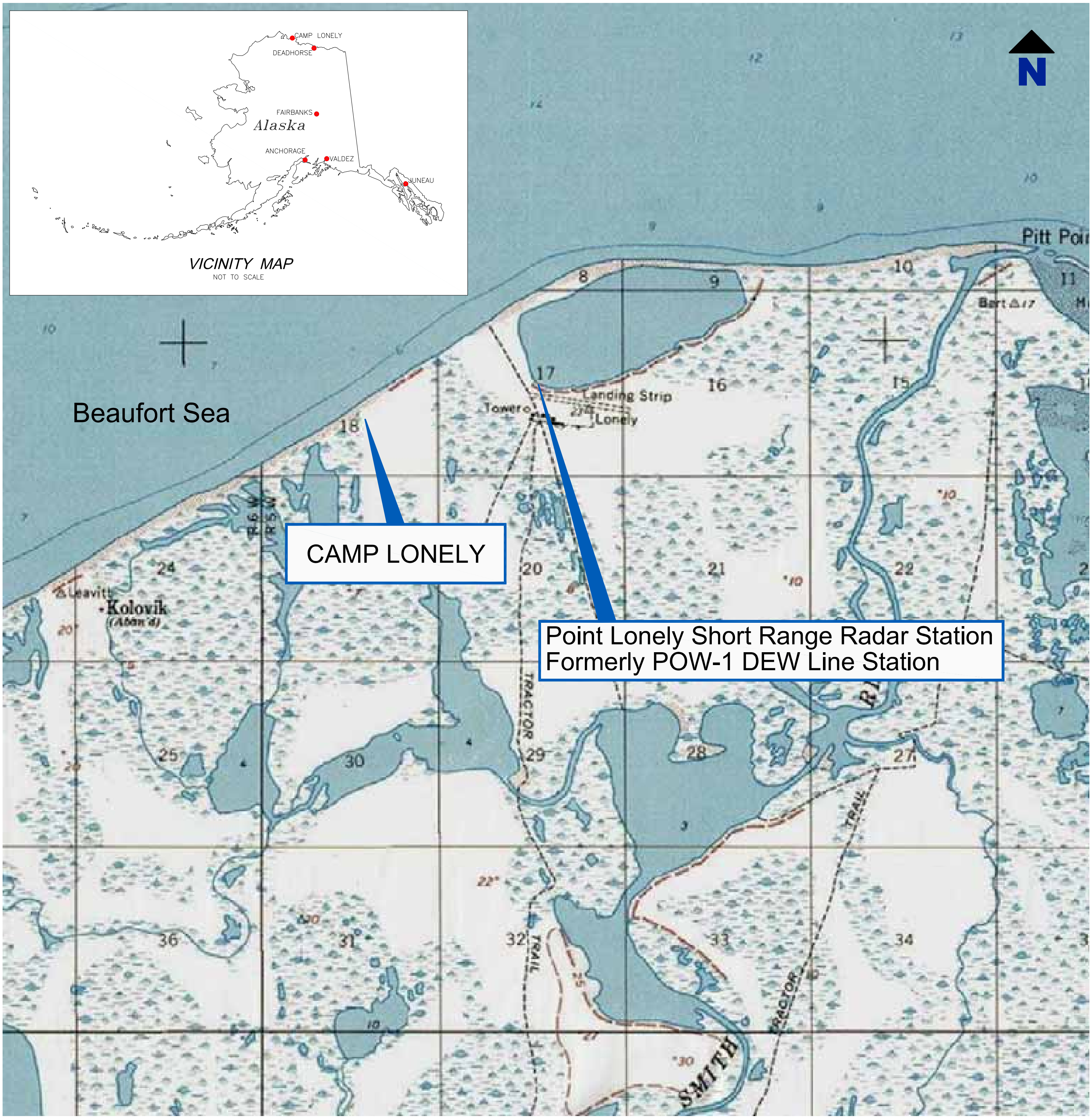
FIGURES



MAP CREATED WITH TOPO® ©2002 NATIONAL GEOGHRAPHIC
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SCALE: 1" = 4,000 FEET
WHEN PLOTTED AT 8.5 x 11 PAGE SIZE

0 4,000' 8,000' 12,000'

THIS DRAWING IS FOR CONCEPTUAL PURPOSES ONLY. ACTUAL LOCATIONS MAY VARY AND NOT ALL STRUCTURES ARE SHOWN.

Site
CAMP LONELY, ALASKA

Report
CLEANUP PLAN FOR LANDFILLS AND ASSOCIATED PAD

Drawing
REGIONAL VICINITY MAP

Date October 26, 2012	Scale AS SHOWN	Fig. No. 1
File Name Camp Lonely Fig 1_12-5-11	Project No. 105.00617.00005	

PHOTO: GOOGLE EARTH © 2010.

SCALE: 1" = 1,000 FEET
WHEN PLOTTED AT 8.5 x 11 PAGE SIZE
0 1,000' 2,000' 3,000'

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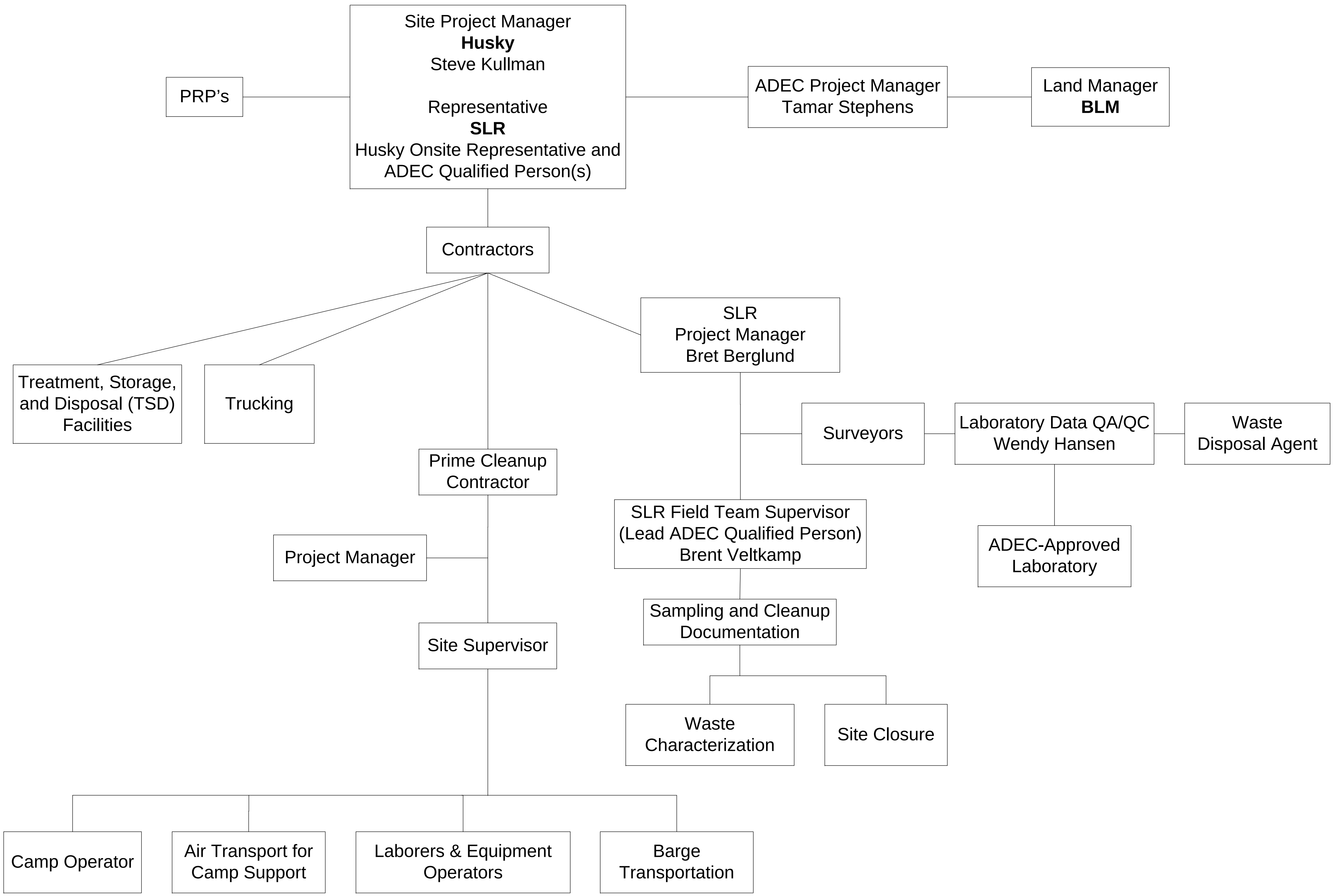
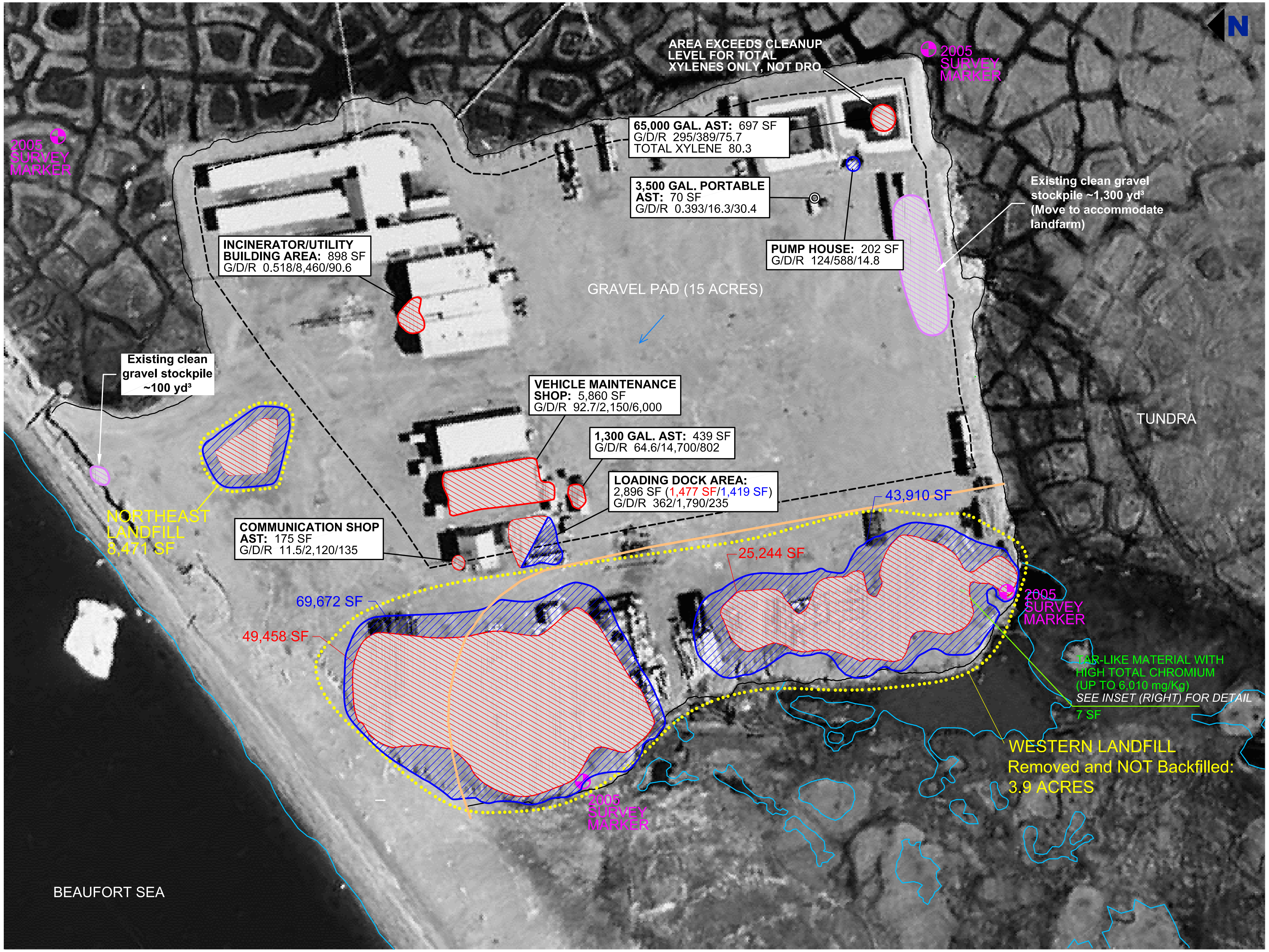
SLR

Site	CAMP LONELY, ALASKA
Report	CLEANUP PLAN FOR LANDFILLS AND ASSOCIATED PAD
Drawing	SITE MAP
Date	October 29, 2012
File Name	Camp Lonely Fig 2_12-21-11
Scale	AS SHOWN
Project No.	105.00617.00005
Fig. No.	2

Figure 3. Organizational Chart for Camp Lonely Cleanup





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SCALE: 1" = 120'
WHEN PLOTTED AT 11 x 17 PAGE SIZE
0 120 240 360'

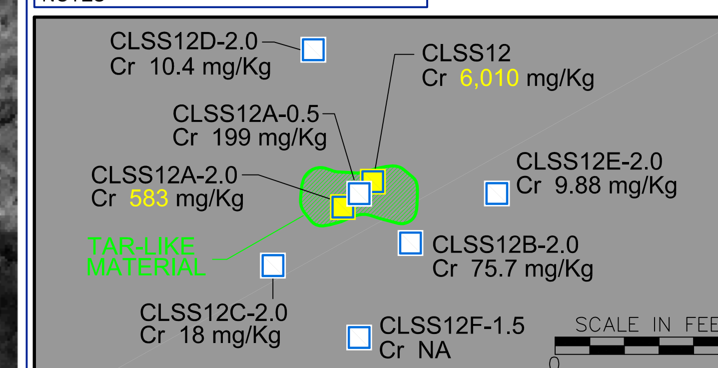
LEGEND

- PETROLEUM CONTAMINATED SOIL (500 mg/Kg < DRO < 1,000 mg/Kg)
- PETROLEUM CONTAMINATED SOIL (DRO > 1,000 mg/Kg)
- LANDFILL BOUNDARY BASED ON GEOPHYSICAL ANOMALIES, TEST PITS, AND SITE OBSERVATIONS. ENTIRE AREA TO BE EXCAVATED.
- SURFACE WATER
- ESTIMATED SURFACE AND ACTIVE ZONE WATER FLOW
- APPROXIMATE PAD EDGE
- APPROXIMATE INTERIOR AND EXTERIOR PAD BOUNDARY FOR CLEANUP PURPOSES (DRO CLEANUP LEVEL 1,000 mg/Kg WITHIN BOUNDARY AND 500 mg/Kg OUTSIDE OF BOUNDARY TO EDGE OF PAD)
- APPROXIMATE GRAVEL PAD TOE AFTER LANDFILL REMOVAL AND CONTOURING - WESTERN EDGE
- 2005 SURVEY MARKER
- **SF** SQUARE FEET
- **(D)RO** GASOLINE (G) / DIESEL (D) / RESIDUAL (R) RANGE ORGANICS (CONCENTRATIONS SHOWN ARE MAXIMUM DETECTIONS FOR AREA; ALL RESULTS IN mg/Kg)

NOTES

1. ALL AREAS ARE APPROXIMATE AND SUBJECT TO CHANGE. ALL STRUCTURES AND DEBRIS WERE REMOVED FROM THE SURFACE OF THE PAD IN 2005.
2. AERIAL PHOTO: AEROMAP U.S. NPRA - JULY 17, 2002.
3. THE EXTENT OF PETROLEUM CONTAMINATED SOIL AT THE NORTHEAST LANDFILL IS ASSUMED TO COINCIDE WITH THE GEOPHYSICAL ANOMALY (BURIED METALLIC DEBRIS). NO ANALYTICAL DATA HAS BEEN COLLECTED IN THIS AREA TO DATE.

NOTES



INSET - AREA OF TAR-LIKE MATERIAL

NOTE: YELLOW BOXES INDICATE THE CHROMIUM (Cr) RESULT EXCEEDS ADEC METHOD TWO CLEANU LEVEL (410 mg/Kg).

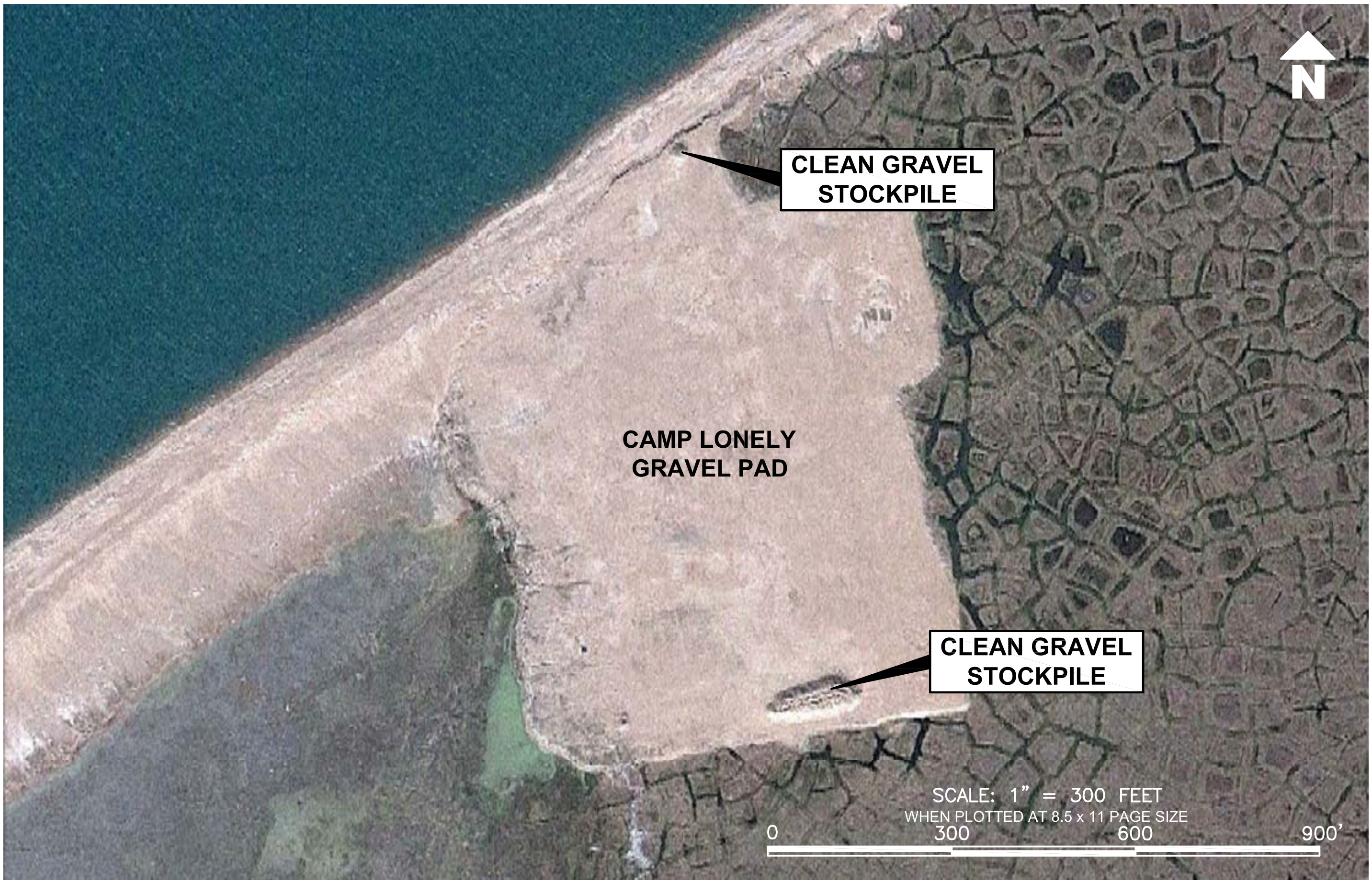
Site: CAMP LONELY, ALASKA

Report: CLEANUP PLAN FOR LANDFILLS AND ASSOCIATED PAD

Drawing: ESTIMATED LANDFILL AND CONTAMINATED SOIL AREAS

Date: October 26, 2012	Scale: 1" = 120 Feet	Fig. No. 4
File Name: Camp Lonely Figs 3, 6_4-13-12	Project No. 105.00617.00005	

SLR



Notes

THESE IMAGES REFLECT CAMP LONELY AFTER ALL STRUCTURES AND DEBRIS WERE REMOVED FROM THE SURFACE OF THE GRAVEL PAD IN 2005.

SLR

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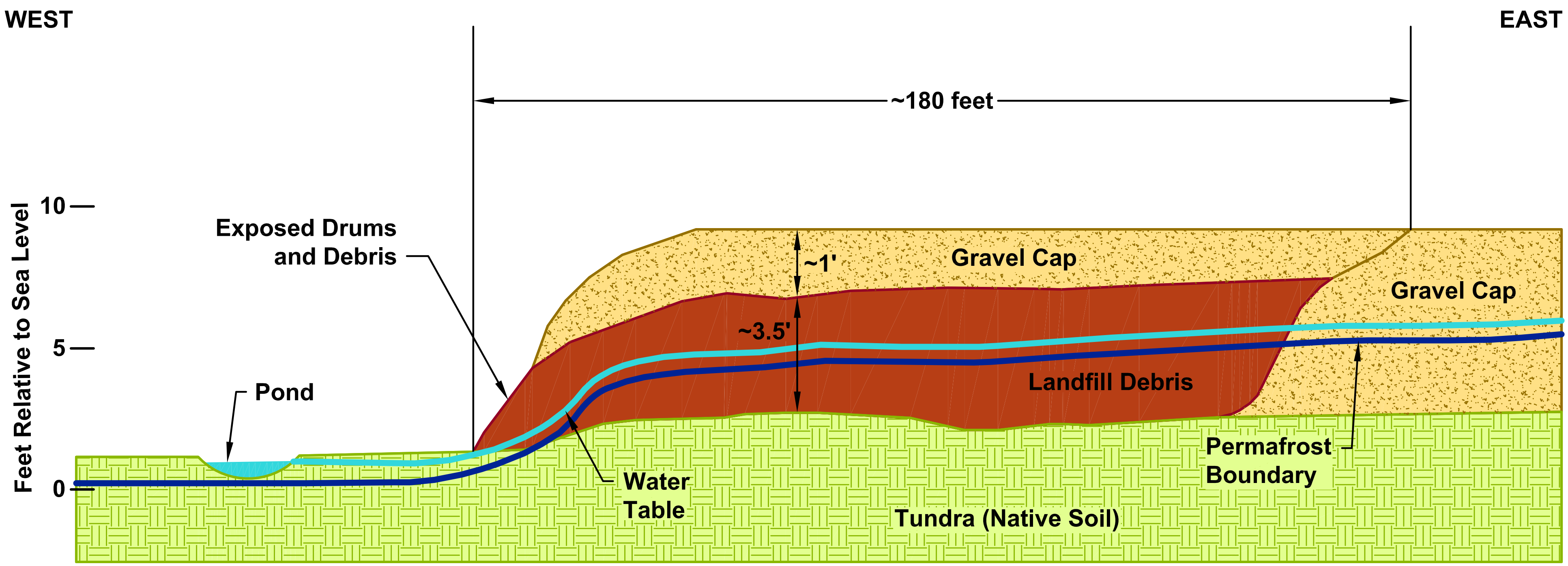
Site	CAMP LONELY, ALASKA
Report	CLEANUP PLAN FOR LANDFILLS AND ASSOCIATED PAD
Drawing	AERIAL PHOTOGRAPHS OF SITE FROM 2010
Date	October 26, 2012
File Name	Camp Lonely Fig 4
Scale	AS SHOWN
Project No.	105.00617.00005
Fig. No.	5



LEGEND

- WATER TABLE (JULY 2005)
- PERMAFROST BOUNDARY (JULY 2005)
- GRAVEL CAP/PAD
- LANDFILL DEBRIS (DOMESTIC AND/OR INDUSTRIAL)
- TUNDRA

NOTE:
1. DISTANCE BETWEEN THE WATER TABLE AND PERMAFROST BOUNDARY IS APPROXIMATELY 0.5'.
2. DEPTH AND DIMENSIONS ARE APROXIMATE.

SCALE: 1" = 30'
WHEN PLOTTED AT 8.5 x 11 PAGE SIZE
0 30 60 90'

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Site: CAMP LONELY, ALASKA

Report: CLEANUP PLAN FOR LANDFILLS AND ASSOCIATED PAD

Drawing: CONCEPTUAL CROSS SECTION THROUGH SOUTH PORTION OF WESTERN LANDFILL

Date October 26, 2012	Scale 1" = 30 Feet	Fig. No. 6
File Name Camp Lonely Fig 5_1-5-12	Project No. 105.00617.00005	

SLR

LEGEND

- ESTIMATED LANDFARM AREA (~ 7 ACRES, ASSUMED 1.25 FT. THICKNESS)
- LANDFILL BOUNDARY BASED ON GEOPHYSICAL ANOMALIES, TEST PITS, AND SITE OBSERVATIONS. ENTIRE AREA EXCAVATED.
- SURFACE WATER
- PRE-CLEANUP CLEAN GRAVEL STOCKPILE AREAS (APPROXIMATE AREA)
- CLEAN EXCAVATED GRAVEL SOIL STOCKPILE AREA, TEMPORARY STAGING (APPROXIMATE AREA)
- APPROXIMATE GRAVEL PAD TOE (2005)
- APPROXIMATE GRAVEL PAD TOE AFTER LANDFILL REMOVAL AND CONTOURING - WESTERN EDGE
- APPROXIMATE INTERIOR AND EXTERIOR PAD BOUNDARY FOR CLEANUP PURPOSES (DRO CLEANUP LEVEL 1,000 mg/Kg WITHIN BOUNDARY AND 500 mg/Kg OUTSIDE OF BOUNDARY TO EDGE OF PAD)
- LOCATION OF ANTICIPATED TEMPORARY CAMP FEATURES
- SF SQUARE FEET
- DRO DIESEL RANGE ORGANICS

NOTES

1. ALL AREAS ARE APPROXIMATE AND SUBJECT TO CHANGE. ALL STRUCTURES AND DEBRIS WERE REMOVED FROM THE SURFACE OF THE PAD IN 2005.
2. THE LANDFARM AREA WILL BE LOCATED AT LEAST 25 FEET FROM THE PAD EDGE ON THE EASTERN, WESTERN AND SOUTHERN SIDES (POST-EXCAVATION), AND APPROXIMATELY 300 FEET FROM THE COASTLINE (NORTHERN EDGE).
3. LANDFARM WILL BE CONSTRUCTED FROM SOUTH TO NORTH.
4. AERIAL PHOTO: AEROMAP U.S. NPRA - JULY 17, 2002.
5. STOCKPILING WILL NOT OCCUR OVER THE LANDFILL FOOTPRINT UNTIL THE LANDFILL HAS BEEN REMOVED.

THIS DRAWING IS FOR CONCEPTUAL PURPOSES ONLY. ACTUAL LOCATIONS MAY VARY AND NOT ALL STRUCTURES ARE SHOWN.

SCALE: 1" = 120'
WHEN PLOTTED AT 11 x 17 PAGE SIZE
0 120 240 360'

N

Site: CAMP LONELY, ALASKA

Report: CLEANUP PLAN FOR LANDFILLS AND ASSOCIATED PAD AND STAGING AREAS

Drawing: PLANNED LANDFARM LAYOUT

Date	October 26, 2012	Scale	1" = 120 Feet	Fig. No. 7
File Name	Camp Lonely Figs 3, 6_4-13-12	Project No.	105.00617.00005	

SLR

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SCALE: 1" = 120'
WHEN PLOTTED AT 11 x 17 PAGE SIZE
0 120 240 360'

LEGEND

- ESTIMATED LANDFARM AREA (~ 7 ACRES, ASSUMED 1.25 FT. THICKNESS)
- LANDFILL BOUNDARY BASED ON GEOPHYSICAL ANOMALIES, TEST PITS, AND SITE OBSERVATIONS. ENTIRE AREA EXCAVATED.
- SURFACE WATER
- APPROXIMATE GRAVEL PAD TOE (2005)
- APPROXIMATE GRAVEL PAD TOE AFTER LANDFILL REMOVAL AND CONTOURING - WESTERN EDGE
- APPROXIMATE INTERIOR AND EXTERIOR PAD BOUNDARY FOR CLEANUP PURPOSES (DRO CLEANUP LEVEL 1,000 mg/Kg WITHIN BOUNDARY AND 500 mg/Kg OUTSIDE OF BOUNDARY TO EDGE OF PAD)
- LOCATION OF ANTICIPATED TEMPORARY CAMP FEATURES
- 2005 SURVEY MARKER
- PROPOSED 20' x 20' EXCAVATION GRID FOR STOCKPILE MANAGEMENT
- PROPOSED MI SAMPLING GRID
- 1 MI DECISION UNIT
- SF SQUARE FEET
- DRO DIESEL RANGE ORGANICS

NOTES

1. ALL AREAS ARE APPROXIMATE AND SUBJECT TO CHANGE. ALL STRUCTURES AND DEBRIS WERE REMOVED FROM THE SURFACE OF THE PAD IN 2005.
2. AERIAL PHOTO: AEROMAP U.S. NPRA - JULY 17, 2002.
3. MI DECISION UNIT DIMENSIONS MAY CHANGE BASED ON ACTUAL EXCAVATION AND LANDSPREAD AREA.

Site: CAMP LONELY, ALASKA

Report: CLEANUP PLAN FOR LANDFILLS AND ASSOCIATED PAD

Drawing: SCHEMATIC OF SAMPLING APPROACH FOR LANDFILL AREAS AND LANDFARM

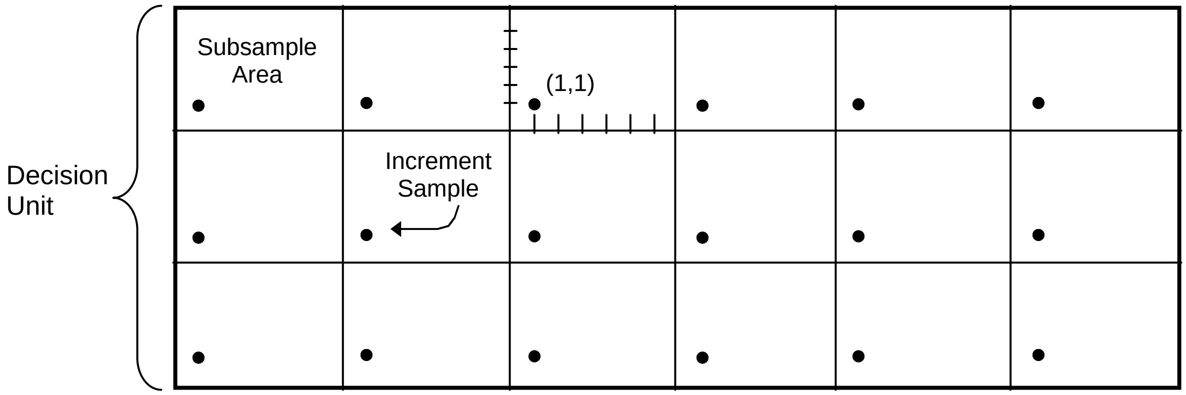
Date	November 21, 2012	Scale	1" = 120 Feet	Fig. No.
File Name	CL Fig 8_Landfill,Landfarm Sampling Approach	Project No.	105.00617.00005	8

SLR

FIGURE 9
MI SAMPLING APPROACH EXAMPLE FOR SOIL SAMPLES

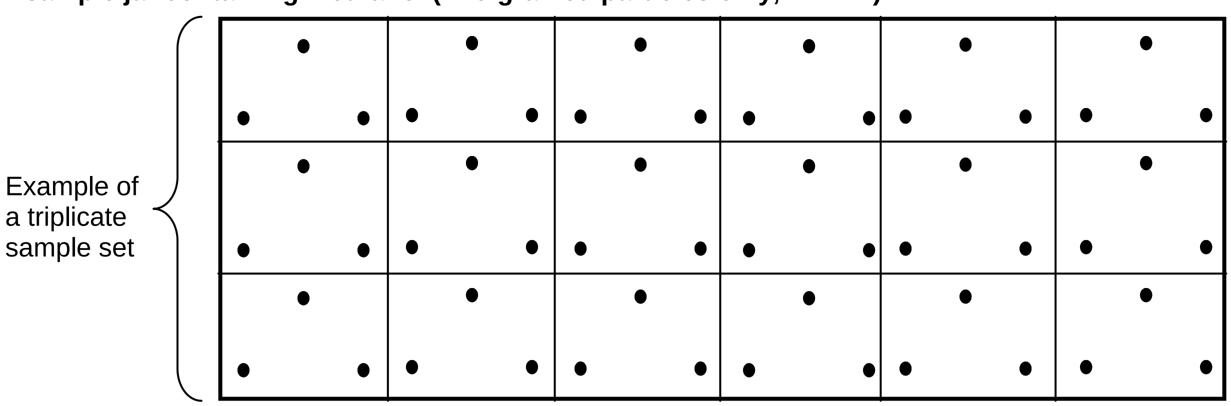
Step 1: Determine decision unit area and mark boundaries.

Step 2: Grid decision unit into 50 approximately equally sized subsample areas (Due to limited space, only 18 are shown here).



Step 3: Collect increment samples from each subsample area. The increment location in the subsample area will be determined by rolling a die twice, once to determine the x-coordinate and once to determine the y-coordinate. Collect volatile samples first. In the diagram above, both die rolled 1.

Step 4: Collect volatile subsample first. For non volatiles, collect increments from each subsample area and combine in one container. For volatiles, increments will be placed directly into a sample jar containing methanol (fine-grained particles only, < 2mm).



Step 5 (if needed): For triplicate sample sets, the primary, duplicate, and triplicate increment samples will not be co-located. They will be a minimum of ½ the grid distance away from the primary increment sample location. The locations will be determined based on where the initial sample location is located. If the primary point is located in the lower left, the duplicate and triplicate samples will be located in the lower right and the upper portion of the subsample area in order to assure the required minimum separation distance.

<u>For Non Volatiles Only</u>
Step 6: For each sample, sieve soil with 2mm (#10) mesh and pour the <2mm fraction onto an aluminum foil lined cookie sheet. Spread the soil evenly and not any thicker than 1/2 inch.

Step 7: Grid the cookie sheet into 50 approximately equally sized areas.

Step 8: Collect an increment (~ 1 gram [volume pre-determined]) from each grid square in the cookie sheet, being sure to capture the entire vertical thickness of the soil layer, and place into the appropriate laboratory container.

TABLES

Table 1 – Camp Lonely Soil COCs and Cleanup Levels

Identified Contaminant of Concern (COC)[5]	Cleanup Level in Milligrams per Kilogram [mg/Kg][1,2,6]	
	Interior Pad Areas	Exterior Pad Areas[4]
Gasoline Range Organics (GRO)[3]	150	100
Diesel Range Organics (DRO)[3]	1,000	500
Residual Range Organics (RRO)[3]	2,000	2,000
Total xylenes	63	63
Naphthalene	42	42
Chromium (total)[7]	410	410

Notes:

1. Cleanup will be determined to be complete in accordance with 18 AAC 75.380(d) (1) when the above cleanup levels have been achieved for the Camp Lonely site, which consists of the constructed gravel pad and the landfills (or dumps) within the pad (gravel fill). ADEC retains the authority specified in 18 AAC 75.380(d) to reassess the need for additional cleanup action.
2. The soil cleanup levels are ADEC Method Two cleanup levels for the Arctic Zone (the lowest value for the Ingestion or Inhalation pathway as listed in 18 AAC 75.341, Table B1 of B2, dated October 1, 2010 [ADEC 2010]), except for GRO, DRO and RRO. In addition, per 18 AAC 75.325(g), cleanup levels established herein ensure that the cumulative risk from hazardous substances does not exceed ADEC risk management standards (cancer risk $\leq 1 \times 10^{-5}$ and a non-cancer risk ≤ 1) as determined by ADEC's Cumulative Risk Guidance.
3. The cleanup levels for GRO, DRO and RRO are more stringent than Method Two for the Arctic Zone to provide contingency and ensure the site conditions are protective of surface water as required by 18 AAC 75.340(c). The GRO, DRO and RRO cleanup levels are target cleanup levels. The cleanup levels may be less stringent than listed above so long as such concentrations are more stringent than Arctic Zone Method Two cleanup levels and do not result in exceedances of AWQS.
4. The cleanup levels for GRO and DRO vary for interior and exterior portions of the pad. For these purposes, the exterior portion of the pad is defined as being within 25 feet of the toe of the pad on the east, west and south sides and 300 feet from the approximate edge of the Beaufort Sea (mean high water) on the northern (seaward) side. More stringent cleanup levels apply to the exterior portions because these areas are considered more susceptible to near term erosion and potential contact with surface water.
5. The listed COCs are the ones identified in investigations and associated risk evaluations to date. If other hazardous substances are identified in the soil during the course of the cleanup, they will be cleaned up to Method Two cleanup levels. For example, if polychlorinated biphenyl's (PCBs) are found to be present, the cleanup level would be 1 mg/Kg. Cleanup level exceedances due to natural conditions are excluded from these requirements. The presence of arsenic in the soil has been demonstrated to be due to natural conditions and is excluded as a COC.
6. These cleanup levels apply to gravel pad and landfill areas within the pad only. Native soils and tundra adjacent to, or beneath the gravel fill will only be removed if needed to protect human health and the environment. Consideration will be given to whether the removal will cause more serve and long term damage than the current conditions. Method Two cleanup levels will typically apply for contaminants, including petroleum hydrocarbons. Native soil impacted with petroleum hydrocarbons less than Method Two generally will not be removed, except if it poses a significant risk to water quality (e.g. has the potential to result in a persistent exceedance of Alaska Water Quality Standards).
7. The cleanup level for chromium + 3 is 205,000 mg/Kg.

Table 2 Camp Lonely Water COCs and Regulatory Standards

Identified Contaminant of Concern[2]	Cleanup level Micrograms per liter [μg/L][1]
Benzene	5
Toluene	1,000
Ethylbenzene	700
Total xylenes	10,000
TAH[3]	10

Notes:

1. The regulatory standards for surface water will be 18 AAC 70 AWQS, dated May 26, 2011, unless the exceedances are demonstrated to be due to natural conditions. In addition to these numeric standards, the surface water must be virtually free from floating oil or petroleum hydrocarbon sheens.
2. The listed COCs are the ones identified in investigations to date. If other potential COCs are suspected during the course of the cleanup, sampling and analysis of the surface water will be performed to determine if there is an associated exceedance of AWQS. Unless there are mitigating circumstances, contaminants exceeding AWQS will be considered COCs.
3. TAH = Total Aromatic Hydrocarbons consisting of the sum of benzene, ethylbenzene, toluene, and total xylenes.

Table 3. Estimated Materials and Wastes to be Encountered during the Camp Lonely Site Cleanup

Waste Type[1] (including contaminated soil)	Quantity[2] (LCY unless specified)	Assumed Disposal/Treatment Location[3]
Waste Identified to Date (volumes approximate)		
Non-hazardous Solid Waste (Debris)	9,540 (<11,000,000 lbs)	Offsite (Alaska)
PCS suitable for landfarming[4]	13,964	Onsite (landfarmed on pad)
Chromium-contaminated soil (RCRA hazardous waste)	4 (<13,000 lbs)	Offsite (Lower 48 States)
Clean Gravel		
Clean Soil (gravel) to be excavated from landfill areas	14,558	Used as backfill or stockpiled onsite for later use
Waste Considered Present for Planning and Management Purposes as Contingency		
PCS or Petroleum-Contaminated tundra not suitable for landfarming (non-hazardous)[5]	500 (<1,620,000 lbs)	Offsite (Alaska)
Other soil (RCRA hazardous waste)	20 (<66,000 lbs)	Offsite (Lower 48 States)
Other soil (non-hazardous and no PCBs > 1 mg/Kg)	25 (<82,000 lbs)	Offsite (Alaska)
PCB contaminated soil (non- TSCA regulated, PCBs between 1 and 50 mg/Kg)	45 (<146,000 lbs)	Offsite (Lower 48 States)
PCB contaminated soil (TSCA regulated, PCBs > 50 mg/Kg)	5 (<18,000 lbs)	Offsite (Lower 48 States,
Asbestos containing material (may be mixed with non-hazardous soil)	10 (<16,000 lbs)	Offsite (Alaska)
Lead batteries (RCRA Universal Waste)	2,000 lbs	Offsite (Lower 48 States)
Other Solid Waste (non soil or liquid, RCRA hazardous)	500 lbs	Offsite (Lower 48 States)
Liquid waste (RCRA hazardous or TSCA regulated)	500 gallons (<4,000 lbs)	Offsite (Lower 48 States)
Liquid Waste (non-RCRA, off specification oil or fuel)[6]	250 gallons (6 drums)	Offsite (Alaska)
Liquid Waste (petroleum contaminated water)	250 gallons (6 drums)	Offsite (Alaska)

Notes

1) The waste types and volumes are estimates, for planning and management purposes. They represent the types and quantities of the wastes expected to be encountered during performance of the Selected Remedy. Actual quantities may vary on the order of 25%.
2) Weights are based on assumed densities of 3,240 lb/CY of soil and 1,500 lb/CY of solid waste.
3) All waste shipped offsite will be disposed at a Treatment, Storage or Disposal (TSD) Facility permitted to accept the waste. Non-hazardous solid waste will be disposed in RCRA subtitle D landfill, if permitted. Scrap metal may be recycled if practical and cost effective. TSCA regulated or hazardous waste will be disposed in RCRA Subtitle C landfill or RCRA permitted hazardous waste treatment facility. The listed locations are for planning purposes and do not constitute a specific selection of particular facilities.
4) Assumes soil to be spread and landfarmed will include all soil (gravel) with DRO > 500 mg/Kg from the Western and Northeast Landfill, and the excavated soil from the other petroleum contaminated areas on the pad (DRO > 1,000 mg/Kg in interior portions and > 500 mg/Kg in exterior portions (see Table 1 for definitions).
5) The removal of native soil is not anticipated except for localized “hotspot” areas at the pad and tundra interface. Native soils, including tundra, generally will not be excavated for treatment or disposal (see Table 1, note 6). .
6) It is assumed recovered used oil and diesel fuel which is not a RCRA or TSCA waste can be burned onsite for energy recovery and the quantity will not exceed 2,000 gallons.

Abbreviations - see next page

Abbreviations (for Table 3):
lbs = Pounds (U.S.)
LCY = Loose Cubic Yards
mg/Kg = milligram per kilogram
PCBs = Polychlorinated Biphenyls
PCS = Petroleum contaminated soil
RCRA = Resource Conservation and Recovery Act
TSCA = Toxic Substances Control Act

Table 4 Summary of Major Work Elements

Number	Major Work Element[1]	Estimated Volume (LCY)	Completed[2]
1	Remove petroleum-contaminated soil from 65,000-gallon AST area. Excavated soil will be landfarmed. Backfill with clean gravel.	113	_____
2	Remove petroleum-contaminated soil from Incinerator/Utility Building Area. Excavated soil will be landfarmed. Backfill with clean gravel.	79	_____
3	Remove petroleum-contaminated soil from Vehicle Maintenance Shop area. Excavated soil will be landfarmed. Backfill with clean gravel.	705	_____
4	Remove petroleum-contaminated soil from 1,300 gallon AST area. Excavated soil will be landfarmed. Backfill with clean gravel.	20	_____
5	Remove petroleum-contaminated soil from Loading Dock area (including areas with DRO > 500 mg/Kg due to proximity to new pad edge). Excavated soil will be landfarmed. Backfill with clean gravel.	402	_____
6	Remove petroleum-contaminated soil from Communication Shop AST area. Excavated soil will be landfarmed. Backfill with clean gravel.	19	_____
7	Investigate source of low resistivity, non-ferrous, linear anomaly on the southeastern portion of the pad by digging three test pits in area. Take additional action if warranted.	n/a	_____
8	Remove solid waste and contaminated soil from Northeast Landfill. Segregate clean and contaminated soil. Remove solid waste from soil to the extent practical. Identify and separate any hazardous or regulated waste. Petroleum-contaminated soil will be landfarmed. Backfill with clean gravel.	1,764 (includes clean interstitial gravel and cap)	_____
9	Remove solid waste and contaminated soil from Western Landfill. Segregate clean and contaminated soil. Remove solid waste from soil to the extent practical. Identify and separate any hazardous or regulated waste. Petroleum-contaminated soil will be landfarmed. Do not backfill area; slope "new" pad edge to minimize erosion.	34,958 (includes clean interstitial gravel and cap)	_____
10	Perform bottom of excavation and sidewall sampling and analysis as necessary (and prior to backfilling if applicable) to verify cleanup levels have been met where solid waste or contaminated soil was removed.	n/a	_____
11	Ship solid waste unsuitable for onsite treatment (e.g., landfarming or burning for energy recovery) offsite for treatment or disposal. Scrap metal may be recycled if practical and cost effective.	9,540	_____
12	Setup landfarm area with petroleum-contaminated soil. Remove solid waste (trash) from soil (gravel) to the extent practical. Verify soil only contains contaminants suitable for landfarming (e.g., petroleum hydrocarbons) prior to spreading. Maintain and operate landfarm as necessary to achieve target treatment level of 1,000 mg/Kg DRO.	13,964 (note 3)	_____
13	Conduct monitoring of adjacent surface water bodies to verify post cleanup conditions are in compliance with Alaska Water Quality Standards (AWQS). Three consecutive years of parameters below AWQS required before monitoring can stop.	n/a	_____

Notes:
1. Cleanup levels are listed in Tables 1 and 2. Estimated volumes listed are subject to change.
2. To be completed as work progresses.
3. Assumes soil to be spread and landfarmed will include all soil (gravel) with DRO > 500 mg/Kg from the Western and Northeast Landfills, and the excavated soil from the other petroleum contaminated areas on the pad (items 1-6).

Table 5 - 2012 Planned Soil Sampling Effort
Camp Lonely Cleanup Plan

Site (Area)	Type of Analysis		Rush Turn Around Time (TAT)						Standard TAT									COMMENTS
	Purpose of Samples/ Stage of Project	Sampling Method (note 2)	DRO/RRO (AK102/103)	PCBs (SW8082) (note 5)	Lead (SW6020)	Chromium (SW6020)	VOC (SW8260B)	Totals	DRO/RRO (AK102/103)	PCBs (SW8082)	GRO/BTEX (AK101/ 8021B)	GRO/VOCs (AK101/8260)	PAHs (SW8270C SIM)	8 RCRA Metals (SW6020/ 7471A)	Lead or Chromium (SW6020)	TOC (SW9060)	Totals	
		Matrix >>	Soil	Soil		Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	
Western Landfill	Sampling of Gravel Cap to Confirm Clean (suitable for fill or cover on pad)	Discrete	20	0	0	0	0	20	0	0	0	0	0	0	0	0	0	Gravel cap is estimated to be 1-foot thick and approximately 7,800 LCY. The cap will be removed and stockpiled for potential use as fill or cover on pad. Areas with surface contamination or soild waste will be segregated and addressed separately (e.g., chrome impacted area or stained soil). Suspected clean cap material with no solid waste will be excavated and placed in ~100 CY stockpiles. Ten (10) discrete screening samples will be collected for PID head space analysis from each pile, at least 12 inches below the surface of the pile and distributed evenly around the pile. If no PID readings are > 10 ppm, no analysis for DRO/RRO will be performed and it will be considered clean with respect to petroleum hydrocarbons. DRO/RRO samples will be analyzed if PID head space readings are elevated (> 10 ppm) to confirm soil is clean (assumed 25% of piles). Soil used for clean, unrestricted fill or pad cover must have DRO ≤ 500 mg/Kg and RRO ≤ 2,000 mg/Kg, and no contaminants above Arctic Zone MethdTwo cleanup levels. Bottom of cap will be considered to be the depth at which solid waste is visible.
	Post Excavation Confirmation Sampling of Chromium "Hot Spot"	Discrete	**0**	**0**	**0**	**5**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	The tar like material and surrounding soil with chromium above 410 mg/Kg in the southern part of the landfill will be excavated, and shipped off of the installation for disposal (estimated to be 4 LCY). Following excavation, discrete samples will be used to determine whether cleanup levels have been met. These samples may be analyzed on a rush basis. A minimum of five confirmation samples will be collected to verify chromium > 410 mg/Kg was removed. Field Replicates will be collected at 10%. MS and MSD samples will be collected at 5% each. Analytical results from the 2005 investigations will be used to profile the soils sent offsite for disposal (4 cy), with additional waste characterization sampling if needed.
	Sampling of Stockpiles during Excavation, Non-cap Material (Waste Characterization)	Discrete	39	389	389	10	10	837	0	0	0	0	0	0	0	0	0	Once the landfill cap is removed, the remaining portion of the landfill will be excavated. Excavated soil (free of large debris) will be stockpiled and sampled for characterization. For tracking the origin of stockpiles, a 20 x 20 ft grid square will be established over the landfill area. Typically soil will excavated in 2 floor lifts corresponding to 30 CY per grid square or a stockpile of 37 LCY. It is estimated that 27,189 LCY of soil mixed with solid waste (debris) is present in the landfill, resulting in ~777 stockpiles (~35 LCY each). Four (4) discrete screening samples will be collected for PID head space analysis from each pile, distributed evenly. If no PID readings are > 10 ppm, then one sample for PCB and lead analysis will be collected from the location in pile with where there is the most solid waste present or alternatively where visual or olfactory evidence suggest contamination. If PID readings are > 10 ppm, the lead and PCB sample will be collected from location with highest PID reading. However, PCB and lead analysis may be eliminated for a portion of the landfill based on results from the southwest quadrant (note 5). The sample count listed assumes 50% of the soil (stockpiles) need analysis for PCBs and lead. In addition, during removal and stockpiling, soil suspected to contain other types of contaminants based on associated debris or appearance will be stockpiled separately for additional waste characterization on a case by case basis. Chrome and VOC analysis added as contingency. DRO/RRO analysis will be performed on stockpiles with PID readings ≤ 10 ppm, to determine if the soil is potentially suitable as clean fill after solid waste removed.
	Confirmation-Excavation floor	Discrete	**0**	**0**	**0**	**0**	**0**	**0**	**107**	**60**	**107**	**0**	**22**	**0**	**11**	**0**	**307**	Following solid waste removal, the excavation area (estimated to be 16,9884 square ft) will be sampled to verify the remaining soil is below applicable cleanup levels. The sampling will be conducted using the same 20 x 20 ft grid square axis established for the landfill removal. Samples for PID head space analysis of volatiles will be collected at all the axis points of the 20 by 20 ft grid squares (e.g. one sample per 400 square ft). Samples for laboratory analysis will be collected at every other sampled point (e.g., every 40 ft on the grid square axis, or one sample every 1,600 square ft) and analyzed for GRO/BTEX and DRO/RRO. In addition, 20% of the laboratory samples will be analyzed for PAHs by selecting the sample with the highest PID readings per consecutive sets of 20 screening samples. If results indicate contaminants remain above cleanup levels, additional rounds of excavation and sampling may be necessary. **PCBs**: Areas from which stockpiles originated containing PCBs > 0.75 mg/kg, will have floor sampling for PCBs (note 6). For planning, it is estimated up to up 15 of the 20 X 20 ft grid squares will require sampling (4 discrete samples per grid square). Lead or chrome may be sampled at specific locations based on stockpile results (one sample per 20 ft grid square, where stockpiles exhibited exceedances).
	Confirmation-Excavation Sidewall (if > 3ft in height)		**0**	**0**	**0**	**0**	**0**	**0**	**15**	**0**	**15**	**0**	**3**	**0**	**0**	**0**	**33**	An estimated 600 feet of sidewall will be greater than 3 ft in height and require confirmation sampling. A PID screening sample will be collected every 20 linear ft and a sample for laboratory analysis every 40 ft. The sidewall samples will be analyzed for the same analytes as the floor.
Northeast Landfill	Sampling of Gravel Cap to Confirm Clean (suitable for backfill)		1	4	4	0	0	9	0	0	0	0	0	0	0	0	0	Gravel cap is assumed to be 1-foot thick and approximately 391 LCY (may be less). The cap will be removed and stockpiled for potential use as fill or cover on pad. The protocol will be the same as described for the Western Landfill (above). PCB and lead sampling may be eliminated based on results from Western Landfill (note 5).
	Sampling of Landfill Stockpiles during Excavation, Non-cap Material (Waste Characterization)	Discrete	4	40	40	0	4	88	0	0	0	0	0	0	0	0	0	Once the landfill cap is removed, the remaining portion of the landfill will be excavated and sampled as described for the Western Landfill (above). It is estimated that 1,373 LCY of soil/debris mix is present in the landfill. That volume will have an anticipated ~40 stockpiles (~35 LCY each) to be generated and sampled. However, PCB and lead sampling and analysis may be reduced or eliminated based on results from the Western Landfill (note 5). The sample count listed assumes the soil (stockpiles) will need analysis for PCBs and lead. VOC and DRO/RRO analysis listed as contingency to assist with characterization.
	Confirmation-Excavation floor	Discrete	**0**	**0**	**0**	**0**	**0**	**0**	**6**	**4**	**6**	**0**	**2**	**0**	**0**	**0**	**18**	Following removal, the excavation area will be sampled to verify the remaining soil is below applicable cleanup levels following the sample protocol as the Western landfill. The landfill is an estimated 8,471 square feet. **PCBs**: See note 6. It is estimated up to four 20 X 20 ft grid squares will require PCB characterization (4 discrete samples per grid square).
	Confirmation-Excavation Sidewall (if > 3ft in height)		**0**	**0**	**0**	**0**	**0**	**0**	**3**	**0**	**3**	**0**	**1**	**0**	**0**	**0**	**7**	Sidewalls: Sidewalls will be sampled if they are 3 feet high or greater following the same protocol as described for the Western Landfill . An estimated 100 feet of sidewall requiring sampling will be present. The sidewall samples will be analyzed for same analytes as the floor samples (described above).
Landfarm Area	Pre-Landfarm and Post-Landfarm Characterization Samples	Discrete	**0**	**0**		**0**	**0**	**0**	**16**	**16**	**0**	**16**	**0**	**16**	**0**		**64**	Prior to spreading the landfarm soils, samples will be collected in the designated landfarm area and analyzed for DRO/RRO, GRO, PCBs, VOCs, and metals to document the pad baseline conditions. These will be collected at a depth of approximately 6 inches bgs. In each of the planned decision units in the landfarm area (eight); one sample will be collected from each decision unit at the approximate mid-point. After tilling is stopped, the pad material (gravel) below the landfarm soils will be sampled to document the post landfarming site conditions. The samples will be collected at the same approximate locations as the baseline samples and analyzed for the same analytes. These samples will be collected by hand augering down through the landfarm soil and then approximately six inches into the original pad material.
	Initial (Baseline), Intermediate and Confirmation	MI	0	0		0	0	0	24	0	16	0	2	0	0	0	42	Soils containing petroleum hydrocarbons will be landfarmed on the pad. The landfarm is estimated to be approximately 7 acres (304,732 square feet) if the soil is spread to a 1.25 feet depth. Decision units will be approximately 40,000 square feet in size (8 decision units at 200 x 200 ft). Each unit will consist of 50 subincrements. Once all soil has been spread, MI samples will be collected for DRO/RRO and GRO/BTEX. Three sample events are planned, baseline, intermediate and final. An intermediate round of samples will be collected for DRO/RRO only. A final (confirmation) round of samples will be collected for DRO/RRO and GRO/BTEX. The final round of samples will also include 20% PAH samples. The PAH samples will be collected from the decision units previously exhibiting the highest DRO concentrations. Triplicates samples will be collected at a rate of 10% for the baseline and final sampling event (1 triplicate per event). If the landfarm decreases in size, the number of decision unit will be decreased accordingly.
		MI (QA/QC triplicates, note 2)	0	0	0	0	0	0	2	0	2	0	1	0	0	0	5	

Table 5 - 2012 Planned Soil Sampling Effort
Camp Lonely Cleanup Plan

Site (Area)	Type of Analysis		Rush Turn Around Time (TAT)						Standard TAT									COMMENTS
	Purpose of Samples/ Stage of Project	Sampling Method (note 2)	DRO/RRO (AK102/103)	PCBs (SW8082) (note 5)	Lead (SW6020)	Chromium (SW6020)	VOC (SW8260B)	Totals	DRO/RRO (AK102/103)	PCBs (SW8082)	GRO/BTEX (AK101/ 8021B)	GRO/VOCs (AK101/8260)	PAHs (SW8270C SIM)	8 RCRA Metals (SW6020/ 7471A)	Lead or Chromium (SW6020)	TOC (SW9060)	Totals	
		Matrix >>	Soil	Soil		Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	
Petroleum Contaminated Soil Areas (6 areas, non-landfill)	Post Excavation Confirmation (Site Closure)	Discrete	**56**	**0**	**0**	**0**	**0**	**56**	**0**	**0**	**56**	**0**	**6**	**0**	**0**	**0**	**62**	Following soil removal, the excavations will be sampled to verify remaining soil is below applicable cleanup levels. The number of samples will follow the ADEC guideline of 1 sample per 250 square feet of the surface area. In addition, if sidewalls are 3 feet or greater in height, samples will be collected every 20 linear feet. All samples will be analyzed for DRO/RRO and GRO/BTEX, with 1 sample from each excavation also being analyzed for PAHs. Field replicates and MS/MSD sample pairs will be collected at the required project frequency of 10% and 5%, respectively for discrete samples. The cleanup level for areas within 25 feet of the edge of the pad is DRO 500 mg/Kg (likely on the Loading Dock Area and Communication Shop AST). For areas in the interior of the pad, the cleanup level is DRO 1,000 mg/Kg. If a sample area exceeds cleanup levels, additional soil removal and sampling will be performed in the corresponding area. If soil is encountered that appears to contain compounds other than petroleum hydrocarbons, the soil will be segregated and sampled for waste characterization (see Table 6). DRO is primary COC and will be analyzed on fast turnaround basis to enable backfilling.
Background Location	Assessment of Biogenic Interference on DRO/RRO Analysis	Discrete	0	0	0	0	0	0	5	0	0	0	0	0	0	5	10	Biogenic interference will be evaluated in confirmation samples for DRO/RRO in areas where there appears to be peaty (organic) soils following ADEC guidance document procedures (Technical Memorandum -06-001). In these areas, standard analysis and analysis with silica gel cleanup of the sample extract will be performed. The silica gel cleanup will be requested at the discretion of the field sampler based on visual observations of the site conditions where the samples are collected. It is assumed that analysis with silica gel cleanup will be needed for 25% of the floor confirmation samples where DRO/RRO is collected. Five background samples will also be collected from the adjacent tundra in undisturbed areas and from a similar strata. The background samples will be analyzed for total organic carbon and DRO/RRO using standard analysis and analysis with silica gel cleanup.
Selected Confirmation Sample Locations			0	0	0	0	0	0	37	0	0		0	0	0	37	74	
	Trip Blanks		0	0	0	0	3	0	0	0	8	2	0	0	0	0	10	Trip blanks - One per shipment for volatile samples
Subtotal Sample Count			120	433	433	15	17	1010	215	80	213	18	37	16	11	42	632	Subtotal prior to added contingency and field replicates
Total Samples Subject to Field QA/QC			56	0	0	5	0	56	147	80	187	16	34	16	11	0	491	
Replicates (10% for discrete confirmation samples)			6	0	0	1	0	6	15	8	19	2	4	2	2	0	50	Field replicates will be collected for any discrete confirmation and characterization samples. Replicates will be collected at a frequency of one per ten samples or less, per matrix and sample method. Triplicate samples are collected for MI sampling and are accounted for under each site above.
MS&MSD (5% each for confirmation samples)			6	0	0	1	0	6	15	8	19	2	4	2	2	0	50	MS and MSD sample volume will be submitted at an approximate frequency of 5% (1 in 20) of the total discrete confirmation and characterization samples per matrix and sample method, as specified in the comments above. MS/MSD will not be required for waste characterization or MI samples.
Subtotal Sample Count			188	433		22	17	1078	392	176	438	38	79	36	26	42	1223	
Contingency			47	44		3	2	108	40	18	44	4	8	4	3	5	123	A 10 percent contingency was added to all sample counts, except for DRO/RRO. 25% contingency added fast turnaround analysis of DRO/RRO to enable rapid confirmation when needed for backfilling excavations.
Total Sample Count			**235**	**477**		**25**	**19**	**1186**	**432**	**194**	**482**	**42**	**87**	**40**	**29**	**47**	**1346**	

Notes: 1 - Sample quantities presented in bold red are discrete confirmation or characterization samples, required QA/QC (field replicates and MS/MSD).

2 - At areas designated from MI sampling, triplicate samples will be collected at a target rate of 10% of the decision units (minimum one set per area) to establish an RSD and 95% UCL. The estimated number of triplicate samples needed is listed in designated row per area. Each triplicate adds two analytical samples.

3 - Rush turnaround time is planned to typically be 3 days after the sample arrives at the laboratory, but may be 2 to 7 days on a case by case basis.

4 - Confirmation samples will be analyzed on a standard turnaround time unless requested on a case by case basis.

5 - PCBs have not been detected at the site, and lead has no been detected above levels considered background. PCB and lead sampling of excavated soil stockpiles prior to landspreading is being performed as a contingency. The area with highest potential for PCBs is the southwest portion of the Western Landfill because it reportedly received waste from the former DEW Line Station at Point Lonely. If PCBs are not detected above action levels (PCBs > 0.75 mg/Kg and lead > 400 mg/Kg) in the soil stockpiles from the southwest quadrant of the Western Landfill, sampling and analysis of soil stockpiles for PCBs and/or lead from other areas will be reduced in frequency or eliminated. The exception being is if the excavated solid waste indicates the potential for materials to contain PCBs or lead (e.g., buried transformer or batteries encountered). In the case, soil adjacent to subject item will be stockpiled and sampled for PCBs and/or lead.

6 - After landfill removal, the excavation floor will be analyzed for PCBs in areas where excavated soil stockpiles contained PCBs > 0.75 mg/kg. In such cases, four discrete samples will be collected and analyzed for PCBs from each 20 X 20 foot grid square where stockpiles with PCBS originated. Eachgrid square will be divided into four quadrants, approximately 100 square feet, and one sample collected from the middle point of each quadrant. If present, soil with PCBs > 1 mg/Kg will be removed from the excavation floor, followed by confirmation sampling at the same frequency.

7 - Data will be provided as Level II ADEC deliverables with electronic data compatible with MS Access.

8- Sample numbers subject to change.

Table 6 - Additional Waste Characterization Sampling
Camp Lonely Cleanup Plan

Sample Type	Asbestos	Oil Burn Specs (Various, 40 CFR 279.11)	VOC (SW8260)	VOC (Chlorinated Solvents [SW8260])	TCLP VOC (SW1311/8260)	Total PCB (SW8082)	VOC (SW8260)	TCLP VOC (SW1311/8260)	Total PCB (SW8082)	Total Metals (including Lead) (SW6010/7470A)	TCLP Metals (SW1311)	Lead (SW6010)	TCLP Lead (SW6010)	Total PCB (SW8082)	SVOC (SW8270)	TCLP SVOC (SW1311/8270)	Totals	COMMENTS
Matrix >>	Solid (Fiber)	Aqueous	Aqueous	Aqueous	Aqueous	Aqueous	Solid	Solid	Solid	Solid	Solid	Solid	Solid	Solid	Solid	Solid	NA	
Petroleum Product (fuel or oil)	0	20	10	0	0	0	0	0	0	0	0	0	0	0	0	0	30	It is assumed that up to 20 drums may be found in the landfill(s) that contain liquid other than water. All of these drums will be analyzed for Oil Burn Specs characterization (Flash Point (Ignitability), Total Halogens, Metals (arsenic, cadmium, chromium and lead), and PCBs. Select drums (assume 50%) will also be analyzed for VOCs based on total halogens detected.
Soil (for offsite treatment/disposal)	0	0	0	0	0	0	10	0	10	15	10	0	0	10	0	0	55	Petroleum saturated soil or other suspected contaminated soil not suitable for onsite landfarming.
Miscellaneous	0	0	5	0	5	5	5	5	0	5	5	0	0	5	5	5	45	Unknown liquid or solid material may be encountered such as containers full of grease or saturated soil. Samples are allocated to characterize appropriately, assume 5 liquids and 5 solids.
Dewatering Discharge	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	2	For the northeast landfill, one dewatering sample will be collected and analyzed for VOCs (chlorinated solvents only) and PCBs. The sample will be collected from the treated water (oil water separator), prior to discharge.
Paint	0	0	6	0	6	6	6	6	6	0	0	6	6	6	0	0	54	It is assumed that up to 12 containers (or equivalent) will be found in the landfill(s) that contain paint. The samples will be characterized for transport and disposal. If containers are similar in exterior appearance and marking, and contents appear similar, they may be considered as single waste stream. Note that paint may be have hardened into solid.
Asbestos	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	It is assumed that up to 5 asbestos samples will be collected.
Subtotal Sample Count	5	20	21	1	11	12	21	11	16	20	15	6	6	21	5	5	186	
10% Contingency	1	2	3	1	2	2	3	2	2	2	2	1	1	3	1	1	19	A 10 percent contingency was added to all samples.
Total Sample Count	**6**	**22**	**24**	**2**	**13**	**14**	**24**	**13**	**18**	**22**	**17**	**7**	**7**	**24**	**6**	**6**	**205**	

Notes:

1 These samples will be collected for the purpose of waste characterization. Types and numbers of samples will vary with waste recovered. Other methods may be used, where considered appropriate.

2 No field QA/QC samples will be collected.

3 Level II deliverable packages will be requested.

Table 7 Summary of Sample Containers and Preservatives

Method	Media	Container Volume	Container Material	Preservative	Hold time (days)
DRO / RRO[2,5] (AK102/103)	Soil	4-8 oz.[2]	Amber Glass	4°C (±2°)	14
PCBs[2,5] (SW8082)	Soil	4-8 oz.[2]	Amber Glass	4°C (±2°)	None
GRO/BTEX[1,3] (AK101/8021B)	Soil	4 oz.	Pre-Tared, Amber Glass	Surrogated Methanol 4°C (±2°)	14
Total Lead, Chromium, or 8 RCRA Metals[2,5] (SW6020/7471A)	Soil	4-8 oz.[2]	Amber Glass	4°C (±2°)	Mercury 28 days, Other metals 180 days
TCLP Metals TCLP Lead (SW1311/6010/6020/ 7471)	Soil	8 oz.	Amber Glass	4°C (±2°)	TCLP 14 days, Lead 180 days
Lead (SW6010)	Solid (Paint)	(30 grams minimum)	1 quart re-sealable plastic bag	None	180 days
VOCs[1,3] (SW8260B)	Soil	4 oz.	Pre-Tared, Amber Glass	Methanol Preserved, 4°C (±2°)	14
SVOC or PAHs[2,5] (SW8270C)	Soil	4-8 oz.[2]	Amber Glass	4°C (±2°)	14
Oil Burn Specs.[4,6] (Various CFR 279.11)	Aqueous[4]	4-8 oz.	Amber Glass	4°C (±2°)	7 to 180, depending on the analysis
VOC[1,4] (SW8260B)	Aqueous[4]	4-8 oz.	Amber Glass	HCl to pH <2, 4°C (±2°)	14
TCLP VOC[1,4,7] (SW1311/SW8260B)	Aqueous[4]	4-8 oz.	Amber Glass	4°C (±2°)	14[7]

Notes:

1- Prior to shipping, a sample cooler with this type of sample requires a trip blank and indication on the chain of custody.

2- For multi-incremental samples, two sample aliquots of approximately 30-35 grams each are required in separate jars for each non-volatile analytical method. An additional jar is required for total solids. 4 oz. containers are preferred unless extra volume is necessary for MS/MSD analyses or multiple methods are being required for analysis (not multi-incremental as no MS/MSD are analyzed). For multi-incremental non-volatile samples, multiple analyses cannot be conducted from the same volume of soil. The entire 30-35 grams must be extracted.

3- Separate, unpreserved, volume is required for total solid determination.

4- The sample matrix is assumed to be waste (e.g. oil or diesel). Volatile samples should be collected leaving minimal headspace.

5- For discrete samples, the volume for these analyses may be combined into one container. However, at least 60 grams should be provided per method and per MS and MSD requested (per method). Triplicate volume per method is required for MS/MSD analysis. Individual containers are required per method for multi-incremental samples.

6- Oil Burn Specifications includes flash point, total halogens, metals (arsenic, cadmium, chromium and lead), and PCBs.

7- TCLP analysis typically has an initial 14 day holding time. Then, once tumbling has occurred, the standard analytical method holding times for liquid apply for extraction and analysis. Since the matrix is assumed to be product, it is assumed that the initial 14 day holding time will apply as analysis will likely consist of a waste dilution into the appropriate solvent.

Table 8 Screening, Sampling and Classification of Soil Stockpiles from Landfill Areas

SOIL STOCKPILE TYPE	TYPICAL SIZE (CY)	DEPTH OF EXCAVATED SOIL AND CONDITIONS	SCREENING METHOD	ANALYTICAL SAMPLING (SEE NOTE 2)	CLASSIFICATION OF SOIL
Landfill Cap (Gravel)	100	No significant visible waste, and depth typically < 1 foot bgs (may be slightly deeper in some areas)	PID head space analysis: 10 grab samples distributed across pile	If all PID readings are ≤ 10 ppm, no analytical sampling needed.	Clean gravel for onsite use (may (be stored in consolidated stockpile onsite)
				If 1 or more PID readings are > 10 ppm, then collect discrete sample from soil with highest PID reading, and analyze for DRO/RRO.	Clean gravel for onsite reuse, if DRO ≤ 500 and RRO ≤ 2,000 mg/Kg. If DRO or RRO exceeds these values, classified as PCS to be landfarmed onsite.
Landfill Material (interstitial soil mixed with waste)	35 (See note 1)	Visible solid waste mixed with soil. Typically > 1 foot bgs (but may be less than 1 foot bgs in some areas)	PID head space analysis: 4 grab samples distributed across pile (or a minimum of 1 sample per 10 CY if pile is smaller than 35 CY)	If 1 or more PID readings > 10 ppm, collect discrete sample for PCBs and lead from screening sample location with the highest PID reading.	If PCBs ≤ 1 mg/Kg and lead ≤ 400 mg/kg, then classified as PCS for onsite treatment (landfarm onsite). If PCBs or lead exceed these cleanup levels, then classified as waste for offsite disposal.
				If all PID readings ≤ 10 ppm, collect 1 discrete sample from location where solid waste appears to be most concentrated or suggestive of potential contamination.	If PCBs ≤ 1 mg/Kg and lead ≤ 400 mg/Kg, then classified as clean fill for onsite reuse (after solid waste is removed). If PCBs or lead exceed these cleanup levels, then classified as waste for offsite disposal. Additional analysis may be necessary.

Notes:

1) Soil in proximity to solid waste that contains items indicative of potential PCB or lead contamination may be removed and stockpiled separately from the surrounding soil during excavation or from the initial stockpile pile, so it can screened and sampled separately. Items indicative of lead contamination would be (but not limited to) lead acid batteries. Items indicative of PCB contamination would be transformers or capacitors. This soil identified for special handling due to potential PCB or lead contamination, may be consolidated into larger piles of up to 20 cubic yards prior to sampling.

2) Excavation and landfill removal is anticipated to begin in the south end of the Western Landfill and proceed to the north. The Northeastern Landfill will not be removed until after the approximate southern half of the Western Landfill is removed. If this is the case, the analysis of PCBs and lead may be reduced in frequency or eliminated, if these substances are not detected above Method Two Arctic Zone cleanup levels in the southern half of the Western Landfill. This change will not be made without ADEC concurrence.

Table 9 Typical Data Qualifiers for Camp Lonely

Qualifier	Description
Q	One or more laboratory quality control criteria (for example, LCS recovery or surrogate spike recovery) failed. Where applicable, an "H", "L", or "N" will be appended to indicate positive, negative, or unknown bias, respectively.
J	Estimated: The analyte was positively identified but the result was outside the calibration range, between the limit of quantitation (LOQ) and the detection limit (DL); the quantitation was an estimate.
M	The concentration was an estimate due to a sample matrix quality control failure. Where applicable, an "H", "L", or "N" will be appended to indicate positive, negative, or unknown bias, respectively.
B	Blank contamination: The analyte was positively identified in a blank (e.g., trip blank and/or method blank) associated with the sample and the concentration reported for the sample was less than five times that of the blank (ten times for metals and common laboratory contaminants methylene chloride and acetone).
P	Sample preservation requirements were not satisfied.
R	The data were rejected. The data was considered unusable for any purpose.

APPENDICES

APPENDIX A

RESULTS OF 2005 GEOPHYSICAL SURVEYS

Figure 1 – EM-61 Survey (GAEA 2005)

Figure 2 – EM-61 Survey (USGS 2005)

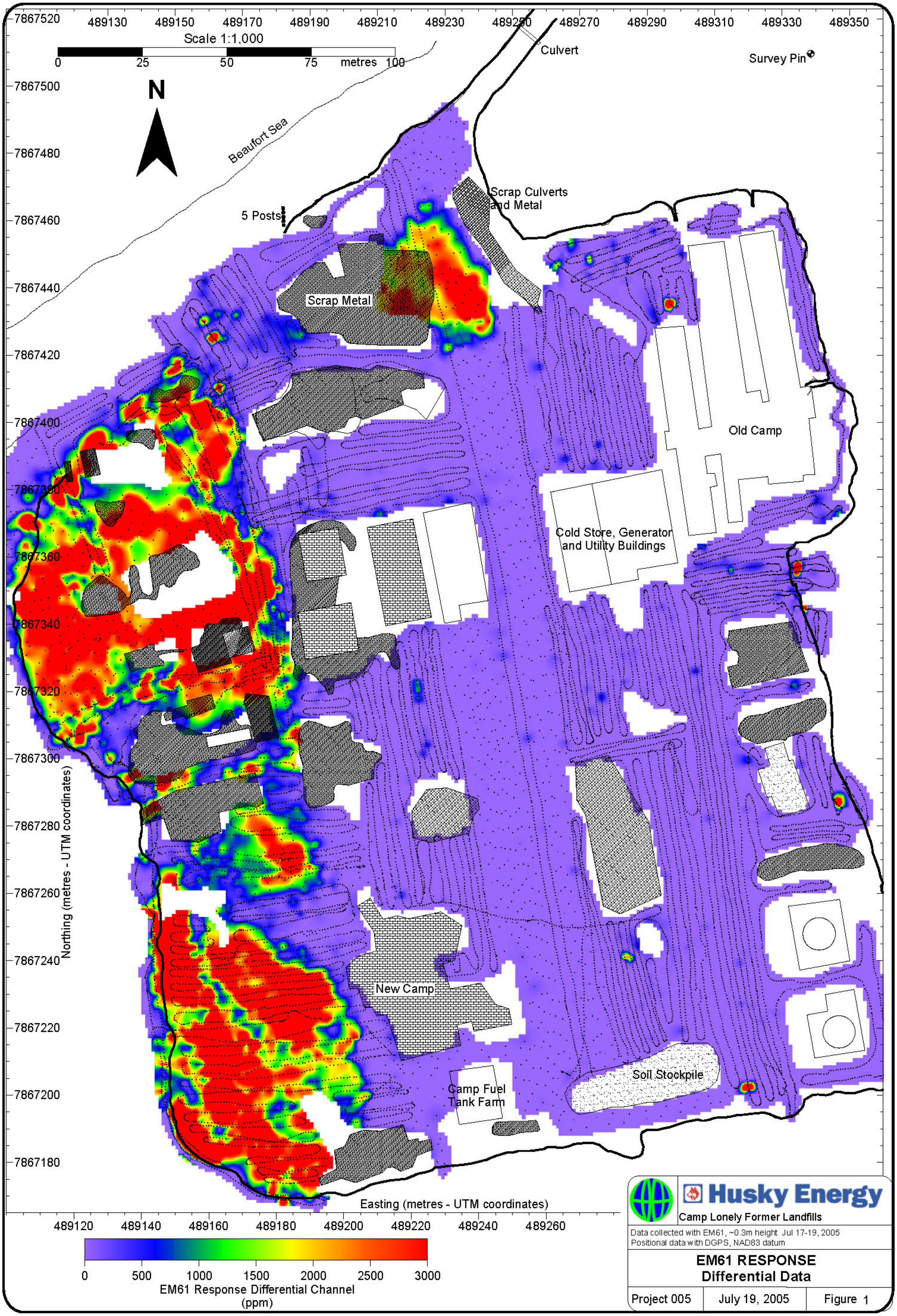
2005 USGS Report
(Only the portion of the report pertinent to the Camp Lonely site is provided)

CAMP LONELY SITE CLEANUP PLAN (LANDFILLS AND ASSOCIATED PAD)

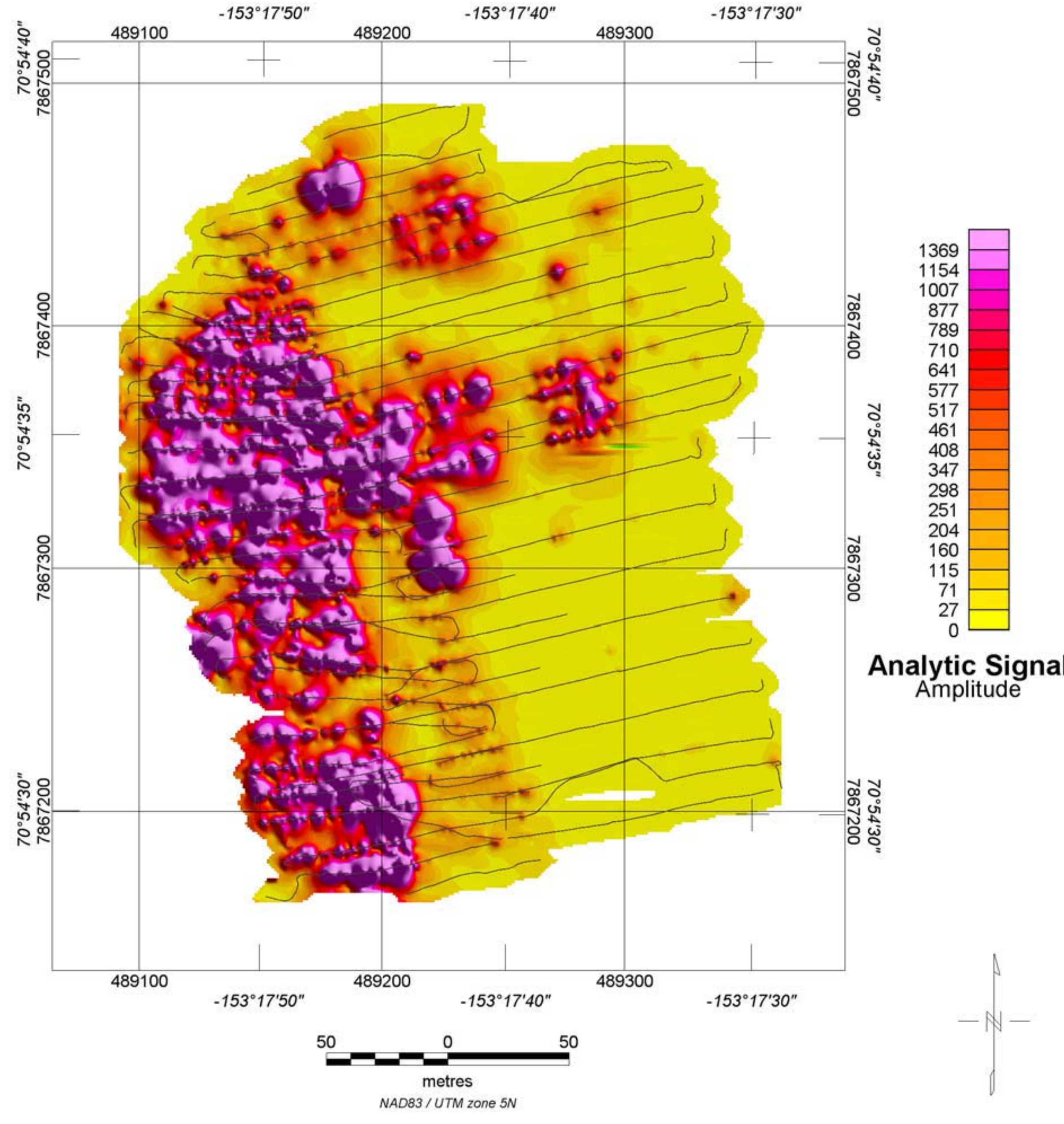
Final

Husky Oil Operations Limited
707 8th Ave. SW, Box 6525, Station “D”
Calgary, Alberta, CANADA T2P 3G7

December 2012



Scale 1:1,000
0 25 50 75 metres 100
N
Beaufort Sea
Culvert
Survey Pin
5 Posts
Scrap Culverts and Metal
Scrap Metal
Old Camp
Cold Store, Generator and Utility Buildings
New Camp
Camp Fuel Tank Farm
Soil Stockpile
Northing (metres - UTM coordinates)
Easting (metres - UTM coordinates)
7867520
7867500
7867480
7867460
7867440
7867420
7867400
7867380
7867360
7867340
7867320
7867300
7867280
7867260
7867240
7867220
7867200
7867180
489130 489150 489170 489190 489210 489230 489250 489270 489290 489310 489330 489350
489120 489140 489160 489180 489200 489220 489240 489260
0 500 1000 1500 2000 2500 3000
EM61 Response Differential Channel (ppm)
Husky Energy
Camp Lonely Former Landfills
Data collected with EM61, ~0.3m height Jul 17-19, 2005
Positional data with DGPS, NAD83 datum
EM61 RESPONSE
Differential Data
Project 005
July 19, 2005
Figure 1



USGS magnetometer survey of Camp Lonely Pad in August, 2005.
Figure taken from USGS 2006 report.

Figure 2

Bureau of Land Management Alaska Northern Field Office

Geophysical Investigations of Selected Infrastructure Sites within the National Petroleum Reserve, Alaska

By Jared D. Abraham, Eric D. Anderson, Bethany L. Burton, and Jeffrey E. Lucius

Administrative Report 2006-LAI-05-0015

U.S. Department of the Interior
U.S. Geological Survey

3.2 Camp Lonely Landfill

3.2.1 Site Description

Camp Lonely is located near the Arctic coast approximately 135 km southeast of Barrow, AK (figure 3.2.1.1) and approximately 1 km west of the Point Lonely (POW-1) DEW line station, which began operation in 1953. Camp Lonely was first used by the US Navy for exploration activities for the NPRA and by NPRA contractor Husky Oil. The USGS took over exploration activities from the US Navy in 1977. In 1977, Husky Oil was granted a solid waste permit, which was amended in 1978 to include the USGS, Husky Oil, and the Point Lonely DEW station contractor. The landfill at Camp Lonely operated from approximately 1977 to 1986. Most waste was incinerated before being placed in the landfill. In addition to the authorized solid waste, such as metal, glass, ash, rubber, chemicals, and domestic waste, Husky Oil allowed disposal of unauthorized waste such as batteries, waste oil, paint solvents, epoxy, and 55 gallon drums (Alaska DEC, 2005). Husky Oil abandoned the camp in 1981. Waste disposal continued until the camp was closed in 1986. The US Air Force and the BLM have conducted site visits and assessments from 1990, when the landfill was closed, to the present.

Figure 3.2.1.2 shows a 1979 picture of the site when it was still an active camp. Figure 3.2.1.3 shows the camp as it appeared in 2003 before the few remaining buildings were removed in 2005; the extent of shoreline erosion is also identified. Figure 3.2.1.4 shows how the site appeared in August 2005 when the USGS geophysical surveys were performed. Magnetic total field and EM induction data were collected August 22 and 25, 2005. The capacitively coupled resistivity system was not used at this site due to time constraints.

3.2.2 GPS

The GPS base station was set up on the same location for both acquisition events at Camp Lonely, August 22 and 25, 2005. The 2.5 hours of data from the first day were submitted to OPUS for processing. Table 3.2.2.1 shows the OPUS-corrected base station coordinates. A high-resolution DEM was created from these surveys and is shown in figure 3.2.2.1. The NAVD88 elevation ranges from 1.8 to 4.8 m.

Table 3.2.2.1 Camp Lonely GPS base station coordinates

ITRF00 Latitude (North)	ITRF00 Longitude (West)	ITRF00 Ellipsoid	UTM NAD83 Zone 5N X	UTM NAD83 Zone 5N Y	NAVD88 Elevation (m)

		(m)	(m)	(m)	
70° 54’ 33.60641”	153° 17’ 49.36398”	0.499	467041.90	7864412.63	3.49

3.2.3 Total Magnetic Field

Approximately 8188 line meters of MVG and total field data were collected at Camp Lonely. The magnetic data were collected and processed as described in the Methods section. The nominal line spacing was 10 meters, trending E/W over an area of approximately 75,000 m^2 (figure 3.2.3.1). The location of ferrous metallic objects can be clearly interpreted from the high amplitude anomalies in the analytic signal. Although a few discrete anomalies were observed, the majority of the anomalies can be characterized as large sections or cells containing ferrous metallic objects. The main section of the landfill is along the western side of the site. However, there are two additional anomalous regions that span several survey path lines located in the northeastern quadrant of the site. As shown in figure 3.2.3.2, large amounts of debris have collected along the western side of the former camp along the edge of the one meter embankment that separated a freshly leveled section from the relatively undisturbed salt marsh to the west. This debris included drift wood and large metallic objects such as pipes and barrels. Barrel lids were also observed on the surface in the southwest section.

3.2.4 EM Induction

The EM induction survey was acquired in the same manner as the magnetic survey: parallel E/W trending, 10 m spaced lines (figure 3.2.4.1), acquiring 7,774 line meters of data over 75,000 m^2. Because there were no capacitively coupled resistivity data to calibrate the EM induction data, the EM data were simply corrected for temporal drift using the pre- and post-calibration files. These drift-corrected data, however, were still inverted using the methods described above. After inversion and processing 7,072 line meters on EM induction data were georeferenced. A 3-D voxel model of the site was produced with a 1 x 1 x 0.5 m (x,y,z) grid cell size using the resistivity sections.

Figure 3.2.4.1 shows the resistivity sections inverted from the EM induction data along each of the survey paths. The majority of the site is resistive with values 100 ohm-m and greater, with resistivity increasing with depth. There are also areas of very low resistivity (red shades) along the western side and to the north. To aid in the interpretation of the 3-D inverted EM induction data, three 2-D depth slices at 0, 2.5, and 5 m are shown in figures 3.2.4.2 through 3.2.4.4, respectively. The low resistivity areas observed on the surface continue to the maximum depth of the model at about 7 m below the surface. The majority of the site is relatively resistive and tends to increase with depth. The metallic waste buried along the western portion of the site is contributing to the low resistivity values. Depth of waste can not be determined from the EM induction measurements in this area.

3.2.5 Combined Results

Figure 3.2.5.1 shows the combined magnetic field and EM induction interpretations for Camp Lonely. The main anomalous area, present in both datasets, is the landfill area on the west side of the site. The analytic signal amplitudes are very high and the resistivity is very low over this area, indicating large amounts of ferrous metal and possibly other conductive waste. The magnetic field data also indicate that ferrous metal is present in the discrete, low resistivity areas in the north-central portion of the site. The very high analytic signal amplitudes cover approximately 23,300 m^2, and the secondary magnetic anomalies with smaller amplitudes cover an additional 2,740 m^2. The volume of ferrous material cannot be determined from these data, because the magnetic field was not inverted for depth, and the presence of large amounts of metal creates artifacts in the EM inversion. Therefore, determination of the true depth to which the landfill extends is not possible with these datasets. As a reference, however, the volume of material with moderately low resistivity values of 100 ohm-m or less is 191,700 m^3, and the volume of material with very low resistivity values of 25 ohm-m or less is 138,900 m^3. The area of 100 ohm-m and less is interpreted to represent the disturbed areas of the landfill containing small debris and miscellaneous conductive waste. The area of 25 ohm-m or less represents areas of large metallic objects and waste. At the ground surface, the 100 ohm-m and 25 ohm-m threshold resistivity values cover areas of 22,520 m^2 and 9,010 m^2, respectively, as shown in figure 3.2.5.1.

Other anomalies of interest are the linear, north-south trending lower resistivity anomaly on the southeastern section of the site and the higher resistivity regions observed in the EM induction data. The linear feature is about 13 m wide and 110 m long. Because this anomaly does not appear in the magnetic data, it is probably a non-ferrous source. There are also regions in the EM induction data that exhibit higher resistivity than the surrounding areas. These variations may be due to different levels of compaction from when this former camp was re-graded. The geophysical anomalies from Camp Lonely are summarized in table 3.2.5.1.

Table 3.2.5.1 Summary of Camp Lonely anomalies

NAME OF ANOMALY	**AREA (M^2)**	**VOLUME (M^3)**	**METHOD**	**INTERPRETED SOURCE**
100 ohm-m or less	22,520	191,700	EM induction	Miscellaneous waste
25 ohm-m or less	9,010	138,900	EM induction	Large metallic objects
Very High magnetic	23,300	NA	Magnetic analytical signal amplitude	Main dump large ferrous metallic wastes
Secondary magnetic	2,740	NA	Magnetic analytical signal amplitude	Small amounts of ferrous metal waste and debris

Figure 3.2.1.2. Aerial view of Camp Lonely during its operation in 1979 (photograph courtesy of BLM). View is to the southwest.

Figure 3.2.1.4. Aerial view of Camp Lonely in August 2005 when the geophysical surveys were performed. View is to the west.

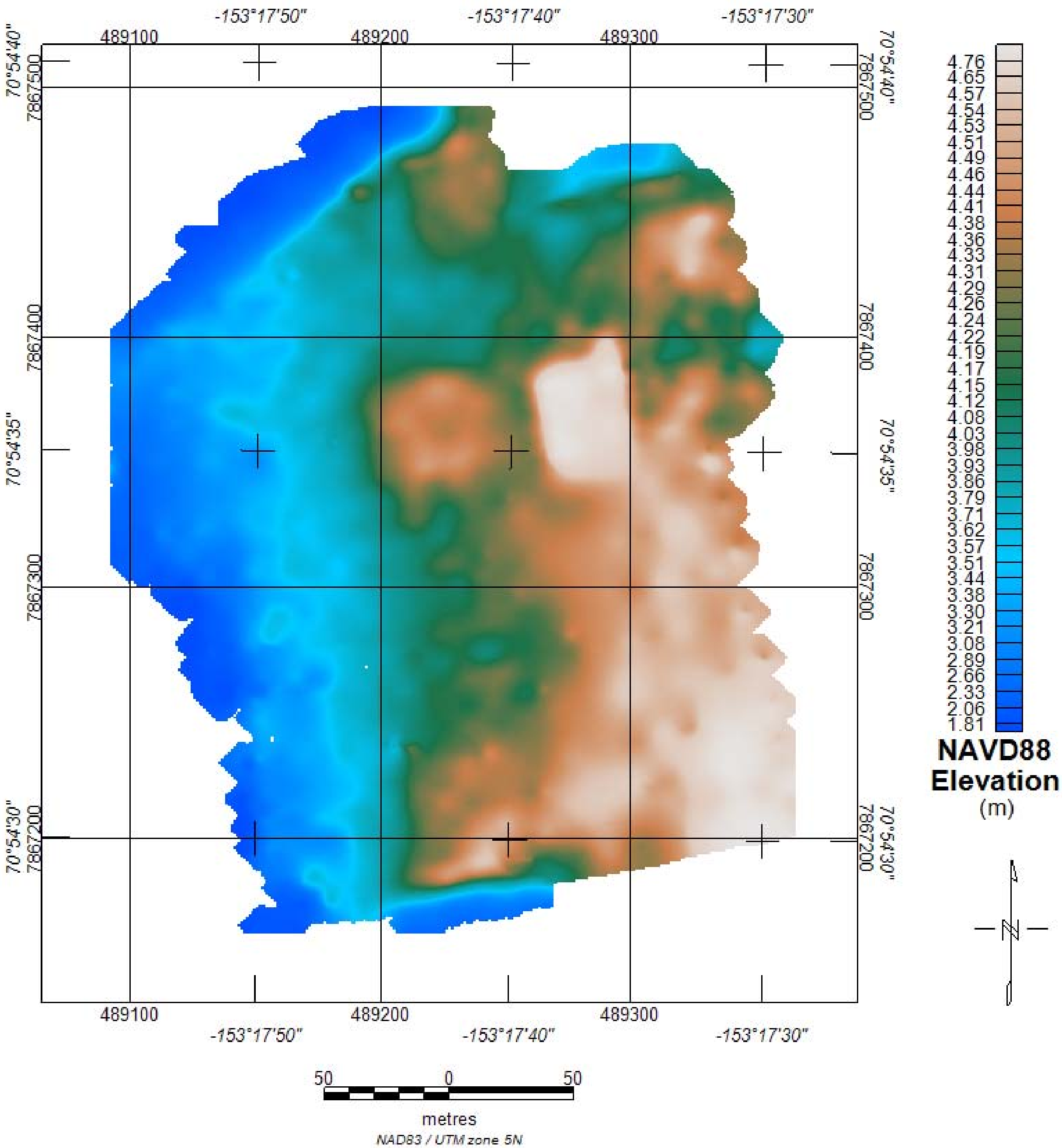


Figure 3.2.2.1. Map of the high-resolution DEM of Camp Lonely, August 2005.

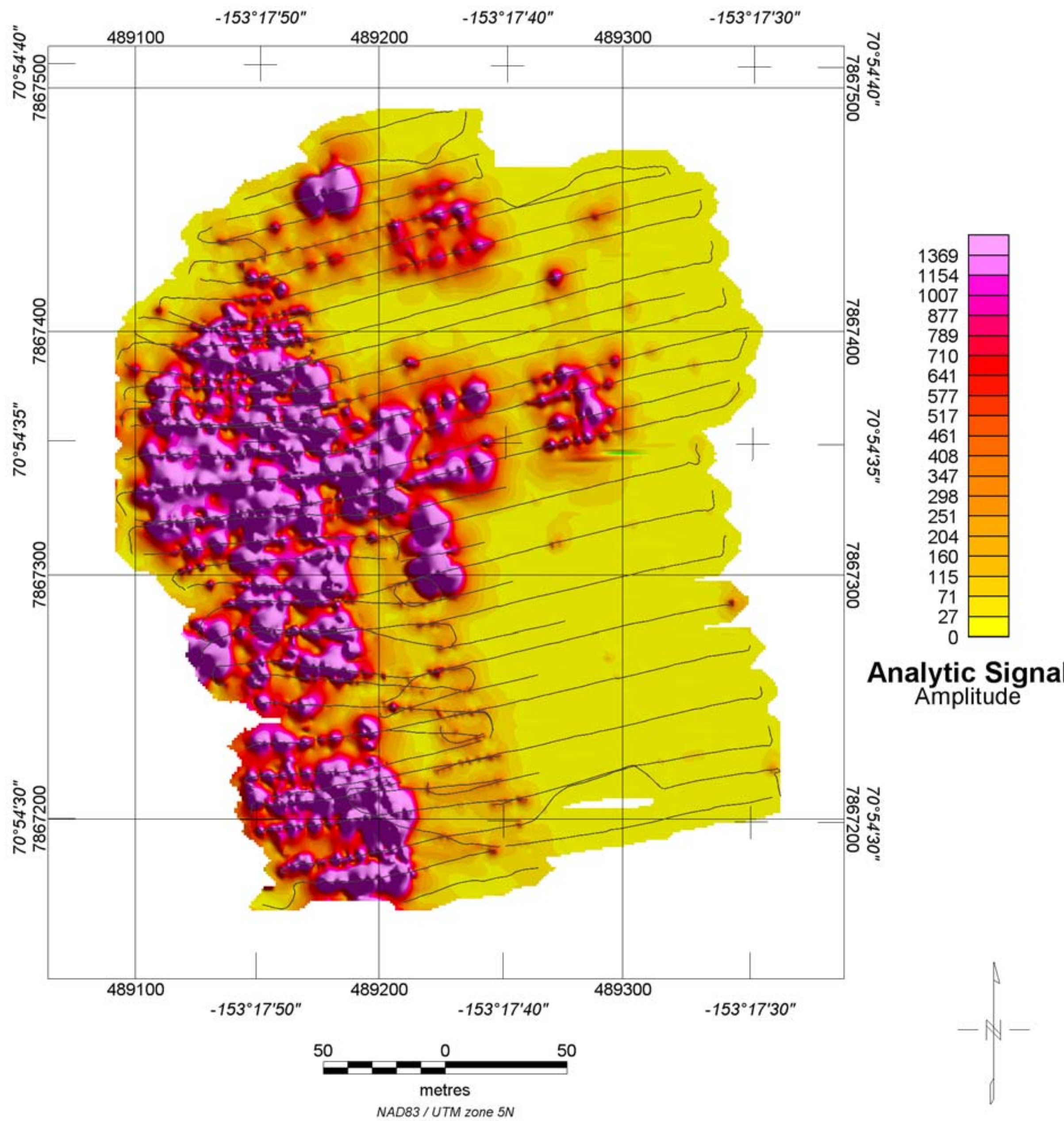


Figure 3.2.3.1. Map of the analytic signal of the bottom sensor total magnetic field of Camp Lonely, August 2005, with the survey path lines overlaid in gray.

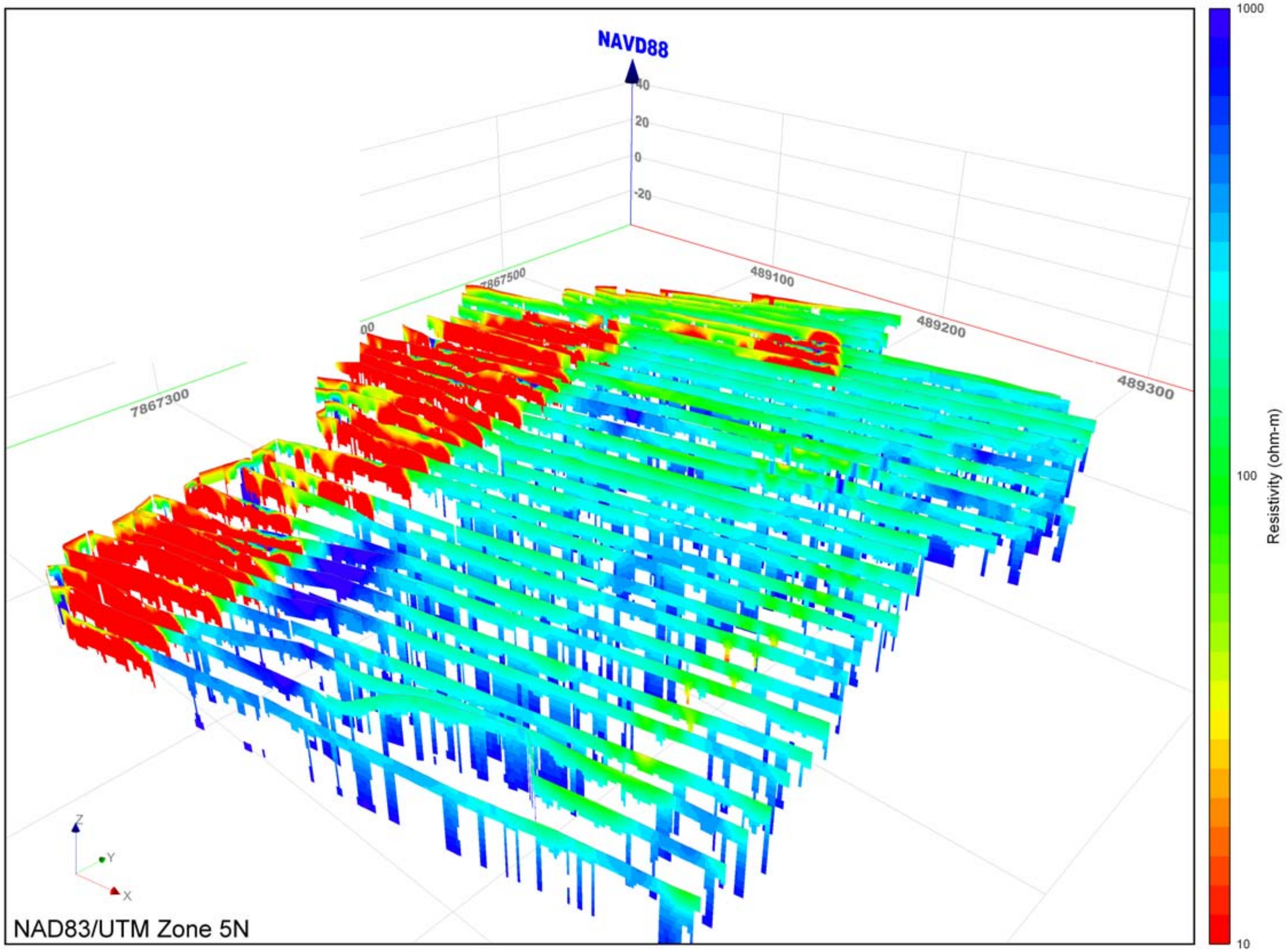


Figure 3.2.4.1. Oblique view of resistivity sections from the inverted EM induction data at Camp Lonely, August 2005.

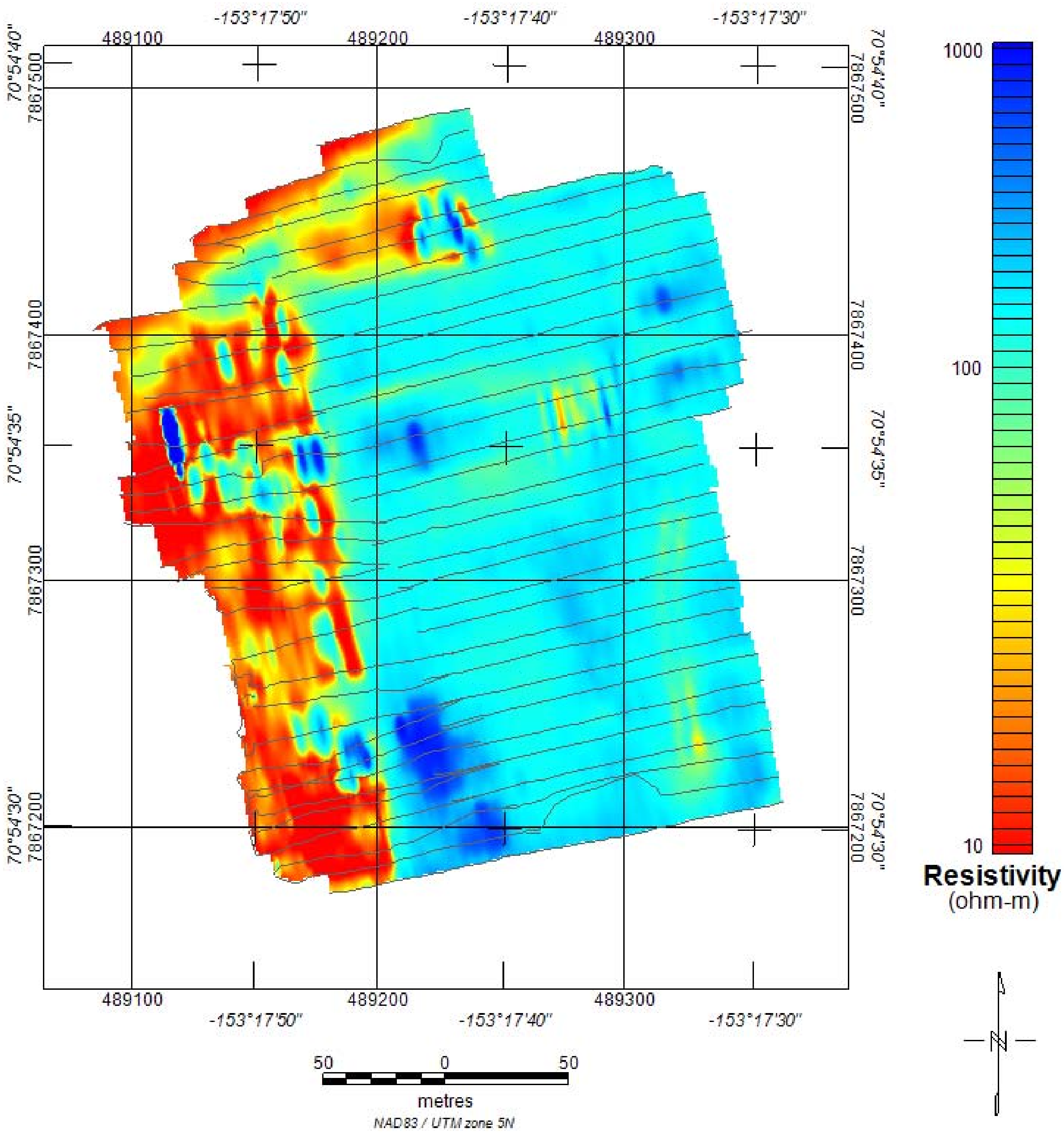


Figure 3.2.4.2. Depth slice 0.0 m below ground surface of the 3-D resistivity model constructed from the EM induction data inversions at Camp Lonely, August 2005. Data collection line locations are also shown.

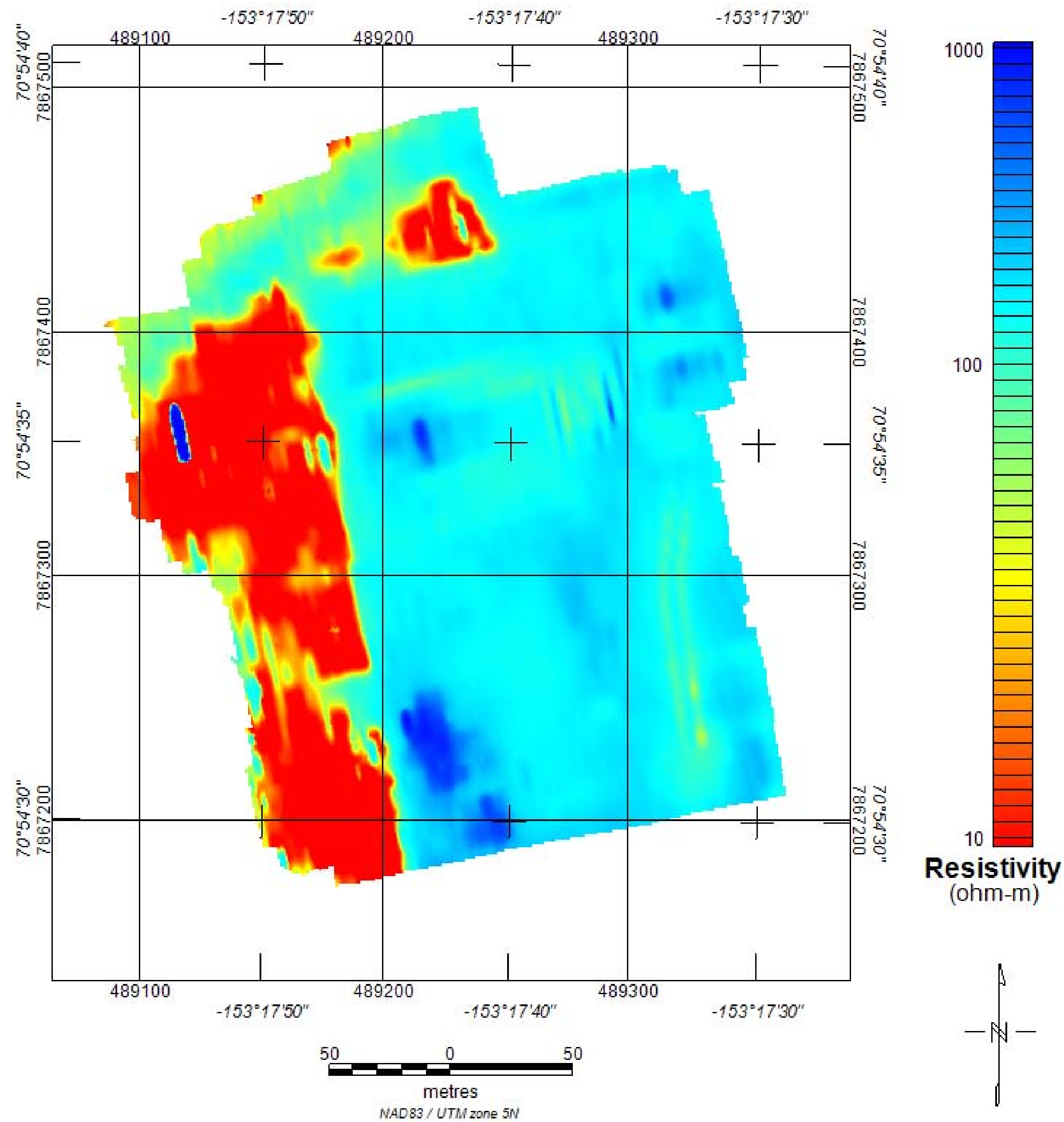


Figure 3.2.4.3. Depth slice 2.5 m below ground surface of the 3-D resistivity model constructed from the EM induction data inversions at Camp Lonely, August 2005.

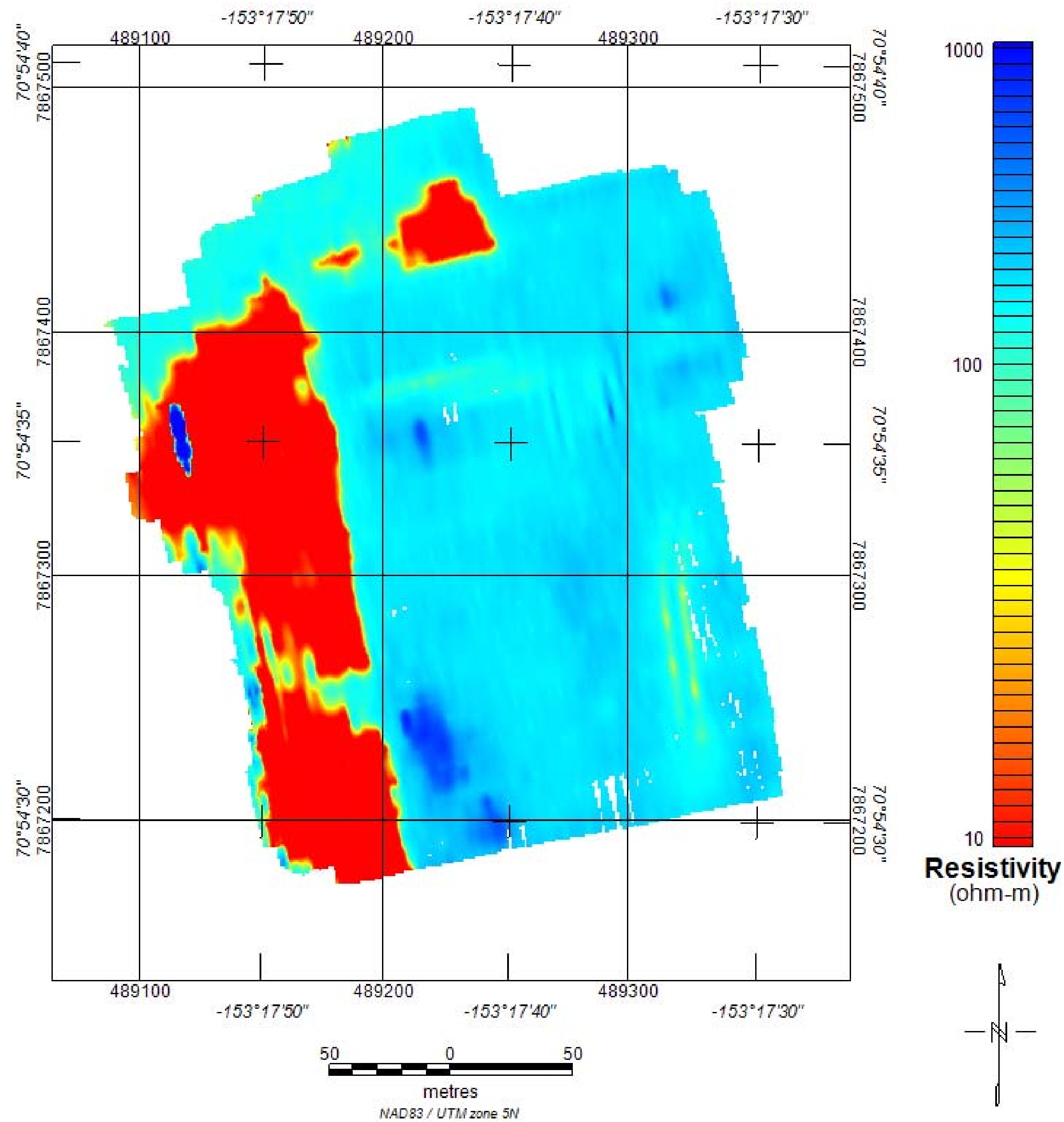


Figure 3.2.4.4. Depth slice 5.0 m below ground surface of the 3-D resistivity model constructed from the EM induction data inversions at Camp Lonely, August 2005.

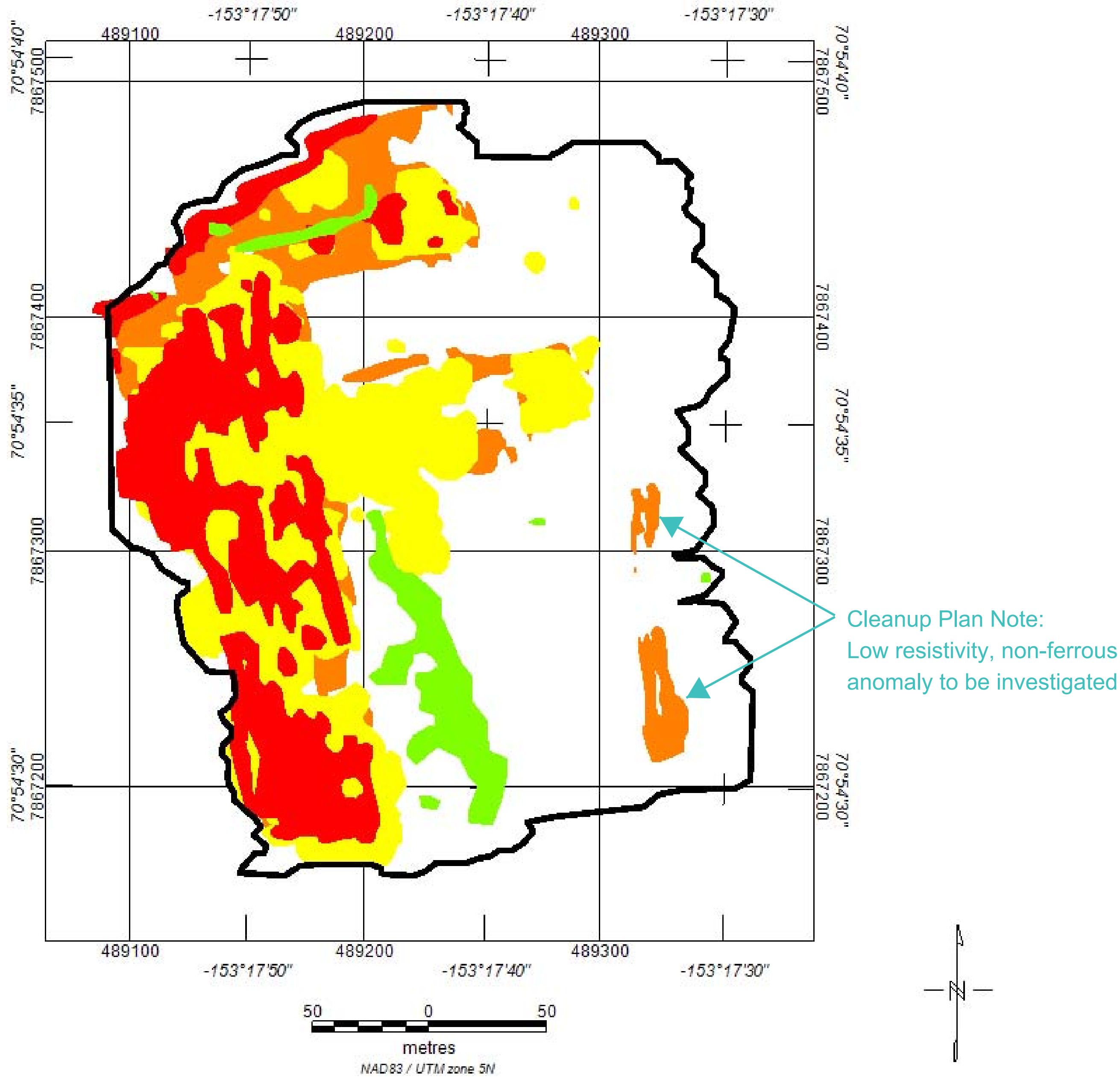


Figure 3.2.5.1. Map of the interpreted anomalies from Camp Lonely, August 2005. The high-amplitude magnetic anomalies are shown in yellow and the secondary, lower amplitude magnetic anomalies are shown in green. Low-resistivity anomalies (100 ohm-m and lower) are shown in orange and very low resistivity anomalies (25 ohm-m and lower) are shown in red. The black line outlines the extent of the magnetic survey.

APPENDIX B

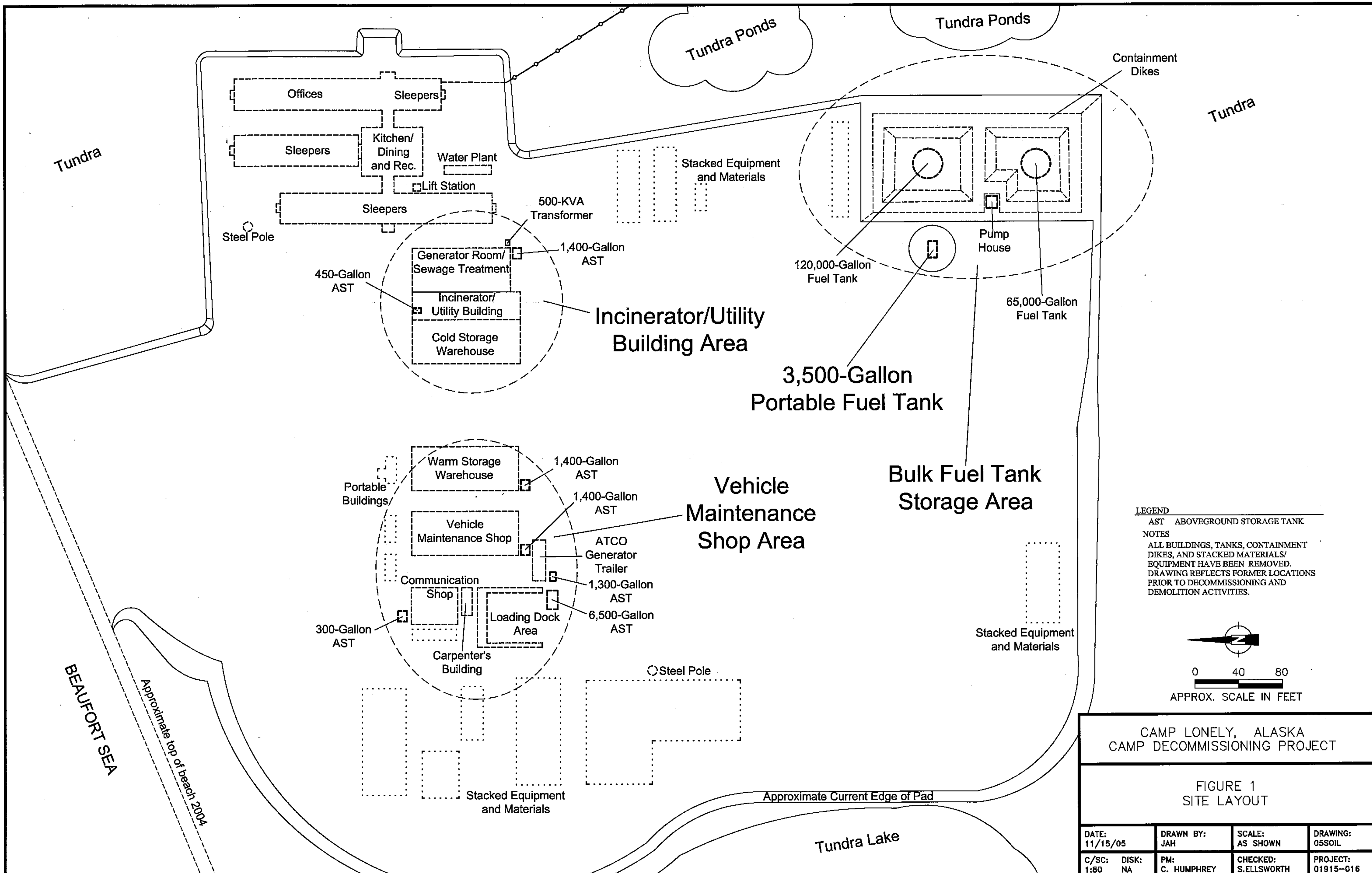
FIGURES FROM CAMP LONELY DECOMMISSIONING ENVIRONMENTAL ASSESSMENT SUMMARY REPORT (ENSR 2005)

CAMP LONELY SITE CLEANUP PLAN (LANDFILLS AND ASSOCIATED PAD)

Final

Husky Oil Operations Limited
707 8th Ave. SW, Box 6525, Station "D"
Calgary, Alberta, CANADA T2P 3G7

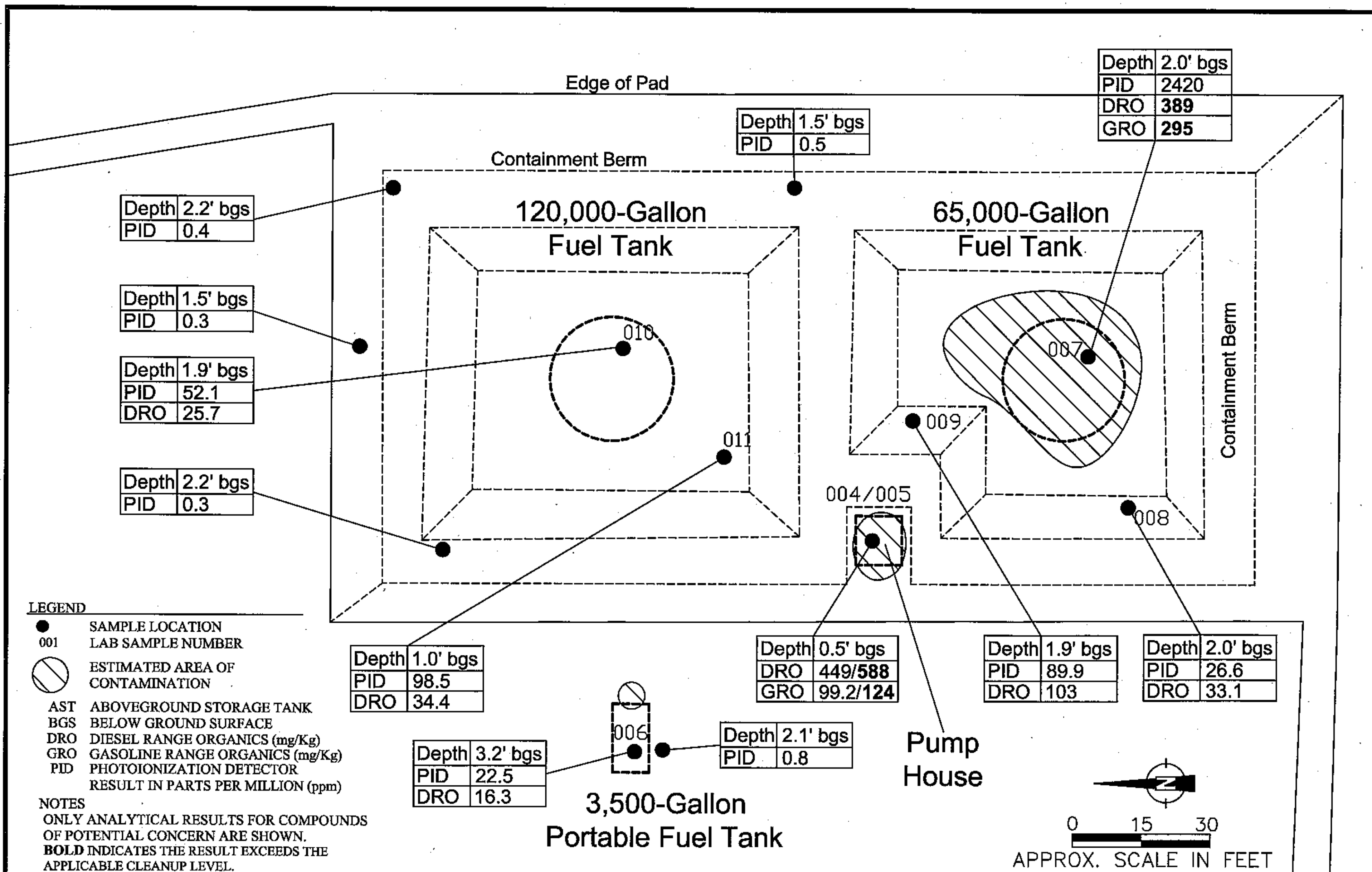
December 2012



CAMP LONELY, ALASKA
CAMP DECOMMISSIONING PROJECT

FIGURE 1
SITE LAYOUT

DATE: 11/15/05	DRAWN BY: JAH	SCALE: AS SHOWN	DRAWING: 05SOIL
C/SC: 1:80 DISK: NA	PM: C. HUMPHREY	CHECKED: S.ELLSWORTH	PROJECT: 01915-016



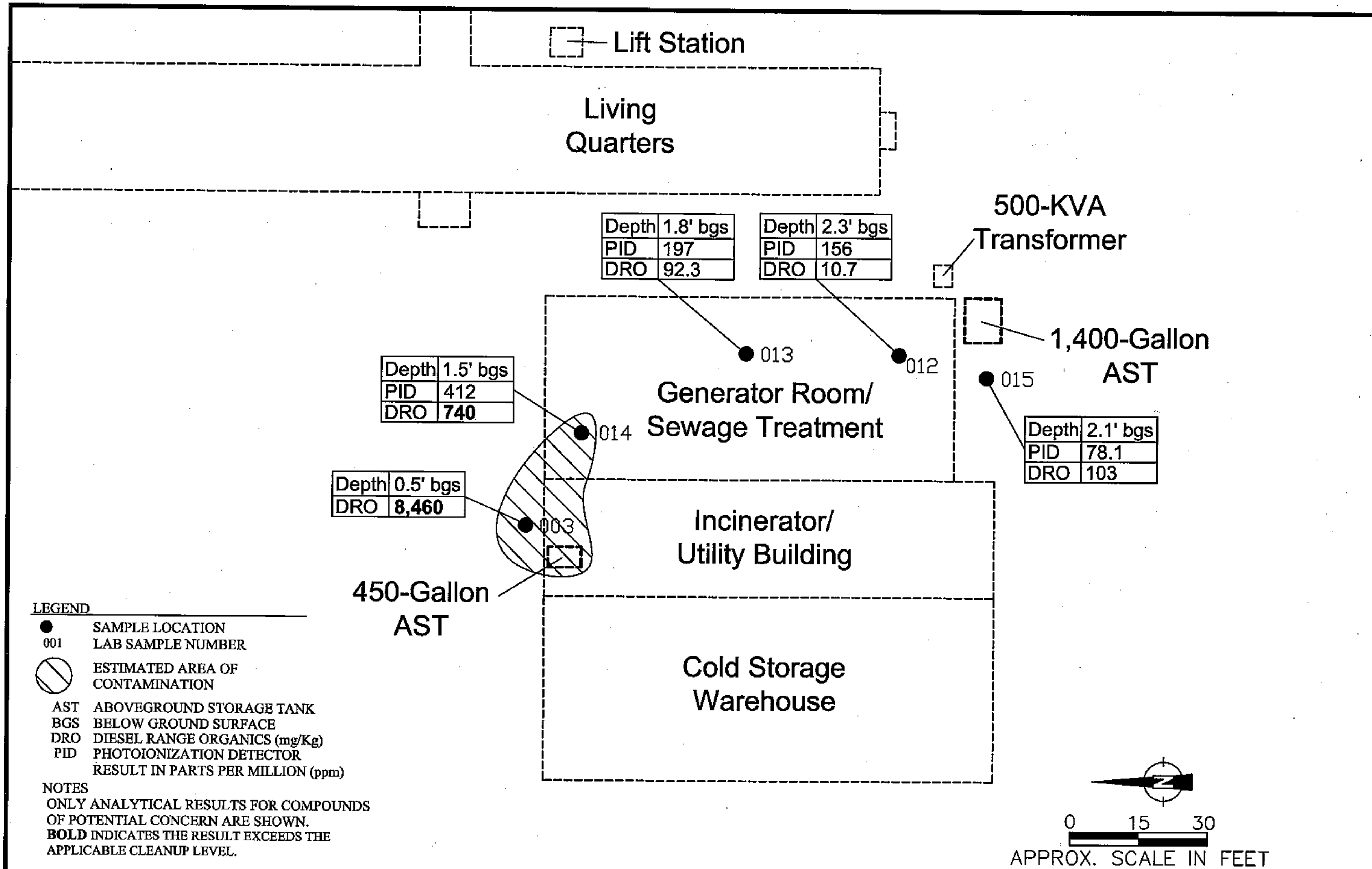
ENSR INTERNATIONAL
1835 SOUTH BRAGAW STREET, #490
ANCHORAGE, AK 99508
(907) 561-5700
FAX: (907) 273-4555

FILE: 05SOIL
C/SC: 1:30
DATE: 11/14/05
DRAWN: JAH
ZIP: NA
CHECK: C.LOCKE

FIGURE 2
BULK FUEL TANK STORAGE AREA

CAMP LONELY, ALASKA
CAMP DECOMMISSIONING PROJECT

PROJECT 01915-016



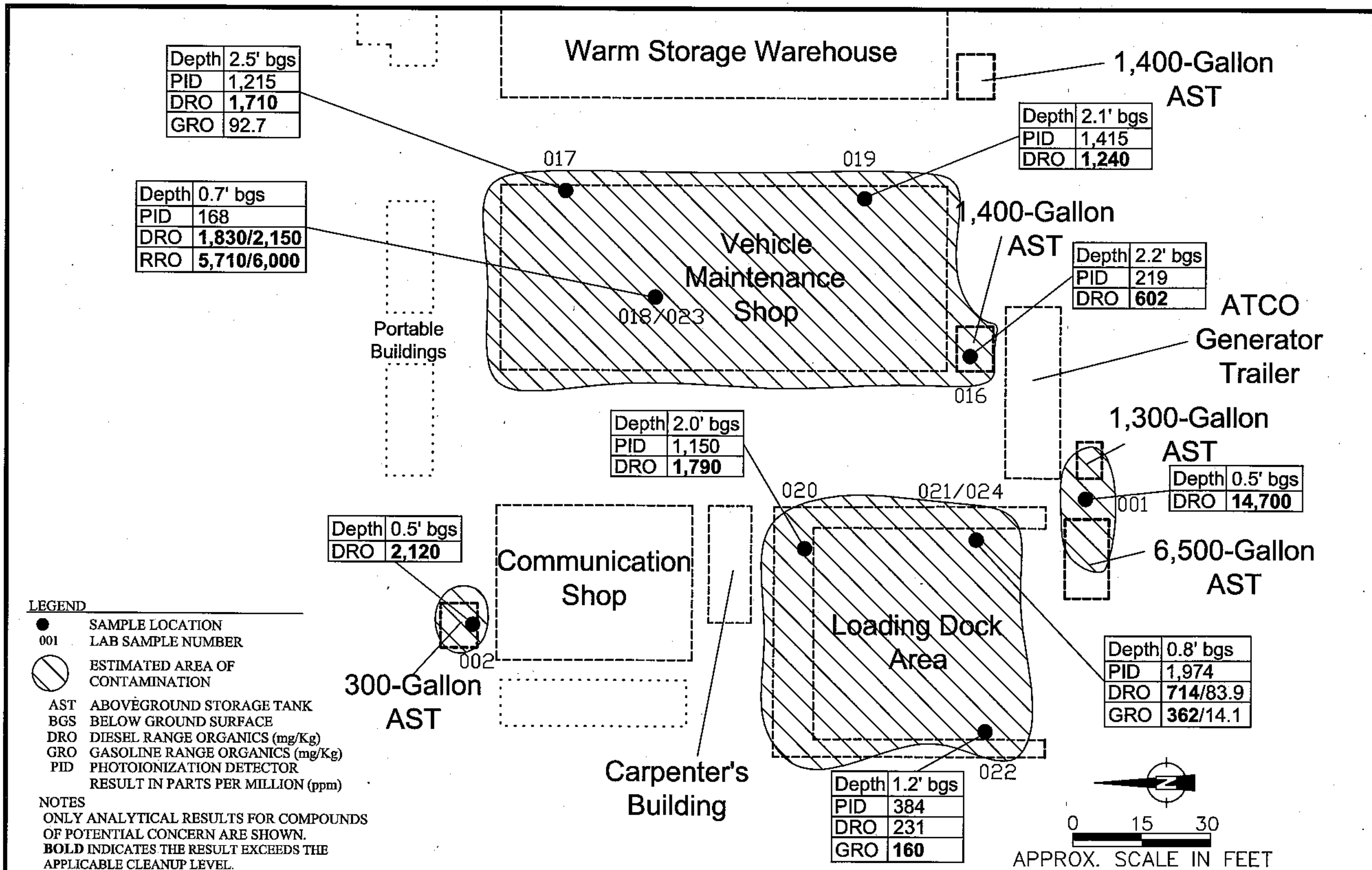
ENSR INTERNATIONAL
1835 SOUTH BRAGAW STREET, #490
ANCHORAGE, AK 99508
(907) 561-5700
FAX: (907) 273-4555

FILE: 05SOIL
C/SC: 1:30
DATE: 11/14/05
DRAWN: JAH
ZIP: NA
CHECK: C.LOCKE

FIGURE 3
INCINERATOR/UTILITY BUILDING AREA

CAMP LONELY, ALASKA
CAMP DECOMMISSIONING PROJECT

PROJECT 01915-016



ENSR INTERNATIONAL
1835 SOUTH BRAGAW STREET, #490
ANCHORAGE, AK 99508
(907) 561-5700
FAX: (907) 273-4555

FILE: 05SOIL
C/SC: 1:30
DATE: 11/14/05
DRAWN: JAH
ZIP: NA
CHECK: C.LOCKE

FIGURE 4
VECHILE MAINTENANCE SHOP AREA

CAMP LONELY, ALASKA
CAMP DECOMMISSIONING PROJECT

PROJECT 01915-016

APPENDIX C

CAMP LONELY SOIL AND DEBRIS VOLUME ESTIMATES

(THESE ARE FOR PLANNING PURPOSES. ACTUAL VOLUMES WILL LIKELY VARY.)

The volume estimates assume soil to be spread and landfarmed will include all soil (gravel) with DRO > 500 mg/Kg from the Western and Northeast Landfill, and the excavated soil from the other petroleum contaminated areas on the pad (DRO < 1,000 mg/Kg in interior portions and > 500 mg/Kg in exterior portions.

CAMP LONELY SITE CLEANUP PLAN (LANDFILLS AND ASSOCIATED PAD)

Final

Husky Oil Operations Limited
707 8th Ave. SW, Box 6525, Station "D"
Calgary, Alberta, CANADA T2P 3G7

December 2012

Appendix C
Camp Lonely Soil and Debris Volume Estimates
(These estimates are intended for planning purposes. Actual volumes will likely vary.)

Table A-1: Estimated Volume of the Camp Lonely Western Landfill (Including Cap)

Item	Material/Waste	[1] Area (ft^2)	[2,3] Depth Interval (ft)	[3] Thickness (ft)	In-place (Bank) Volume (ft^3)	In-place (Bank) Volume (yd^3)	[4] Excavated Volume (yd^3)	Percent of Total Volume
1	[2] Cap/Cover (clean sand and gravel)	167,798	0 - 1	1	167,798	6,215	7,768	22.2%
2	Landfill Material (waste/debris/soil)	167,798	1 - 4.5	3.5	587,293	21,752	27,189	77.8%
	Total					**27,966**	**34,958**	**100.0%**

Notes and Assumptions:

1 Landfill area is based on geophysical anomalies mapped in 2005, test pits, and site observations. See Figure 1 for aerial extent.

2 1 to 2 feet of fill material covers the existing landfill areas. A thickness of 1 foot is a conservative estimate. The cap material is classified as "clean" soil for cost estimating purposes, although small localized areas of contamination are present.

3 The landfill is assumed to be built on tundra grade with an estimated depth to native soil (tundra) of 4.5 feet.

4 Excavated volume includes 25% fluff factor.

Table A-2: Classification of Landfill Material with respect to DRO Soil Concentrations (1 - 4.5 Foot Depth Interval, Cap Excluded)

Item	Material/Waste	[1] Area (ft^2)	[2] Depth Interval (ft)	[2] Thickness (ft)	In-place (Bank) Volume (yd^3)	Percent of Landfill Material	[3] Excavated Volume (yd^3)
2a	Clean Soil (DRO <500 mg/Kg) and Debris	53,695	1 - 4.5	3.5	6,961	32.0%	8,701
2b	Petroleum-Contaminated Soil (DRO ≥ 500 mg/Kg) and Debris	114,103	1 - 4.5	3.5	14,791	68.0%	18,489
	Total	**167,798**			**21,752**	**100.0%**	**27,189**

Notes and Assumptions:

1 It was assumed during the landfill actions the separation of clean and petroleum-contaminated soil/debris will not occur as precisely as shown on Figure 1. The percentage of clean soil was assumed to be 32% of the total landfill area instead of the 33% shown on Figure 1.

2 The thickness is assumed to be the same within the entire area. There is insufficent data to provide a more detailed estimate of the thickness.

3 Excavated volume includes 25% fluff factor.

Appendix C
Camp Lonely Soil and Debris Volume Estimates

(These estimates are intended for planning purposes. Actual volumes will likely vary.)

Table A-3: Estimated Quantities of Soil and Debris within the Camp Lonely Western Landfill Excluding Cap (1 - 4.5 Foot Depth Interval)

Item	[1, 2] Description	In-place (Bank) Volume (yd^3) (from Table A-2)	[2] Material Composition	[3] Percent by Material	In-place (Bank) Volume (yd^3) by Material	[4] Density (lb/yd^3)	[4] Weight (lbs)	[5] Excavated Volume (yd^3)	[4] Weight (Tons)
2a	Clean Soil (DRO <500 mg/Kg) and Debris	6,961	Soil	70%	4,872	3,240	15,786,436	6,090	7,893
			Debris	30%	2,088	1,500	3,132,229	2,610	1,566
2b	Petroleum-Contaminated Soil (DRO ≥ 500 mg/Kg) and Debris	14,791	Soil	65%	9,614	3,240	31,150,021	12,018	15,575
			Debris	35%	5,177	1,500	7,765,319	6,471	3,883
	Total	**21,752**			**21,752**		**57,834,004**	**27,189**	**28,917**
			Total Debris (solid waste)		**7,265**		**10,897,548**	**9,081**	**5,449**
			Total Soil (excluding cap)		**14,487**		**46,936,457**	**18,108**	**23,468**

Notes and Assumptions:

1 Soil is considered "clean" if less than 500 mg/Kg DRO. However, there may still be restrictions on use of soil with DRO from 200-500 mg/Kg.

2 Clean debris is considered material acceptable for landfilling in a Class I Landfill.

3 Soil is estimated to account for 70% of the total landfill volume in areas shown to be clean on Figure 1. Soil is estimated to be 65% of the volume in the landfill areas with contaminated soil. These percentages are approximate and there may be localized variability.

4 The soil density is assumed to be 3,240 lbs/yd^3, which is the standard density for gravel with sand (Glover, 1996). The industrial garbage (metal debris in landfill) is assumed to be 1,500 lb/yd^3. Weight was calculated from the in-place soil volume.

5 Excavated volume includes 25% fluff factor.

Appendix C
Camp Lonely Soil and Debris Volume Estimates
(These estimates are intended for planning purposes. Actual volumes will likely vary.)

Table A-4: Classification and Estimated Volume of Western Landfill Contents based on a DRO Cleanup Level of 500 mg/Kg (0 - 4.5 Foot Depth Interval)

Material/Waste	Volumes (yd^3) by Material Type			
	[1] Items	In-place Volume	Excavated Volume	Percent of Total
Clean Soil and Cap Material (DRO < 500 mg/Kg)	1+2a	11,087	13,859	40%
Petroleum-Contaminated Soil (DRO ≥ 500 mg/Kg)	2b	9,614	12,018	34%
Debris	2a+2b	7,265	9,081	26%
Total		**27,966**	**34,958**	100%

Notes and Assumptions:

1. Volume calculations are based on adding the items (components) found in the row of the specific item number referenced from Tables A-1 and A-3.

Appendix C
Camp Lonely Soil and Debris Volume Estimates
(These estimates are intended for planning purposes. Actual volumes will likely vary.)

Table A-5: Estimated Volume of Materials and Waste in the Camp Lonely Northeast Landfill

Item	Material/Waste	[1] Area (ft^2)	[2] Depth Interval (ft)	[2] Thickness (ft)	[2] In-place (Bank) Volume (ft^3)	[2] In-place (Bank) Volume (yd^3)	[5] Excavated Volume (yd^3)	Percent of Total Volume
1	[2] Cap/Cover (clean sand and gravel)	8,471	0 - 1	1	8,471	313	391	22.2%
2	Landfill Material (waste/debris/soil)	8,471	1 - 4.5	3.5	29,649	1,098	1,373	77.8%
	Total					**1,411**	**1,764**	**100.0%**

Notes and Assumptions:

1 Landfill area is based on geophysical anomalies mapped in 2005, test pits, and site observations. See Figure 1 for aerial extent.

2 Two (2) feet of fill material covers the waste. This fill material is assumed to be clean.

3 The landfill is assumed to be built on tundra grade with an estimated depth to native soil (tundra) of 4.5 feet.

4 Excavated volume includes 25% fluff factor.

Table A-6: Classification of Northeast Landfill Petroleum-Contaminated Soil based on DRO Soil Concentrations

Item	Soil Classification (Contamination Concentrations)	[1] Estimated Percent of Landfill Material	[2] In-place (Bank) Volume (yd^3)	[3] Material Composition	[4] Percent by Material	In-place (Bank) Volume (yd^3) by Material	[4] Density (lb/yd^3)	[5] Excavated Volume (yd^3)	[5] Weight (Tons)
2a	Clean Soil (DRO <500mg/Kg) and Debris	32.0%	351	Soil	70%	246	3,240	307	398
				Debris	30%	105	1,500	132	79
2b	Petroleum-Contaminated Soil and Debris (DRO ≥ 500 mg/Kg)	68.0%	747	Soil	65%	485	3,240	607	786
				Debris	35%	261	1,500	327	196
	Total	**100%**	**1,098**			**1,098**		**1,373**	**1,460**

Total Debris (solid waste)	**367**	3,240	**458**	**275**
Total Soil (excluding cap)	**731**	1,500	**914**	**1,185**

Notes and Assumptions:

1 The Northeast Landfill has not been characterized. It is assumed that the percentages of landfill material and contaminated soil will approximate those in the Western Landfill.

2 The volumes of contaminated soil estimated for any concentration range from available data could vary significantly from actual.

3 Clean debris is considered material acceptable for landfilling in a nonhazardous solid waste landfill (Subtitle D Landfill).

4 Soil is estimated to account for 70% of the total landfill volume in portions of the landfill containing clean soil and 65% of the volume in landfill areas with contaminated soil. These percentages are approximate and there will be localized variability.

5 Excavated volume includes 25% fluff factor. Weight was calculated from the in-place soil volume. The soil density is assumed to be 3,240 lbs/yd^3, which is the standard density for gravel with sand (Glover, 1996). The density of debris is assumed to be similar to that of industrial garbage - 1,500 lb/yd^3.

Appendix C
Camp Lonely Soil and Debris Volume Estimates
(These estimates are intended for planning purposes. Actual volumes will likely vary.)

Table A-7: Classification and Estimated Volume of Northeast Landfill Contents based on a DRO Cleanup Level of 500 mg/Kg (0 - 4.5 Foot Depth Interval)

Material/Waste	In-place Volumes (yd^3) by Material Type		
	[1] Items	Volume	Percent
Clean Soil and Cap Material (DRO < 500 mg/Kg)	1+2a	559	40%
Petroleum-Contaminated Soil (DRO ≥ 500 mg/Kg)	2b	485	34%
Debris	2a+2b	367	26%
Total		**1,411**	100%

Notes and Assumptions:

1. Volume calculations are based on adding the items (components) found in the row of the specific item number referenced from Tables A-5 and A-6.

Appendix C
Camp Lonely Soil and Debris Volume Estimates
(These estimates are intended for planning purposes. Actual volumes will likely vary.)

Table A-8: Estimated Volume of Non-Landfill Petroleum-Contaminated Soil on the Camp Lonely Pad

Area	Contaminated Area Description	[1] Area (ft^2)	[1] Area (yd^2)	[2] In-place (Bank) Volume (yd^3)	[3] Excavated Volume (yd^3)	[4] Percent of Total Volume	[5] Weight (Tons)
1	65,000-gallon AST	697	77	90	113	8%	146
2	Pump House	--	--	--	--	--	--
3	3,500-Gallon Portable Fuel Tank	--	--	--	--	--	--
4	Incinerator/Utility Building Area	898	100	63	79	6%	102
5	Vehicle Maintenance Shop	5,860	651	564	705	53%	914
6	Loading Dock Area[6]	2,896	322	322	402	30%	521
7	1,300-gallon AST	439	49	16	20	2%	26
8	Communication Shop AST	175	19	16	19	1%	25
	Total	**10,965**	**1,218**	**1,071**	**1,339**	**100%**	**1,736**

Notes and Assumptions:

1 The areas are measured from maps provided in the ENSR Nov.18, 2005 report, but modified to only include areas with DRO > 1,000 mg/Kg (see Figure 1).
Some areas identified in the ENSR report do not contain DRO > 1,000 mg/Kg, so no surface area or volume is listed for that area.

2 In-place volumes are based on estimated depths used by ENSR in 2005 report and modified surface areas from CAD figure.

3 Excavated volume includes 25% fluff factor.

4 Total volume values are based on in-place volumes and rounded to the nearest percent.

5 The soil density is based on the standard density for gravel with sand (Glover, 1996), which is 3,240 lbs/yd^3. Weight was calculated from the in-place soil volume.

6 The loading dock area is located along the future edge of the pad after the Western Landfill is removed (see Figure 1). Therefore, all soil with DRO > 500 mg/Kg will be removed.

Appendix C
Camp Lonely Soil and Debris Volume Estimates
(These estimates are intended for planning purposes. Actual volumes will likely vary.)

Table A-9: Summary of Estimated Volumes of Camp Lonely Material and Waste at a DRO Cleanup Level of 1,000 mg/Kg (0 - 4.5 Foot Depth Interval)

Location	Material/Waste	Volumes (yd^3) by Material Type — Estimated Volumes of Contaminated Soil and Debris				Reference
		[1] In-place Volume	Excavated Volume	Tons	Percent of Total Volume	
Western Landfill	[2] Clean Soil and Cap Material	11,087	13,859	17,961	40%	**Table A-1 and A-3**
	Petroleum Contaminated Soil (DRO > 500 mg/Kg)	9,614	12,018	15,575	34%	
	Debris	7,265	9,081	5,449	26%	
	SubTotal	**27,966**	**34,958**	**38,985**	100%	
Northeast Landfill	[2] Clean Soil and Cap Material	559	699	906	40%	**Table A-5 and A-6**
	Petroleum Contaminated Soil (DRO > 500 mg/Kg)	485	607	786	34%	
	Debris	367	458	275	26%	
	SubTotal	**1,411**	**1,764**	**1,967**	100%	
[3] Pad (Non-Landfill Areas)	[2] Clean Soil and Cap Material	0	0	0	0%	**Table A-8**
	Petroleum Contaminated Soil (DRO > 1,000 mg/Kg)	1,071	1,339	1,736	100%	
	Debris	0	0	0	0%	
	SubTotal	**1,071**	**1,339**	**1,736**	100%	
[4] CAMP LONELY TOTALS	[2] Clean Soil and Cap Material	**11,646**	**14,558**	**18,867**	38%	
	Petroleum Contaminated Soil	**11,171**	**13,964**	**18,097**	37%	
	Debris	**7,632**	**9,540**	**5,724**	25%	
	TOTAL	**30,449**	**38,061**	**42,687**	100%	

Notes and Assumptions:

1 Areas used to calculate in-place volumes are based on geophysical anomalies mapped in 2005, test pits, and site observations.

2 A "cap" thickness of 1 foot is a conservative estimate for the Western Landfill and the Northeast Landfill. This material is classified as "clean" soil for cost estimating purposes, although small localized areas of contamination are present.

3 In-place volumes are those determined based on ENSR in 2005, but modified to only include areas with soil having DRO concentrations > 1,000 mg/Kg.

4 Volume calculations are based on adding the appropriate items from the referenced table(s). Based on the limited amount of analytical data available, estimates of total volume could vary by 40%

Appendix C
Camp Lonely Soil and Debris Volume Estimates
(These estimates are intended for planning purposes. Actual volumes will likely vary.)

Table A-10: Landfarm Size Requirements for Petroleum-Contaminated Soil

Soil Classification (Contamination Concentrations)	Approximate Total Excavated Volumes (yd^3)			Excavated Volume (ft^3)	Thickness of Landfarm (ft)	[1] Landfarm Area (ft^2)	[1] Landfarm Area (acres)
	Western Landfill	Northeast Landfill	Pad Soil				
Petroleum-Contaminated Soil (DRO ≥ 500 mg/Kg in Western Landfill, DRO ≥ 1,000 mg/Kg in NE Landfill and Pad Areas)	12,018	607	1,339	377,021	1.25	301,617	6.9
Total	**12,018**	**607**	**1,339**	**377,021**		**301,617**	**6.9**

[2] **Western Landfill area**	167,798	3.9
[3] **Total Pad area**	670,000	15.4
[4] **Buffer Zone area**	84,000	1.9
[4] **Usable Landfarm area**	418,202	9.6

Notes and Assumptions:

1 Landfarm areas are based on a single cell construction for all Camp Lonely Petroleum-Contaminated Soil above 500 mg/Kg DRO (Western Landfill) or 1,000 mg/Kg DRO (Northeast Landfill and Pad Areas). Actual construction would likely occur in cells with space between them to accomdate equipment access for tilling and watering the soil. Therefore, the area required for landfarm construction may be larger than calculated here.

2 The Western Landfill occupies approximately 3.9 acres of the Camp Lonely Pad.

3 The current surface area of the Camp Lonely Pad is approximately 15 acres, including the capped Western Landfill.

4 In a landfarm application on the Camp Lonely Pad to treat contaminated soil, the usable portion of the pad would be reduced by the area of the Western Landfill and a 100 foot buffer zone from the current bluff location.

Appendix C
Camp Lonely Soil and Debris Volume Estimates
(These estimates are intended for planning purposes. Actual volumes will likely vary.)

Soil Location	[1] Approximate Total In-Place Soil Volumes (yd^3)	Percent of Total Volume	[2] Excavated Volume (yd^3)	[3] Weight (Tons)
	Petroleum-Contaminated Soil (DRO ≥1,000 mg/Kg)			
Western Landfill	9,614	88.2%	12,018	15,575
Northeast Landfill	485	4.5%	607	786
Pad (Non-Landfill Areas)	804	7.4%	1,004	1,302
Total	**10,903**	**100.0%**	**13,629**	**17,663**

Notes and Assumptions:

1 Based on the limited amount of analytical data available, estimates of total volumes could vary by 40%.

3 Excavated volume includes 25% fluff factor.

4 The soil density is based on the standard density for gravel with sand (Glover, 1996), which is 3,240 lbs/$yd^{3.}$
Weight was calculated from the in-place soil volume.

5 Maximum detected level of DRO in Camp Lonely soil was 6,980 mg/Kg from Test Pit 15.

APPENDIX D

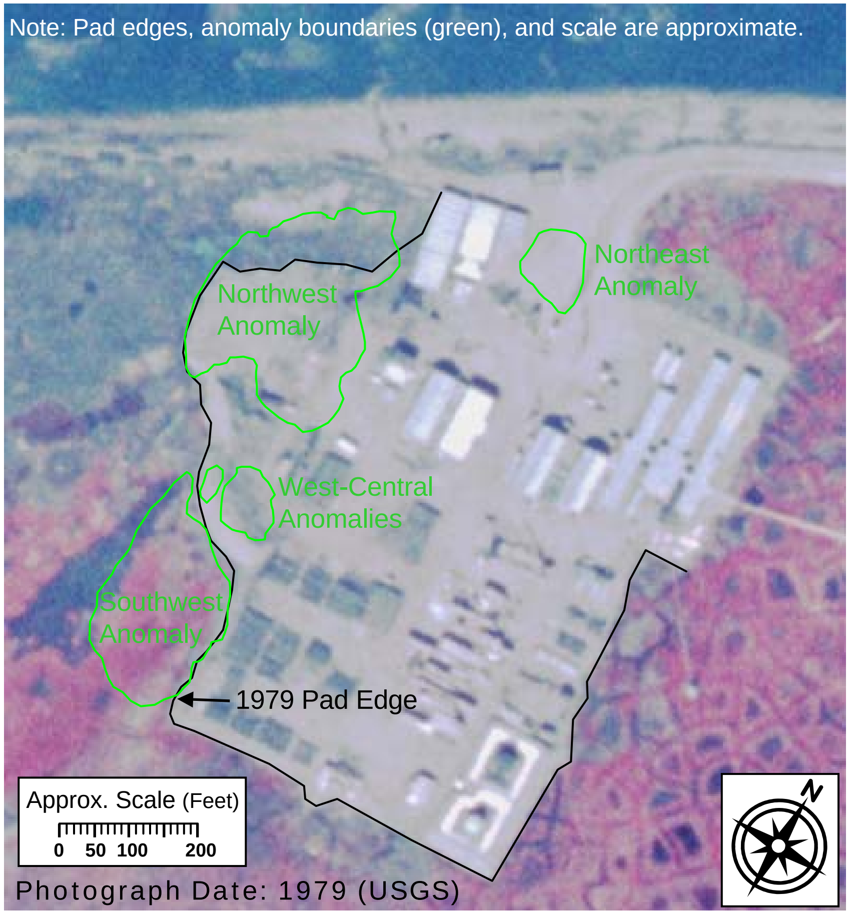
PHOTOGRAPHS OF CAMP LONELY PAD, 1979 TO 2002 (HCG 2006)

CAMP LONELY SITE CLEANUP PLAN (LANDFILLS AND ASSOCIATED PAD)

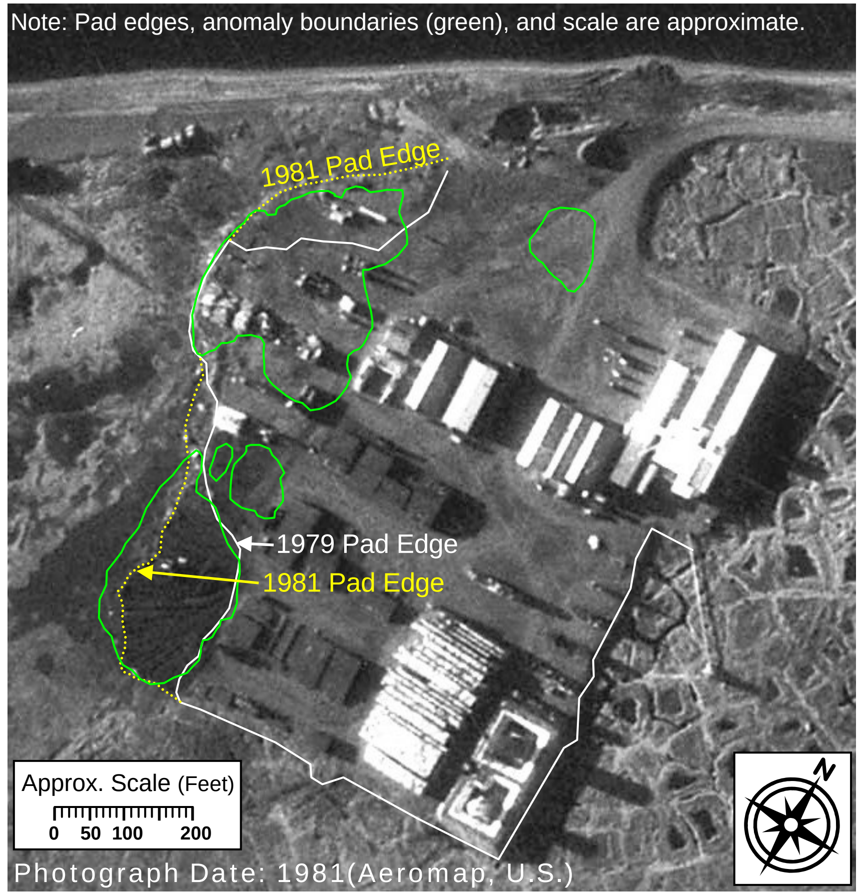
Final

Husky Oil Operations Limited
707 8th Ave. SW, Box 6525, Station "D"
Calgary, Alberta, CANADA T2P 3G7

December 2012

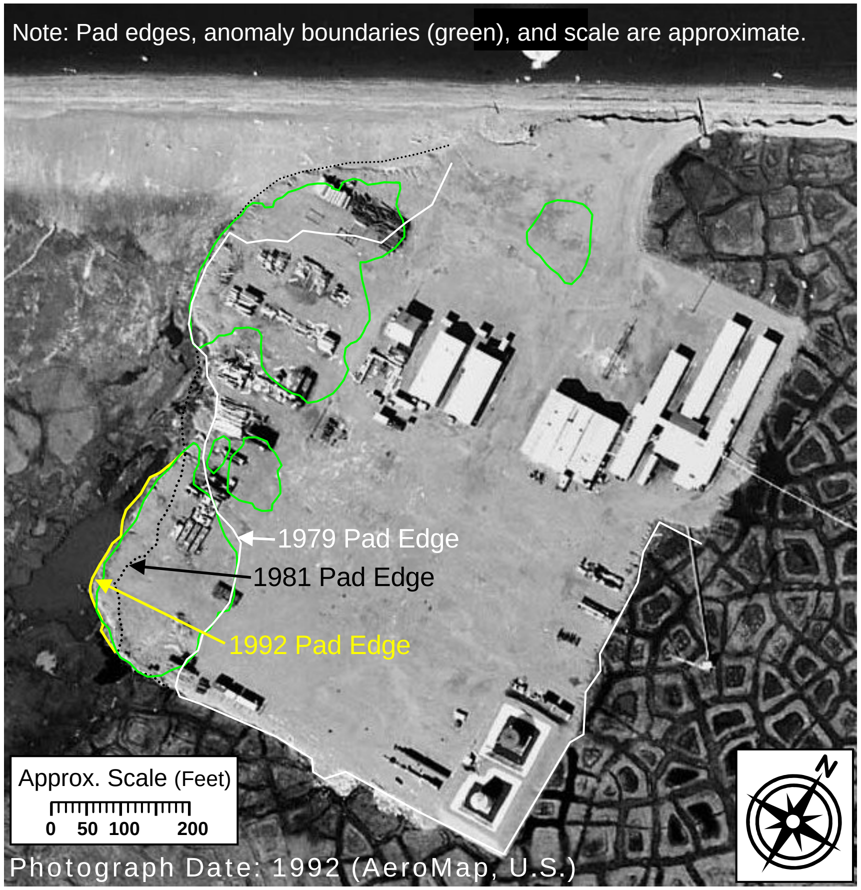


Lateral extent of the pad in 1979.

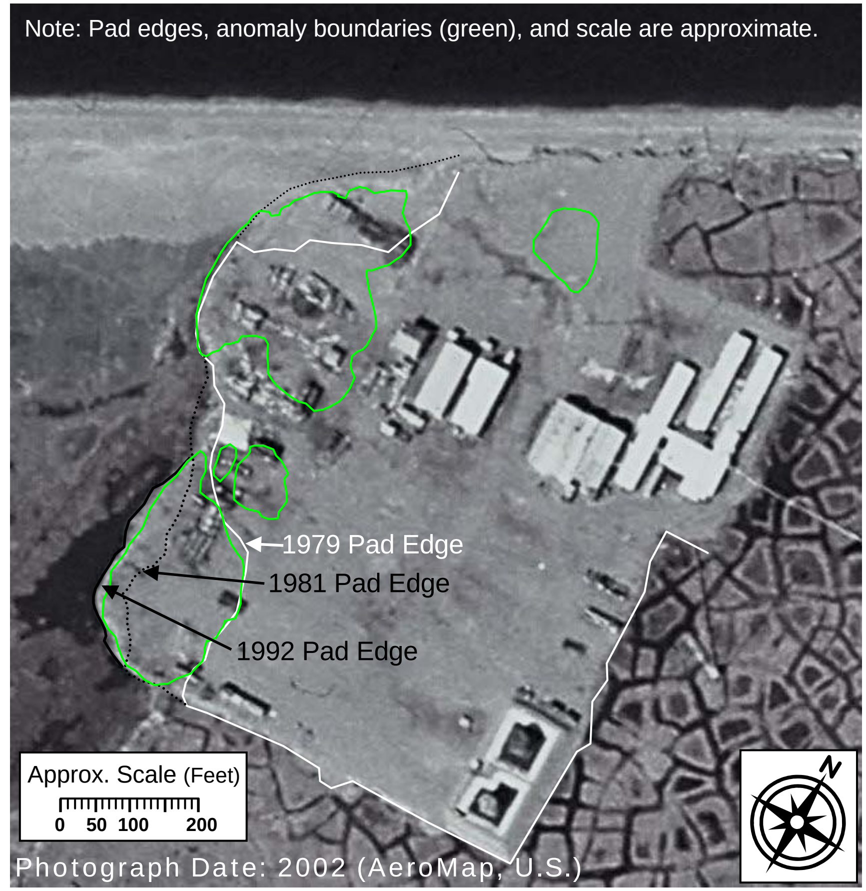


Lateral extent of the pad in 1981. Note the expansion at the northwest and southwest corners of the pad (yellow highlighted areas).

Figure 6-1 : Change in Camp Lonely pad from 1979 to 1981.



Lateral extent of the pad in 1992. Note the expansion at the southwest corner of the pad.



Lateral extent of the pad in 2002. Note that no significant changes in the pad boundary have occurred since 1992 except for along the coastline.

Figure 6-2 : Change in Camp Lonely pad from 1979 to 2002.

APPENDIX E

GUIDELINE FOR SHIPMENT OF CONTAINERS AND SAMPLES WITH PRESERVATIVES

CAMP LONELY SITE CLEANUP PLAN (LANDFILLS AND ASSOCIATED PAD)

Final

Husky Oil Operations Limited
707 8th Ave. SW, Box 6525, Station "D"
Calgary, Alberta, CANADA T2P 3G7

December 2012

Shipping Options:

Containers:

Volume Restrictions:

Packing Group PG I – Do not exceed ***300 mls*** total volume.

Packing Group PG II – Do not exceed ***500 mls*** total volume.

Methanol, UN1230, 3, PGII
Sodium Bisulfate, UN2837, 8, PGII
Hydrochloric acid, UN1789, 8, PG II
Nitric Acid, UN2031, 8, PG II
Sulphuric acid, UN1830, 8, PG II (Concentrated)
Sulphuric acid, UN2796, 8, PG II (<51% acid)

Packing Group PG III – Do not exceed ***1 Liter*** total volume.

IATA Outer Container Limits:
None.

DOT Outer Container Limits:
Cannot exceed 29 kg (64 pounds) maximum gross weight. IATA PG limitations do not apply.

Preserved Samples & Sample Containers with Preservatives

This guideline addresses both the shipment of sample bottles containing only preservatives and the shipment of preserved samples. Both can be shipped in small quantities in accordance with IATA Excepted Quantity and DOT Small Quantity exemptions. These provisions preclude the usual requirements for marking, labeling, packaging, and documentation. However, other less restrictive requirements (specified herein) must be met. ***If shipping more than 30 milliliters of dangerous goods in a single inner container or more than 500 mls total volume (for PG II only – note the packing group specific volume differences on the left), you must follow the more stringent requirements for that particular preservative, or you must package the materials in separate outer containers. See the individual Hazardous Material & Dangerous Goods Shipping Guidelines for the acid or solvent being shipped if you include these materials in a single outer container.***

If shipping by air, IATA Requirements should be followed. If shipping by ground, DOT Requirements must be met. Both IATA and DOT requirements are specified herein. Refer to the appropriate section and comply with all applicable specifications. If you have questions or if you are shipping by barge or ocean going vessel, contact Bret Berglund for guidance. Keep in mind that ***IATA requirements and the FAA and TSA "Prohibited Items List" will not allow you to check dangerous goods, in any quantity, as baggage on a commercial flight. You need to plan ahead and ship via an air cargo carrier***.

Sample Bottles Containing Only Preservatives:

Sample bottles containing only preservatives such as methanol or acid meet specifications for class 3 flammable liquids, or class 8 corrosives, respectfully, and must be shipped as hazardous materials or dangerous goods as outlined herein.

Preserved Samples:

Soil samples preserved with methanol or sodium bisulfate are also considered hazardous materials or dangerous goods and must meet the same requirements as sample bottles containing only preservatives (i.e., specifications for class 3 flammable liquids or class 8 corrosives).

However, Groundwater and surface water samples containing acid preservatives that are significantly diluted, no longer meet the specifications for a class 8 corrosive material, and are therefore excluded from regulation. You do need to take the necessary precautions to ship this material responsibly and ensure samples are packaged so bottles do not break and leaks do not occur during shipment.

Inner Containers:

Inner containers specification requirements typically include glass/earthenware. IATA and DOT both require that container and packaging used for transport of these materials meet basic temperature, pressure and vibration standards to prevent release during transport. You must adhere to the requirements of IATA section 2.7 and DOT 49 CFR

Shipping Options:

Containers:

Volume Restrictions:

Packing Group PG I – Do not exceed ***300 mls*** total volume.

Packing Group PG II – Do not exceed ***500 mls*** total volume.

Methanol, UN1230, 3, PGII
Sodium Bisulfate, UN2837, 8, PGII
Hydrochloric acid, UN1789, 8, PG II
Nitric Acid, UN2031, 8, PG II
Sulphuric acid, UN1830, 8, PG II (Concentrated)
Sulphuric acid, UN2796, 8, PG II (<51% acid)

Packing Group PG III – Do not exceed ***1 Liter*** total volume.

IATA Outer Container Limits:
None.

DOT Outer Container Limits:
Cannot exceed 29 kg (64 pounds) maximum gross weight. IATA PG limitations do not apply.

173.4. Inner containers may not contain more than 30 milliliters of the hazardous material or dangerous good.

Inner containers should also be sealed with tape to prevent vibrations from loosening the tops during transport. We will forego this requirement when submitting samples for analysis of gasoline or volatile organic compounds.

Outer Containers:

Outer containers must be made of suitable materials and must have adequate strength to ensure the package can withstand normal wear and tear including being dropped from 8 feet above the surface. ***The inner containers must be packaged with enough absorbent to contain the entire volume of all inner containers packaged within to prevent an external release should the inner containers leak or break.*** Common outer containers include laboratory sample coolers and sturdy cardboard boxes. ***The inner containers should be packaged in absorbents and sealed in plastic containers such as zip-lock bags.*** Limits exist for total volume within the outer containers. Refer to the notes on the left side of the page for volume restrictions based on the preservatives packing group.

DOT specifies that the maximum weight of the outer containers cannot exceed 64 pounds. IATA has not imposed a weight restriction.

If possible, have the laboratory ship sample containers directly to project locations or client facilities (with client approval) to limit liability and minimize project costs.

Marking & Labeling Requirements:

IATA Overpack / Cardboard Box or Cooler – (Outer Container)

TOP VIEW

From:
Company Name
3401 Minnesota Drive
Anchorage, AK 99503

To:
Client Project Site
999 Main Street
Bush, AK 99543

For Sample Bottles with Preservatives: Excepted Quantities label must be completed for all types of preservatives, and must include proper shipping names, UN Number, Hazard Class and Packaging Group (PG) for all dangerous goods shipped within the box. This information is provided below for common preservatives.

Methanol, UN1230, 3, PGII
Sodium Bisulfate, UN2837, 8, PGII
Hydrochloric acid, UN1789, 8, PG II
Nitric Acid, UN2031, 8, PG II
Sulphuric acid, UN1830, 8, PG II (concentrated)
Sulphuric acid, UN2796, 8, PG II (<51% acid)

For Preserved Samples containing methanol or sodium bisulfate: Excepted Quantities label must be completed for both types of preservatives and must include proper shipping names, UN Number, Hazard Class and Packaging Group (PG) for all dangerous goods shipped within the box. This information is provided above for these preservatives.

Inner containers must be packaged in accordance with the up arrows on the outer containers.

FRONT VIEW

SIDE VIEW