

Final

# Summary of Remedial Investigation and Feasibility Study Reports for OU B-2 Sites

Former Adak Naval Air Facility  
Adak, Alaska

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# Acronyms and Abbreviations

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AAA	anti-aircraft artillery
ADEC	Alaska Department of Environmental Conservation
AGC	U.S. Army Geospatial Center
AOC	areas of concern
ARAR	applicable or relevant and appropriate requirement
bgs	below ground surface
BRAC	Base Realignment and Closure
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
COPC	chemical of potential concern
CSM	conceptual site model
DGM	digital geophysical mapping
DMM	discarded military munitions
DoD	Department of Defense
EPA	U.S. Environmental Protection Agency
EPC	exposure point concentration
ESHA	Explosives Safety Hazard Assessment
FCR	field change request
FFA	Federal Facilities Agreement
GIS	geographic information
GRA	general remedial action
HA	Hazard Analysis
HMX	octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine
IC	institutional controls
LUC	land use controls
MC	munitions-related compounds
MD	munitions debris
MDL	method detection limit
MEC	munitions and explosives of concern
MPPEH	material potentially presenting an explosive hazard
NAF	Naval Air Facility
NCP	National Contingency Plan
NOFA	no further action
NTCRA	non-time-critical removal action
OB/OD	open burn/open detonation
OU	Operable Unit

QAPP	Quality Assurance Project Plan
RAA	remedial action area
RAO	remedial action objective
RCRA	Resource Conservation and Recovery Act of 1976
RDX	Hexahydro-1,3,5-trinitro-1,3,5-triazine
ROD	Record of Decision
SI	site inspection
SOP	standard operating procedure
TBC	to be considered
UXO	unexploded ordnance
VSP	visual sampling plan
WWII	World War II

SECTION 1

# Introduction

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This report presents the summarized findings of the Remedial Investigation and Feasibility Study (RI/FS) conducted at Operable Unit (OU) B-2 at the former Naval Air Facility (NAF) on Adak Island, Alaska. The RI Report comprises Volume I of the RI/FS Report and the FS Report comprises Volume II. This summary is similarly divided, with Section 2 presenting the findings of the RI and Section 3 presenting the findings of the FS. Copies of each report, including all appendixes and data files, are provided on the enclosed DVD.



## SECTION 2

# Remedial Investigation Summary

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The RI Report presents the findings of RI activities conducted at OU B-2 at the former NAF on Adak Island, Alaska (Figure 1). The purpose of the RI was to collect and analyze data at sites potentially contaminated with munitions and explosives of concern (MEC) and munitions-related compounds (MC) at 24 sites located in OU B-2. Data used to develop the OU B-2 RI were collected in 1999, 2000, and 2008. The relevant areas of concern (AOC) at OU B-2 are as follows:

- Andrew Lake Disposal Area (ALDA-01)
- Andrew Lake Beach Crater Area (ALDA-02)
- Andrew Lake Seawall (ALSW-01)
- Blind Cove/Camper's Cove Impact Area Firing Point 1 (BC-03)
- Combat Range #1 Mortar Impact Area (C1-01)
- Hand Grenade Range #1 (HG-01)
- J.M. Candidate Chemical Weapons Disposal Site (JM-01)
- Lake Jean Disposal Area (LJ-02A)
- Andrew Lake World War II Magazine (MAG-01)
- Andrew Lake Rocket Disposal Site (MI-01)
- Andrew Lake 40 mm Impact Area (MI-02)
- Andrew Lake Mortar Impact Area (MI-03)
- Mount Moffett Impact Area Lone 81 mm Mortar (MM-10D)
- Andrew Lake Disposal Range (open burn/open detonation [OB/OD-01] )
- Andrew Lake 40 mm Rifle Grenade Range (RG-01)
- Andrew Lake Hand Grenade/40 mm Impact Area (RR-01)
- Andrew Lake Mortar Impact Area (RR-02)
- Andrew Lake Flare Disposal Site (RR-03)
- Andrew Lake Range Remainder (RR-04)
- Andrew Lake Subcaliber Training Range (SA-01)
- Source Area 93 Multiple Impact Area (SA93-01)
- Source Area 93 Eastern Impact Area (SA93-02)
- Source Area 93 Firing Point (SA93-03)
- Source Area 93 Eastern Disposal Site (SA93-04)

AOC locations are show on Figures 2, 3, and 4.

As part of planning for the 2008 RI, data from the 1999 and 2000 investigations were evaluated to determine whether the information was adequate to assess risk and evaluate remedial alternatives in an FS and then proceed to the Proposed Plan and Record of Decision (ROD) for OU B-2. Data gaps were identified at 18 of the AOCs. The 2008 RI/FS Work Plan (Tetra Tech, 2008) documented the gaps and described the field activities necessary to fill them at each of the 18 AOCs. Existing information was deemed sufficient to conclude that no further action (NOFA) was required at five AOCs. These AOCs were assigned NOFA status because they could not be located (JM-01), did not contain evidence of MEC (BC-03, LJ-02A, and MM-10D), or were fully surveyed and cleared of MEC (RR-03). In addition to the NOFA sites, earlier investigations had concluded that conditions at RG-01 were sufficiently hazardous to merit removal of MEC under a non-time-critical removal action (NTCRA), so further investigation of the AOC was not included in the 2008 RI Work Plan. The NTCRA at RG-01 was conducted during the 2006 and 2008 field seasons and the results of site inspections and characterization activities conducted in support of the removal action were reported in an after-action report (USA Environmental, 2009). Although the data collected at RG-01 during the removal action were not part of the RI, these data are summarized in the RI Report so as to complete the Explosives Safety Hazard Assessment (ESHA) and chemical risk assessment evaluations that determine whether further action is required at the AOC.

The Final RI Work Plan (Tetra Tech, 2008) was approved on June 6, 2008. During the course of the 2008 field season, weekly conference calls were held to discuss the progress of the RI and evaluate the need for possible changes to the approved RI Work Plan. Agreed-upon changes were memorialized through the field change request (FCR) process and in meeting notes.

The MEC data collected during the investigations were used to provide data to determine the nature and extent of contamination and complete the Adak conceptual site model, and as input to an Adak-specific ESHA tool that analyzes the results of the MEC portion of the RI and determines the potential magnitude of the risk/hazard present. In addition, analytical data for samples collected at AOCs also were evaluated to characterize potential risks posed to human and ecological receptors exposed to MC in site soils, sediment, surface water, and groundwater. The results of the MEC and MC risk evaluations were used to determine the need for further action to address unacceptable risk. Potential remedial alternatives for mitigating the identified risks are evaluated and documented in the FS Report.

Once remedial activities at OU B-2 AOCs are complete, the Navy and Department of Defense (DoD) intend to transfer the property to the Department of the Interior. Accordingly, this project is being conducted to meet Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) 120; CERCLA 120(h); and DoD 6055.9-STD site characterization requirements for federal land transfer. All actions required under CERCLA must be completed prior to assertion that the CERCLA 120(h) covenant requirements are met and the real estate can be transferred.

## 2.1 Regulatory Drivers

The OU B-2 RI/FS project is being conducted under the Base Realignment and Closure (BRAC) Environmental Restoration Program for NAF Adak. The U.S. Navy intends to relinquish the parcel containing OU B-2 upon completion of the RI/FS process, proposed plan, ROD, and required remedial actions. The reasonably anticipated future land uses are expected to be wildlife management, subsistence (fishing and hunting), research, and recreation.

The principal regulatory driver for the RI/FS is CERCLA 120. This is because NAF Adak was placed on the CERCLA National Priorities List in May 1994, prior to identification of the base for closure under the BRAC Environmental Restoration Program. The Adak Federal Facilities Agreement (FFA) of 1993 specified the scope of work for this CERCLA site. Under DoD guidance on CERCLA 120(h) compliance, existing cleanup authorities and programs must be used to evaluate the need for remedial action. Therefore, the federal land transfer process under CERCLA 120(h) does not create an additional or overriding procedure for evaluating the need for remedial action.

Under CERCLA 120 and Executive Order 12580, the Navy is the lead agency responsible for the cleanup effort. U.S. Environmental Protection Agency (EPA) Region 10 and the Alaska Department of Environmental Conservation (ADEC) provide oversight. This oversight includes participation on the OU B Project Team, which consists of representatives from the Navy, ADEC, EPA, U.S. Fish and Wildlife Service, and consultants for the various members. The project team was formed to facilitate the development of a site-specific CERCLA process for assessing and remediating MEC on Adak. It provides a forum for data input, discussion, and issue resolution.

One of the AOCs located in OU B-2, OB/OD-01, is also regulated under the Resource Conservation and Recovery Act of 1976 (RCRA) because it was identified as a hazardous waste treatment unit in a RCRA Part B Permit application submitted to EPA in May 1991. Although a RCRA Part B Permit was never issued, OB/OD-01 is considered an interim status site because RCRA activities, including treatment of RCRA-regulated wastes, occurred and, therefore, OB/OD-01 is subject to the substantive closure and post-closure care requirements of RCRA.

## 2.2 2008 Field Investigation

The RI/FS Work Plan (Tetra Tech, 2008) presented the activities and assessment protocols needed to complete the RI process and associated hazard assessments for the OU B-2 sites. Field activities associated with the RI/FS Work Plan were conducted between June 9 and September 13, 2008, and, following a brief hiatus due to power issues,

were completed between October 1 and 8, 2008. The 2008 RI/FS field work was conducted in accordance with the definable features of work detailed in the MEC and MC Quality Assurance Project Plans (QAPP) by USA Environmental, with subcontracted support from NAEVA Geophysics and CH2M HILL. Battelle served as the Government Quality Assurance contractor.

Table 1 presents a summary of the 2008 investigation activities conducted at OU B-2.

**TABLE 1**  
**Summary of 2008 Field Investigation**  
*Summary of Remedial Investigation and Feasibility Study Reports for OU B-2 Sites, Former Adak NAF, Adak, Alaska*

AOC	Activities
ALDA-01	<p>Instrument-aided evaluation of four craters.</p> <p>Collection of one three-point composite soil sample and field duplicate for MC analyses within one crater.</p> <p>Northern portion of ALDA-01 included in ALSW-01 Grid 12 (intended to identify possible location of a small arms burial area) and in the instrument-aided visual inspection to better determine extent of non-munitions-related metal debris possibly used in construction of the seawall.</p>
ALDA-02	<p>Collection of one sediment sample from within the bed of the stream that originates in C1-01 and flows to the north through ALDA-02 into Andrew Bay. The western transect for ALSW-01 extended into ALDA-02 and no MEC was found.</p>
ALSW-01	<p>Geophysical survey and limited intrusive investigation along transects following the top and sides of the seawall east of the spillway.</p> <p>Instrument-aided visual inspection west of the spillway.</p> <p>100 percent geophysical survey and limited intrusive investigation of a 30-meter by 30-meter grid at the expected location for a small arms burial area.</p> <p>Intrusive investigations that followed the 2008 surveys were limited due to the extremely rough and cobbly nature of the seawall as well as the high density of anomalies caused by the possible use of non-munitions-related metal debris in construction of the seawall</p>
C1-01	<p>Accessibility assessment for boundary definition along eastern side of AOC.</p> <p>Soil sampling for MC at two breached munitions locations. Sediment sample from stream that drains area (sample physically located in ALDA-02).</p> <p>Observation of physical features indicative of erosion or site instability.</p>
HG-01	<p>Intrusive investigation of 25 uninvestigated target anomalies identified during previous investigation.</p> <p>Geophysical and intrusive investigation of two 30-meter by 30-meter grids (Grids 8 and 9) centered on the locations of two prior MEC discoveries.</p>
MAG-01	<p>Instrument-aided visual inspection of the accessible portions of AOC.</p> <p>Planned 100 percent sweep in the southern portion of the AOC was modified because of heavy vegetation. Survey in this area modified to consist of sweeps along 4-foot-wide paths approximately 8 to 10 feet apart.</p>
MI-01	<p>Geophysical survey and intrusive investigation at two 30-meter by 30-meter grids (Grids 5 and 6) centered on prior MEC finds.</p> <p>Step-out transects (X1 through X4) required east of Grid 6 at MI-01 to define AOC boundary.</p> <p>Expansion grids/step-out transects for MEC finds along other Grid 5 and 6 boundaries deferred to remedial action based on similarity in MEC distribution in nearby MI-02 and MI-03.</p> <p>Soil sampling for MC at previously identified possible breached munitions location.</p>

TABLE 1

**Summary of 2008 Field Investigation***Summary of Remedial Investigation and Feasibility Study Reports for OU B-2 Sites, Former Adak NAF, Adak, Alaska*

AOC	Activities
MI-02	<p>Geophysical survey and intrusive investigations along 12 transects and in four 30-meter by 30-meter grids, two of which (Grids 1 and 2) were centered on prior MEC finds. Two (Grids 3 and 4) were located on the apparent northern and eastern boundaries of the AOC with MI-03 to assist in boundary delineation.</p> <p>Step-out transects (16a and 17A) required on north side of Grid 3. Step-out transects/expansion grids for other MEC finds within AOC deferred based on similarity in MEC distribution in nearby MI-01 and MI-03.</p> <p>Soil sampling for MC at previously identified possibly breached munitions location and groundwater sampling for MC from two seeps along valley wall. Erosion/instability reconnaissance.</p> <p>Observation of physical features indicative of erosion or site instability.</p>
MI-03	<p>Geophysical survey and intrusive investigations along numerous transects and in two grids (Grids 7 and 8). No expansion grids or step-out transects required.</p> <p>Soil sampling for MC at previously identified possibly breached munitions location.</p> <p>Instrument-aided visual inspection in previously uninspected areas.</p> <p>Observation of physical features indicative of erosion or site instability.</p>
OB/OD-01	<p>Soil sampling for MC at three previously identified possibly breached munitions locations along center line of AOC.</p> <p>Collection of additional sample for grain size analysis at one location.</p>
RG-01	<p>NTCRA completed in 2008.</p>
RR-01	<p>Geophysical survey at numerous transects and intrusive investigations. No expansion grids or step-out transects required.</p> <p>Instrument-aided visual inspection in previously uninspected areas in southern portion of AOC.</p> <p>Observation of physical features indicative of erosion or site instability.</p> <p>Sediment sampling for MC at Moffett Creek.</p>
RR-02	<p>Geophysical survey and intrusive investigation of a series of transects spaced at 25 meters in the uncharacterized accessible areas in the north central portions of the AOC.</p> <p>Instrument-aided visual inspection of the accessible, northeastern, southwestern, and western portions of the AOC.</p> <p>Collection of a multi-incremental sampling soil sample for MC and perchlorate analyses at one previously identified breached munitions anomaly location near the northern tip of RG-01 where a cluster of items was found during previous investigation.</p>
RR-04	<p>Geophysical and intrusive investigation of two transects in areas where previous data did not meet the Level 2 spacing required by the combat range model adopted for this AOC since none exists for this buffer area.</p> <p>Instrument-aided visual inspection and site reconnaissance of the accessible areas of the southwestern corner of the AOC.</p> <p>Collection of one sediment sample for MC and perchlorate analyses within the Moffett Creek drainage channel about midway through the AOC.</p> <p>Collection of one co-located sediment and surface water sample for MC and perchlorate analyses within the Mitchell Creek drainage channel at the mouth of Moffett Creek, west of the road paralleling Andrew Lake.</p> <p>Collection of six shallow groundwater samples (three north and three south of Moffett Creek) near the Andrew Lake shoreline, west of the road paralleling Andrew Lake, for MC and perchlorate analyses.</p>
SA-01	<p>100 percent geophysical survey and intrusive investigation of one 30-meter by 30-meter grid centered on the area where the buried small arms munitions were previously discovered.</p> <p>Instrument-aided inspection of remaining accessible portions of the AOC.</p>

TABLE 1

**Summary of 2008 Field Investigation***Summary of Remedial Investigation and Feasibility Study Reports for OU B-2 Sites, Former Adak NAF, Adak, Alaska*

AOC	Activities
SA93-01	<p>Geophysical surveys and intrusive investigations, including numerous transects and one 30-meter by 30-meter grid (Grid 13). MEC found on eastern boundary of grid. Step-out transects on eastern side of Grid 13 not surveyed due to steep ravine and similarity in finds in nearby SA93-03.</p> <p>Accessibility assessment for boundary definition along eastern and western sides of SA93-01.</p> <p>Observation of physical features indicative of erosion or site instability.</p> <p>Soil sampling for MC at previously identified possibly breached munitions locations.</p> <p>Surface water and sediment sampling in unnamed creek that drains SA93-01.</p>
SA93-02	<p>Instrument-aided visual inspection of the accessible portions of the AOC.</p> <p>Observation of physical features indicative of erosion or site instability.</p> <p>Collection of co-located sediment and surface water samples for MC and perchlorate analyses within the Mitchell Creek drainage channel at the southern end of the AOC.</p>
SA93-03	<p>100 percent geophysical survey and intrusive investigation at one grid (Grid 14) occupying entire accessible portion of AOC. Unexploded ordnance (UXO) found on western, eastern, and southern sides of grid. Step-out transects X1 through X6 completed on eastern and southern sides of grids. Step-out transects on western side not surveyed due to steep terrain and similarity in finds in nearby SA93-01.</p> <p>Soil sampling for MC at previously identified possible breached munitions location.</p>
SA93-04	<p>Instrument-aided visual inspection of the accessible portions of the AOC to identify potential evidence of burial or disposal.</p>

The measurement performance criteria identified in the MEC and MC QAPPs were met. All field procedures and documentation were accomplished in accordance with the approved 2008 RI Work Plan (Tetra Tech, 2008), standard operating procedures (SOP), the MEC and MC QAPPs, and FCRs.

Figures 5 through 23 show the locations and results of the 2008 field investigation.

## 2.3 Additional Work

The Navy conducted several supplemental investigations in 2010 and 2011 to obtain additional information concerning historical activities at certain AOCs and to better characterize the natural and cultural resources at OU B-2.

### 2.3.1 Andrews Bay Data Collection Assessment Report

During the course of the 2008 RI, it was recognized that insufficient data were available to evaluate the nature and extent of MEC at ALSW-01 based on historical and continuing observations of accumulated MEC on the seawall and adjacent tidelands. In response to these uncertainties, the Navy agreed to collect available historical information about possible offshore munitions disposal near ALSW-01 and also to support remedial decision-making by evaluating the feasibility of collecting MEC-related data of known and usable quality from the marine source area at ALSW-01. Conceptual remedial approaches were developed in concert with the review and evaluation to identify any further data gaps to be addressed, to aid in developing data quality objectives, and to aid in framing questions for upcoming remedial decision-making. Finally, the implementability, costs, and long-term effectiveness of a potential data collection effort and remedial action were evaluated. The results of the study were documented in a technical memorandum (Navy, 2011) and were incorporated into the relevant sections of the Final RI and FS reports.

### 2.3.2 Historical Photographic Analysis

In 2011, the U.S. Army Geospatial Center (AGC) conducted a review of historical aerial photograph, maps, and other documents in order to characterize historical conditions at OU B-2 and identify potential locations of historical firing ranges, impact areas, and munitions disposal areas. The findings of the review did not result in changes to the conceptual site models for most OU B-2 AOCs. However, the analysis found evidence of possible solid waste and MEC disposal in the vicinity of ALDA-02, which was not consistent with the conceptual site model (CSM) previously developed for that AOC (bombing range). The results of the analysis were documented in a report (AGC, 2011) and have been incorporated into the relevant sections of the Final RI and FS reports.

### 2.3.3 Cultural Resources Survey

The cultural resources survey at OU B-2 was conducted by the URS Group Inc. in September 2011. The survey focused on AOCs where MEC had been previously found and remedial action was anticipated. Five of these AOCs were closely examined for the presence of cultural resources including prehistoric sites and historic features associated with World War II (WWII) and Cold War activities.

The survey effort resulted in the identification and recordation of ten cultural resources, including seven historic sites and three historic isolates. No prehistoric cultural material was encountered. The seven historic sites recorded within OU B-2 consist of an underground bunker and four Quonset hut depressions at ALDA-01; an underground bunker at ALSW-01; a hand grenade range containing protective walls, bunkers, and a magazine at HG-01; two diversion dams at MI-03; three collapsed wooden structures and an abandoned bridge at OB/OD-01; and a rifle range at RR-01. The three historic isolates include a debris scatter at OB/OD-01 and an iron logging yarder and scattered segments of a redwood water pipeline at RR-01. Other than the newly discovered resources, no previously recorded cultural resource occurs within the project area (Navy, 2012a).

The locations of identified cultural resources are depicted on the figures included in relevant sections of the Final FS reports.

### 2.3.4 Wetlands Survey

The wetlands survey at OU B-2 was conducted by the URS Group in September and October 2011. The survey focused on 11 AOCs where MEC had been previously found and remedial action was anticipated. Seventy-five wetlands were delineated within the study area. These wetlands range in size from less than 0.01 acre to over 40 acres. A total of 117.58 acres of wetlands were identified across the surveyed areas (Navy, 2012b).

The locations of identified wetlands at OU B-2 are depicted on the figures included in relevant sections of the Final FS reports.

### 2.3.5 Threatened and Endangered Species Survey

A wildlife and habitat field survey and a literature review were conducted by the URS Group in September and October 2011. The survey focused on 11 AOCs where MEC had been previously found and remedial action was anticipated, and encompassed all habitats and species with potential to occur in the vicinity of the OU B-2 sites. All 11 sites were visited to observe and record wildlife habitat and species. Focused surveys occurred for two species: Aleutian shield fern (*Polystichum aleuticum*) and Kittlitz's murrelet (*Brachyramphus brevirostris*). A stream assessment was conducted for Moffett Creek and the lower part of Mitchell Creek to locate and map potential spawning areas for salmon. In addition, a reconnaissance-level field survey of existing habitats was conducted on foot in both terrestrial and tidal areas at OU B-2 sites.

The only site in the study area with potential habitat for Aleutian shield fern was C1-01. However, C1-01 lacks certain preferred habitat elements, including steep ledges and overhangs. No Aleutian shield fern plant was found during the 2011 field survey.

Kittlitz's murrelet is known to nest on high-elevation rocky slopes and overwinter in marine waters on Adak Island. Suitable nesting habitat for this species occurs within Site C1-01. Kittlitz's murrelet is currently a candidate for listing under the Endangered Species Act and is expected to be listed or removed from the candidate list by the end of 2013.

## 2.4 Nature and Extent of Contamination

The components of the nature and extent of contamination evaluations are summarized below. Table 2 presents a summary of the nature and extent of contamination results.

### 2.4.1 Nature and Extent of MEC

The data used to complete the nature and extent evaluations for MEC at each AOC included reconnaissance observations concerning site accessibility and the potential for MEC to be transported beyond AOC boundaries by erosion or slope failure, instrument-aided visual surveys for the presence of MEC, and geophysical/intrusive investigation data. The nature and extent of MEC at each AOC was evaluated by mapping the distributions of finds using instrument-aided visual inspection, geophysical, and intrusive investigation data from previous investigations, and from the 2008 field investigation. The completeness of MEC characterization for each AOC was determined in accordance with the 2008 RI Work Plan, MEC QAPP definable features of work, and SOP requirements; and by reviewing maps of geophysical transect/grid coverage, intrusive investigation results, and information about accessibility and visual observations. Boundary confirmation was conducted by reviewing the distribution of MEC across the AOC and in adjacent AOCs, and determining whether all identified MEC was located within 15 meters of the previously determined boundaries. If MEC was found within the safety buffer, the intrusive data for the AOC, step-out transects, and adjacent sites were evaluated to determine if the AOC should be expanded or combined with an adjacent or surrounding AOC to form remedial action areas. The potential for erosion and offsite transport of MEC was evaluated by reviewing the reconnaissance reports for locations of erosion features, unstable slopes, and other areas deemed likely to erode within an AOC, then determining whether MEC was present in the vicinity of such areas based on a review of intrusive investigation result maps. If no MEC was present in the vicinity, or if the unstable/erodible slopes were not near AOC boundaries, the potential for offsite migration was determined to be low. Otherwise, further evaluation of possible offsite movement of MEC downstream of the AOC was required. The potential for erosion and offsite migration of MEC was found to be low at all AOCs examined for such characteristics.

### 2.4.2 AOC Type Confirmation

AOC type confirmation was accomplished by (1) reviewing reconnaissance observations and geophysical and intrusive investigation data from previous investigations plus the 2008 field investigation, and (2) comparing the types and distributions of MEC found at each AOC to the identified AOC type. If items found during the intrusive investigation were different than expected, or if the distribution patterns or penetration depths for UXO were contrary to those expected, the AOC type was re-evaluated and modified to reflect the items and conditions encountered at the AOC. The work conducted at the AOC was then re-evaluated under the Level 2 Methodology requirements for the appropriate AOC type.

### 2.4.3 Nature and Extent of MC Contamination

The nature of potential MC contamination in soil, sediment, surface water, and groundwater was characterized by comparing the individual sample results collected at the AOC (including samples collected during previous investigations) to conservative risk-based screening levels that were presented in Appendix B of the RI Work Plan. These screening levels accounted for direct exposure of human and ecological receptors to MC and for potential offsite transportation and subsequent exposure of human and ecological receptors to MC.<sup>1</sup> If the detected concentrations of one or more chemicals were above their respective screening levels, then additional sampling or evaluation to characterize the extent of contamination was required. Otherwise, no additional sampling or evaluation was necessary to establish extent.

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<sup>1</sup> Samples collected during previous investigations were analyzed for a broad list of target analytes, including volatile organic compounds (VOCs), semi-volatile organic compounds (SVOCs), metals, and total petroleum hydrocarbons (TPH). The 1996 screening level risk assessment and 1997 detailed risk assessment (URS, 1997) found that these types of chemicals did not pose unacceptable risk to human or ecological receptors. Therefore, only the MC results from these earlier investigations are considered in the MC evaluation.

TABLE 2

**Summary of Nature and Extent Findings***Summary of Remedial Investigation and Feasibility Study Reports for OU B-2 Sites, Former Adak NAF, Adak, Alaska*

AOC	AOC Type	Nature and Extent Conclusions
ALDA-01	Disposal Area	<p>Site use consistent with AOC type (debris disposal). However, possible bombing or demolition craters and evidence of storm-deposited debris, including MEC, are also present on surface of AOC. DMM and MPPEH is intermingled with debris and rocks on surface and in subsurface. Specific finds include 40-mm MK II projectile (unfuzed, unfired) and M47A2 Incendiary gasoline gel bomb case with possible burster tube and residue. Both items found at 18 inches below ground surface (bgs), intermingled with other debris. MEC disposal appears incidental with general disposal practices at the time. Geophysical anomalies indicated buried debris over 4.7 acres. Field observations from limited intrusive investigation indicate debris extends at least 4 feet bgs. The degree to which MEC was actually disposed of in the debris disposal area is uncertain because only limited intrusive investigations have occurred in the upland portion of the AOC. Aerial photographs indicate craters in this AOC and the area to the west. Possible use of the area for demolition, if at all, appears to have been limited. MEC found at the surface in 1999 may be related to such use, or may have been washed into the area during storm events.</p> <p>Investigations conducted to date only partially fulfill Level 2 Methodology requirements for a disposal area because a 100 percent intrusive investigation of all identified anomalies has not been completed. Sufficient information has been gathered to make a determination about potential hazards and to evaluate potential remedies to address the hazards in the FS.</p> <p>Soil at ALDA-01 not impacted by MC.</p>
ALDA-02	Aerial Bombing Range/Disposal Area	<p>Site use may not be consistent with AOC type based on 2011 review of historical aerial photographs and maps. Large craters on surface of AOC may be related to use of the area for MEC demolition, rather than use as historical bombing runs.</p> <p>Site was characterized as NOFA for MEC prior to 2008 investigation because investigation would be very difficult and bedrock is shallow, which would promote high order detonation of any bombs dropped. The western transect for ALSW-01 extended into ALDA-02 and no MEC was found.</p> <p>Site walk/visual observation does not meet Level 2 Methodology requirements for aerial bombing range or OB/OD area. However, site conditions do not appear to be suitable for completion of geophysical survey and intrusive investigation. Additional site reconnaissance planned for 2012 will determine whether additional investigation or remedial action is required.</p> <p>Sediment at ALDA-02 not impacted by MC.</p>

TABLE 2

**Summary of Nature and Extent Findings***Summary of Remedial Investigation and Feasibility Study Reports for OU B-2 Sites, Former Adak NAF, Adak, Alaska*

AOC	AOC Type	Nature and Extent Conclusions
ALSW-01	Wash-up Area for Offshore MEC	<p>Designated a munitions response area based primarily on historical and continuing observations of accumulated MEC along the tidal and upland zones of the AOC. Historical reports suggest that an on- or offshore area was used to discard munitions. The eastern portion of the seawall was used for anti-aircraft artillery (AAA) practice. However, no AAA-associated UXO has been found to date in ALSW-01.</p> <p>Variety of MEC and MPPEH on the surface of the shoreline and nearby uplands. Items found at surface of depositional zone during annual surface sweeps include a wide range of types, including bombs, mortars, fuzes, grenades, projectiles, bursters, flares, and small arms ammunition. Most items found were highly deteriorated, likely the result of abrasion in heavy wave action, surf, and surge activity in a rugged marine environment. Approximately 10 to 20 items are recovered from the seawall each year. Data on quantities, munitions type, category, condition, and specific location vary considerably. Quantifiable and reliable trending analysis for these data is not possible. MEC may also be present in the subsurface as a result of burial by more recent accumulations of cobbles and boulders. However, these surface conditions preclude intrusive investigation. The current lateral deposition limits for MEC along the Andrew Lake Seawall are at approximately 300 yards west and 800 yards east of the Andrew Lake spillway. These limits were verified during site visits in 2010.</p> <p>MEC occurrence consistent with CSM for wash-up area. There is no Level 2 methodology for the wash-up area. With the addition of data gathered in 2010 and 2011, sufficient information has been gathered to make a determination about potential hazards and to evaluate potential remedies to address the hazards in the FS.</p> <p>Items found in subsurface consisted of munitions debris (MD) and non-munitions-related metal debris possibly used in construction of seawall or accumulated in the cobbles by wave action. The cobble and boulder substrate pose significant obstacles to intrusive investigation and data collection. The presence of metal debris makes selection of individual anomalies problematic. No MEC items were found at depth and no evidence of small arms burial was found. Therefore, it does not appear that ALSW-01 was used as a disposal area. Geophysical mapping, but limited investigation of anomalies, partially satisfies Level 2 Methodology requirements for disposal area. However, there is no evidence that MEC was buried at the seawall. Consequently, this CSM for MEC occurrence at ALSW-01 has been discarded.</p>
BC-03	Firing Point	<p>No MEC found.</p> <p>All Level 2 Methodology requirements for firing point fulfilled.</p>
C1-01	Target/Impact Area	<p>Site use consistent with AOC type.</p> <p>Items found consisted of UXO (60 mm and 81 mm mortars; 20 mm, 37 mm, and 40 mm projectiles) and MD. Items typically encountered within 2 feet of surface. Approximate extent of target/impact area determined by geophysical survey and intrusive investigation. MD found in vicinity of slumped soil along eastern boundary. Complete delineation of eastern boundary not feasible due to presence of steep terrain.</p> <p>Soil not impacted by MC.</p> <p>The Level 2 Methodology requirements for the target/impact area are fulfilled.</p>

TABLE 2

**Summary of Nature and Extent Findings***Summary of Remedial Investigation and Feasibility Study Reports for OU B-2 Sites, Former Adak NAF, Adak, Alaska*

AOC	AOC Type	Nature and Extent Conclusions
HG-01	Target/Impact Area	<p>Site use consistent with the AOC type.</p> <p>100 percent survey and investigation of anomalies in accessible areas; however, there is uncertainty about the quality of the 1999 investigation because UXO was found in 2008 in a portion of the AOC that had been reported as cleared in 1999. Data coverage analysis determined that previous DGM coverage did not exceed 80 percent of the site. Materials found at the surface and subsurface consisted of UXO, MD, .30 and .50 caliber projectiles, and a variety of metal wastes. All MEC items were found within 2 feet of the surface.</p> <p>Level 2 Methodology requirements for target/impact area fulfilled.</p>
JM-01	Disposal Area	AOC has not been located, no evaluation. AOC was assigned NOFA status prior to the 2008 investigation.
LJ-02A	Disposal Area	<p>Site use not consistent with AOC type, no evidence of MEC disposal found.</p> <p>Level 2 Methodology requirements for disposal area fulfilled, no MEC found.</p>
MAG-01	Storage Magazine	<p>Site use not consistent with AOC type. No evidence of possible storage magazine found and only non-munitions-related metal debris found at surface and subsurface anomalies.</p> <p>Partial survey and intrusive investigation partially satisfies Level 2 Methodology requirements for storage magazine. However, no evidence of storage magazine or MEC was found. Sufficient information has been gathered to make a determination about potential hazards and to evaluate potential remedies to address the hazards in the FS.</p>
MI-01	Disposal Area/ Target/Impact Area	<p>Conditions at MI-01 are not consistent with its identified AOC type (disposal area). The AOC appears to be a target/impact area.</p> <p>Items found consist primarily of UXO (2.36-inch and 3.5-inch rockets, 40 mm projectiles, and rifle grenades) and MD (rocket motors). UXO (rockets and rifle grenades) found in step-out transects X2 and X3, indicating possible overlap with MI-02 and MI-03 target/impact areas. All items found within 1 foot of surface. Abundance and type of MEC in uninvestigated portions of AOC assumed to be similar to that found in Grids 5 and 6.</p> <p>Approximate extent of target/impact area determined by geophysical survey and intrusive investigation, but appears to overlap with MI-02 and MI-03 target/impact areas.</p> <p>100 percent digital geophysical mapping (DGM) survey and intrusive investigation of grids centered on previous MEC finds partially completes Level 2 Methodology requirements for disposal area and exceeds requirements for target/impact areas. Sufficient information has been gathered to make a determination about potential hazards and to evaluate potential remedies to address the hazards in the FS.</p> <p>Soil not impacted by MC.</p>

TABLE 2

**Summary of Nature and Extent Findings***Summary of Remedial Investigation and Feasibility Study Reports for OU B-2 Sites, Former Adak NAF, Adak, Alaska*

AOC	AOC Type	Nature and Extent Conclusions
MI-02	Target/Impact Area	<p>Site use consistent with the AOC type.</p> <p>Materials found consist of UXO (2.36-inch and 3.5-inch rockets, 40 mm projectiles, and mortars), MD, and metal fragments. All items found within 2 feet of surface. Abundance and type of MEC in areas outside 30-meter by 30-meter grids assumed to be similar to that found in Grids 1 through 4.</p> <p>Approximate extent of target/impact area determined by DGM survey and intrusive investigation and encompasses the portion of MI-02 where UXO and MD were found. Boundaries with MI-01 and MI-03 are indistinct and steep slopes along the northern and southern margins of the AOC limit possible refinement of the target/impact area.</p> <p>Level 2 Methodology requirements for target/impact area fulfilled.</p> <p>Soil and groundwater not impacted by MC.</p>
MI-03	Target/Impact Area	<p>Site use consistent with the AOC type.</p> <p>Materials found consist of UXO (grenades, mortars, and 40 mm projectiles), MD, and metal fragments. All items found within 2 feet of surface. Abundance and type of MEC in areas outside 30-meter by 30-meter grids assumed to be similar to that found in Grids 7 and 8.</p> <p>Approximate extent of the target/impact area was determined by DGM survey and intrusive investigation and encompasses the portion of MI-03 where UXO and MD were found.</p> <p>Level 2 Methodology requirements for target/impact area fulfilled.</p> <p>Surface water, sediment, and soil not impacted by MC (based on samples from previous investigations and 2008).</p>
MM-10D	Target/Impact Area	<p>Site use not consistent with AOC type, no MEC found.</p> <p>Level 2 Methodology requirements for target/impact area fulfilled. AOC was assigned NOFA status prior to the 2008 investigation.</p>

TABLE 2

**Summary of Nature and Extent Findings***Summary of Remedial Investigation and Feasibility Study Reports for OU B-2 Sites, Former Adak NAF, Adak, Alaska*

AOC	AOC Type	Nature and Extent Conclusions
OB/OD-01	OB/OD Disposal Area	<p>Site use consistent with AOC type.</p> <p>Items found consisted of UXO (M34 WP grenades), MD (fuzes, rocket motors, and fins), and a variety of metal wastes. All items found within 2 feet of surface (4-foot maximum investigation depth). Numerous anomalies not investigated. Abundance and type of MEC in uninvestigated portions of AOC assumed to be similar to that found in grids selected for intrusive investigation.</p> <p>Approximate extent of OB/OD-01 includes demo crater identified on aerial photography and has been extended outward to meet adjacent AOC boundaries. 100 percent geophysical mapping of 30-meter by 30-meter grids covering the site, but 38 percent investigation of anomalies only partially satisfies Level 2 Methodology requirements for OB/OD area. Sufficient information has been gathered to make a determination about potential hazards and to evaluate potential remedies to address the hazards in the FS.</p> <p>SVOCs and VOCs detected in 1992 soil samples. A 1997 detailed risk assessment indicated that for human health, site soils posed no significant risk to hypothetical residential, recreational, or occupational use, and for ecological health, a small area beneath the burn pan was problematic. The burn pan and the underlying soil were removed and the soil results are not considered representative of current conditions.</p> <p>Nitroglycerin detected in one of the three 2008 soil samples, but detected concentration was lower than the project screening level. MC not detected in the other two soil samples.</p>
RG-01	Target/Impact Area	<p>Site use consistent with AOC type.</p> <p>Characterization and clearance of all detectable MEC completed during NTCRA. All detected MEC recovered and destroyed.</p> <p>Hexahydro-1,3,5-trinitro-1,3,5-triazine (RDX) and octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine (HMX) detected in initial soil sample collected at one breached munitions location, with RDX concentration above project screening level. RDX also detected in several follow-up samples at location, but at concentrations below the project screening level.</p>
RR-01	Target/Impact Area	<p>Site use consistent with the AOC type.</p> <p>Items found at RR-01 in 1999 and 2008 consist of UXO (2.36-inch rockets and 40 mm projectiles), MPPEH, and metal fragments. Most UXO was found within 1 foot of the surface. All anomalies in former known-distance rifle range AOC not investigated. Based on items found, MEC may remain in this area. Abundance and type of MEC assumed to be similar to that found along other transects in area.</p> <p>Approximate extent of the target/impact area has been bounded, and surface conditions in previously un-inspected portions of the AOC south of the target/impact area are not indicative of possible impact.</p> <p>Level 2 Methodology requirements for target/impact area partially fulfilled. Sufficient information has been gathered to make a determination about potential hazards and to evaluate potential remedies to address the hazards in the FS.</p> <p>Surface water and sediment not impacted by MC.</p>

TABLE 2

**Summary of Nature and Extent Findings***Summary of Remedial Investigation and Feasibility Study Reports for OU B-2 Sites, Former Adak NAF, Adak, Alaska*

AOC	AOC Type	Nature and Extent Conclusions
RR-02	Range Buffer Zone	<p>Site use consistent with initial AOC type (range buffer zone) rather than adjusted AOC type (target/impact area).</p> <p>AOC investigation completed in accordance with RI work plan. No MEC found. Items found consisted of a variety of MD and metal waste, most likely carried over from adjacent ranges. No UXO items were found. Surface conditions in previously uninspected portions of the AOC not consistent with those of an impact area.</p> <p>All Level 2 Methodology requirements for target/impact range fulfilled.</p> <p>Soil at RR-02 not impacted by MC.</p>
RR-03	Range Buffer Zone	<p>Site use consistent with AOC type.</p> <p>AOC investigation completed in accordance with RI work plan. All MEC items removed and disposed.</p> <p>All Level 2 Methodology requirements for target/impact area fulfilled. AOC was assigned NOFA status prior to the 2008 investigation.</p>
RR-04	Range Buffer Zone	<p>Site use consistent with the AOC type.</p> <p>AOC investigation completed in accordance with RI work plan. No MEC found. Materials found at the surface and subsurface consisted of metals fragments and a variety of non-munitions-related metal debris associated with use of the area as a support area for nearby ranges. Partially full container (55-gallon drum) of tar or similar petroleum product found along transect in the eastern portion of the AOC in 2008.</p> <p>No specific Level 2 Methodology for range buffer zone. Combat range methodology (mapping of transects spaced at 25 meters) applied. All requirements fulfilled.</p> <p>Surface water, sediment, and groundwater at RR-04 not impacted by MC.</p>
SA-01	Small Arms Range	<p>Site use consistent with the AOC type.</p> <p>AOC investigation completed in accordance with RI work plan, No MEC items found. Materials found at the surface and subsurface at SA-01 consist of small-caliber projectiles and metal wastes.</p> <p>No specific Level 2 Methodology for small arms range. Disposal area methodology applied. All requirements fulfilled.</p>
SA93-01	Target/Impact Area	<p>Site use consistent with the AOC type.</p> <p>Multiple mortars, projectiles, and rockets were found along a northwest/southeast alignment crossing through the AOC. Abundance and type of MEC in areas outside Grid 13 assumed to be similar to that found in Grid 13.</p> <p>The approximate extent of the target/impact area has been defined, although the eastern boundary with SA93-02 is indistinct due to steep terrain. Based on MEC results for the SA93-03 area, located just east of Grid 13, the impact area appears to extend from SA93-01, across an intervening ravine, and into SA93-03.</p> <p>Surface water, sediment, and soil at SA93-01 not impacted by MC.</p>

TABLE 2

**Summary of Nature and Extent Findings***Summary of Remedial Investigation and Feasibility Study Reports for OU B-2 Sites, Former Adak NAF, Adak, Alaska*

AOC	AOC Type	Nature and Extent Conclusions
SA93-02	Storage Area	<p>Site use not consistent with either the initial (target/impact area) or adjusted (storage area) AOC types. Inspection of the area suggests that most of the AOC was used as a range buffer zone. However, the uninvestigated ravine between SA93-01 and SA93-03 may be part of target/impact area.</p> <p>Accessible portion of AOC surveyed and intrusively investigated. The 1999 survey found only non-munitions-related metal debris, much of which was domestic in origin (auto parts, nuts and bolts). No MEC items found. The 2008 instrument-aided inspection and site reconnaissance found only an artillery lifting lug and an expended M48 series fuze and no evidence of impact or detonations.</p> <p>AOC investigated as possible storage area based on 1999 finds. All Level 2 Methodology requirements fulfilled.</p> <p>Surface water and sediment at SA93-02 not impacted by MC.</p>
SA93-03	Target/Impact Area	<p>Site use consistent with the AOC type.</p> <p>Materials found consist of 2.36-inch rockets, as well as MD associated with impact. Most UXO items were encountered within 1 foot of the surface. Abundance and type of MEC in area west of Grid 14 assumed to be similar to that found in Grid 14. No UXO found in step-out transects. Extent of the target/impact area appears to extend westward across the ravine and into SA93-01.</p> <p>Level 2 Methodology requirements for target/impact area fulfilled. However, use of expansion transects rather than grids at boundary does not meet the 100 percent survey and investigation requirement for full MEC clearance at an AOC.</p> <p>Soil at SA93-03 not impacted by MC.</p>
SA93-04	Storage Area	<p>Site use does not appear to be consistent with AOC type. Inspection of the area found no evidence of site use consistent with either the initial AOC type (target/impact area) or the adjusted AOC type (potential storage area).</p> <p>Accessible portion of AOC surveyed and intrusively investigated. 1999 survey found trash pile containing metal banding, metal crates, and a lid from an ordnance crate that originally contained 155 mm projectiles. 2008 reconnaissance found no MEC items or evidence of impact or detonations.</p> <p>AOC investigated as possible storage area based on 1999 finds. All Level 2 Methodology requirements fulfilled.</p>

## 2.5 Risk Evaluation Results

Two separate risk evaluations were conducted for OU B-2: one to characterize potential MEC hazards, and one to characterize potential hazards associated with human and ecological exposure to MC in environmental media at OU B-2.

### 2.5.1 Explosives Safety Hazard Assessment

Information about overall site conditions and the nature and extent of MEC at each AOC were used as input to the Adak-specific ESHA tool that analyzes the results of the MEC portion of the RI and determines the potential magnitude of the risk/hazard present. The ESHA methodology for Adak was developed as part of the overall framework for assessing and managing potential threats due to the presence of MEC on Adak Island (OU B Project Team-Hazardous Assessment Working Group, 2000). The methodology reflects the following premises about MEC risk or hazard on Adak:

- Areas where MEC are known or indicated to be present create more potential for explosive hazards than areas where MEC have been purposefully searched for and have not been found or where all known MEC has been removed.
- Different types of MEC present different potentials to detonate if disturbed, and, if detonated, can produce a range of adverse consequences.
- The potential for explosive hazards is created when MEC are located where they are likely to be disturbed by current and/or future land use activities.
- There is greater potential for explosive risk where public exposure is greatest (e.g., increased contact or easier accessibility).

The factor and subfactor inputs to the Adak ESHA methodology are both quantitative and qualitative, with the overall framework and ESHA scoring being qualitative in nature. The ESHA assigns relative scores to qualitative estimates of the MEC but does not define quantitative measures of known MEC risk. Although five separate hazard scores ranging from a low of A to a high of E are possible, there are only two possible outcomes related to the Adak RI: (1) Adak no further action with baseline institutional controls, or (2) evaluate in the FS.

Site-specific scoring details and results for each AOC are provided in Table 3.

TABLE 3

**Remedial Investigation Explosives Safety Hazard Assessment Scoring Results (Assuming No Action and Unrestricted Access)**

*Summary of Remedial Investigation and Feasibility Study Reports for OU B-2 Sites, Former Adak NAF, Adak, Alaska*

AOC Name	ESHA Score	Scoring Details
ALDA-01	C	100 percent survey, limited intrusive investigation, variety of DMM intermingled with subsurface debris.
ALDA-02	A	Score is based on presumption of bombing range use. No MEC found. Bedrock is shallow, which would promote high-order detonation of any bombs dropped. Additional investigation of possible MEC disposal area planned for 2012.
ALSW-01	D	Variety of highly deteriorated MEC, including bombs, mortars, grenades and projectiles, bursters, and flares (critical hazard ratings); MEC at surface.
BC-03	A	100 percent instrument-aided reconnaissance in accessible areas. All contacts intrusively investigated; only cultural metal debris found.
C1-01	D	40-mm projectiles (critical hazard rating), MEC present; MEC at surface.
HG-01	D	Hand grenades (catastrophic hazard rating), MEC found, MEC at surface.
JM-01	A	AOC has not been located; characterization not feasible.
LJ-02A	A	100 percent survey and investigation; no MEC found.

TABLE 3

**Remedial Investigation Explosives Safety Hazard Assessment Scoring Results (Assuming No Action and Unrestricted Access)***Summary of Remedial Investigation and Feasibility Study Reports for OU B-2 Sites, Former Adak NAF, Adak, Alaska*

AOE Name	ESHA Score	Scoring Details
MAG-01	A	No evidence of possible storage magazine found, and only cultural metal debris found at surface and subsurface.
MI-01	D	40-mm projectiles (critical hazard rating), MEC found; MEC at surface.
MI-02	D	40-mm projectiles (critical hazard rating), MEC found; MEC at surface.
MI-03	D	40-mm projectiles (critical hazard rating), MEC found; MEC at surface.
MM-10D	A	100 percent survey and investigation; no MEC found.
OB/OD-01	D	Fuzing (critical hazard rating), MEC present; MEC at surface.
RG-01	A	AOE scored to complete RI requirements for site; 100 percent investigation and removal to a depth of 2 feet bgs during NTCRA.
RR-01	D	40-mm grenades (catastrophic hazard rating), MEC present; MEC at surface.
RR-02	A	No MEC encountered (no explosive hazard rating); no MEC at surface or depth.
RR-03	A	100 percent survey and investigation. All detected MEC cleared.
RR-04	A	No MEC encountered (no explosive hazard rating); no MEC at surface or depth.
SA-01	A	No MEC encountered (no explosive hazard rating); no MEC at surface or depth.
SA93-01	D	Multiple MEC encountered (critical hazard rating); MEC at surface.
SA93-02	A	No MEC found.
SA93-03	A	Score reflects 100 percent geophysical survey and removal to a depth of 2 feet in 2008, but does not account for investigation/clearance completeness issue (use of transects instead of expansion grids) on boundary of AOE.
SA93-04	A	No MEC found.

Notes:

ESHA Score Explanation:

A or B – Adak Institutional Control Site

C or D – FS Site

WP = white phosphorus

## 2.5.2 Chemical Risk Evaluation

The purpose of the chemical risk evaluations is to determine whether there is a potential for risk to human health or the environment under current and reasonably anticipated future land and water uses, from past releases of MC to soil, sediment, surface water, and groundwater at the site. The risk assessment approach taken at OU B-2 consisted of tiered risk screening evaluations for both human and ecological exposure. This approach is consistent with the methods described in ADEC, EPA, and Navy guidance documents.

The approach consists of a Tier 1 Screening Level Risk Assessment followed by a Tier 2 Baseline Human Health Risk Assessment or Baseline Ecological Risk Assessment, if required. During Tier 1, analytical data are compared to conservative risk-based benchmarks for human and ecological receptors (separate comparisons). If there are no exceedances of the benchmarks for either human or ecological receptors, then risks are acceptable and no further action is needed to address chemical risk. If exceedances are identified for either human or ecological receptors, then further evaluation (i.e., Tier 2) or remedial action may be required. The chemical risk evaluations for OU B-2 were completed using Tier 1 protocols.

### 2.5.2.1 Chemicals of Potential Concern

Chemicals of potential concern (COPC) are those constituents that are evaluated in the risk screening process. For this risk screening evaluation, both the detected constituent concentrations and the method detection limits (MDL) for those constituents not detected are conservatively screened to identify whether any potential for risk

exists. The RI for OU B-2 focused on past releases of MC as analyzed by Methods 8330 and 8330B, and perchlorate as analyzed by Method 6850. Methods 8330 and 8330B list 17 different compounds. Therefore, 18 total analytes are considered COPCs.

### 2.5.2.2 Data Sources

The analytical data used in the risk screening evaluation include data from soil, sediment, surface water, and groundwater samples collected during the 2008 OU B-2 field investigation, including data for discrete soil samples collected at RG-01.

### 2.5.2.3 Exposure Point Concentrations

Exposure point concentrations (EPC) are estimated constituent concentrations with which a receptor may come into contact, and are specific to each exposure medium. For this risk screening evaluation, EPCs were identified as the maximum detected concentrations or maximum reported MDLs, rather than aggregating data spatially. No statistical averaging was considered necessary.

### 2.5.2.4 Potentially Complete Human Exposure Pathways and Receptors

Based on the current understanding of land and groundwater use conditions at or near the OU B-2 sites, the exposure pathways considered for screening human health risks include the following:

- Incidental ingestion and dermal contact with soil and sediment by current and future workers (e.g., commercial, construction, researchers), hypothetical future residents, and future recreationalists (e.g., hunters/fisherman)
- Inhalation of ambient dust particles generated by wind or maintenance activities for current and future workers, future recreationalists, and hypothetical future residents
- Ingestion and dermal contact with surface water and groundwater by current and future workers, hypothetical future residents, and future recreationalists

In order to determine whether land use restrictions or remedial actions may be needed to address chemical risks at the OU B-2 sites, the hypothetical residential exposure scenario is the focus of this risk screening evaluation. If risk estimates under unrestricted land use assumptions are found to be lower than the residential action level, no land use controls would be deemed necessary.

### 2.5.2.5 Potentially Complete Ecological Exposure Pathways and Receptors

The most plausible ecological exposure pathways based on the available habitat and food sources at the OU B-2 sites include the following:

- Direct contact with soil in areas containing suitable habitat for terrestrial mammals, birds, and plants
- Uptake of site-related chemicals via the food chain by higher trophic level receptors (for example, Arctic fox and bald eagle)
- Direct uptake of site-related constituents from shallow groundwater (assuming migration to surface water occurs) by aquatic and benthic organisms
- Direct contact with and ingestion of site-related constituents in shallow groundwater (assuming migration to surface water occurs) by mammals and birds
- Direct uptake of site-related constituents from surface water and sediment by aquatic and benthic organisms and plants
- Direct contact with and ingestion of site-related constituents in surface water by mammals and birds

### 2.5.2.6 Human Health Screening Evaluation Results

The primary decision for which the results of the human health screening evaluation provide input is whether to address any areas and COPCs at the site because of the potential threat of human health risk from chemical releases. Based on the nature and extent of constituent concentrations observed during this RI, and considering current and reasonably anticipated future land use conditions, the cumulative risks posed to human health are well below the ADEC regulatory threshold of  $1 \times 10^{-5}$  (for carcinogens) and 1 (for non-carcinogens) for all exposure scenarios, and additional risk assessments or remedial actions are not required to address human health risk.

### 2.5.2.7 Ecological Screening Evaluation Results

The primary decision for which the results of the ecological screening evaluation provide input is whether to address any areas and COPCs at the site because of the potential threat of ecological risk. The risk to wildlife, vegetation, and aquatic resources potentially exposed to soil, sediment, surface water, and groundwater is considered low. This conclusion was drawn on the basis of considering that concentrations of COPCs detected in site media are not high enough to pose unacceptable risk to potential ecological receptors.

## 2.6 Remedial Investigation Conclusions and Recommendations

Information about AOC type, investigation history, nature and extent of contamination Level 2 Methodology status, MEC hazards, and chemical risk assessment findings summarized were used to develop recommendations about the status of and path forward for each AOC at OU B-2. Four categories of site recommendations were developed:

- **Category 1 – Feasibility Study Areas** – This category includes areas to be carried forward in the FS because MEC found in the AOC poses unacceptable explosive safety risks to future land users and remedial action is required. The FS Areas include the following AOCs:
  - Andrew Lake Disposal Area (ALDA-01)
  - Andrew Lake Seawall (ALSW-01)
  - Combat Range 1 Mortar Impact Area (C1-01)
  - Andrew Lake Hand Grenade Range (HG-01)
  - Andrew Lake Rocket Disposal Area (MI-01)
  - Andrew Lake 40-millimeter (mm) Impact Area (MI-02)
  - Andrew Lake Mortar Impact Area (MI-03)
  - Andrew Lake Disposal Range(OB/OD-01 area)
  - Andrew Lake Hand Grenade/40-mm Impact Area (RR-01)
  - Source Area 93 Multiple Impact Area (SA93-01)
  - Source Area 93 Firing Point (SA93-03)
- **Category 2 – Removal Action Complete Areas** – This category includes AOCs that were found to contain MEC and that were fully investigated and cleared (100 percent DGM and intrusive investigation of all detected anomalies within accessible areas of the AOC) as part of the RI or a removal action. The Removal Action Complete Areas include:
  - Andrew Lake 40-mm Rifle Grenade Range (RG-01)

Residual risks at this AOC are considered acceptable (low) and, therefore, manageable through institutional controls (IC) that address potential MEC hazards throughout Adak. Additional active remedies to address MEC in the AOC are not required.
- **Category 3 – Institutional Control Only Areas** – This category includes AOCs that were fully investigated in accordance with the RI/FS Work Plan and found to have acceptable (low) potential explosive hazards that are manageable through ICs alone. Active remedies to address MEC are not required. The IC Only Areas include:
  - Blind Cove/Camper’s Cove Impact Area Firing Point 1 (BC-03)
  - J.M. Candidate Chemical Weapons Disposal Area (JM-01)

- Lake Jean Disposal Area (LJ-02A)
  - Andrew Lake World War II (WWII) Magazine (MAG-01)
  - Mount Moffett Impact Area Lone 81-mm Mortar (MM-10D)
  - Andrew Lake Mortar Impact Area (RR-02)
  - Andrew Lake Flare Disposal Area (RR-03)
  - Andrew Lake Range Remainder (RR-04)
  - Andrew Lake Subcaliber Training Range (SA-01)
  - Source Area 93 Eastern Impact Area (SA93-02)
  - Source Area 93 Eastern Disposal Area (SA93-04)
- **Category 4 – Additional Investigation Areas** – This category includes an AOC that was investigated in accordance with the RI/FS Work Plan and found to have acceptable (low) potential explosive hazards based on presumed use as a bombing range. However, historical archive information found in 2011 identified additional site activities that could have resulted in MEC contamination from munitions disposal operations. The affected AOC is Andrew Lake Beach Crater Area (ALDA-02). A reconnaissance of ALDA-02 to determine whether evidence exists of munitions disposal activities is planned for 2012. Depending on the outcome of the reconnaissance, ALDA-02 will be assigned to the FS Area category or the IC Only Area category.



# Feasibility Study Summary

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The FS Report presents the findings of the FS for OU B-2, former NAF, Adak Island, Alaska. The FS process assembles technologies and process options into alternatives. It then screens and evaluates these alternatives to determine practical, cost-effective actions to reduce the potential hazard associated with MEC contamination to an acceptable level. In addition to the required elements of an FS, the FS also presents the Navy-recommended approaches to address MEC contamination at the OU B-2 sites. Pursuant to information presented in the OU B-2 RI Report, MC associated with known MEC releases (i.e., breached munitions) have been fully investigated, require no further action, and thus are not included in the FS. However, additional action may be required to address possible localized MC contamination where breached munitions are found during MEC removal activities.

There are 24 AOCs at OU B-2, divided into four categories based on site history and the results of MEC investigations conducted in 1999, 2000, 2008, and supplemental data received in 2011:

- **Category 1 – FS Areas** – This category includes areas that require remedial action because MEC found in the AOC poses unacceptable explosive safety risks to future land users. The FS Areas were assembled into remedial action areas (RAA) on the basis of similarities in CSMs, proximity, and distribution of MEC, as described in the following section.
- **Category 2 – Removal Action Complete Areas** – This category includes AOCs that were found to contain MEC and that were fully investigated and cleared as part of the RI or a removal action. Residual risks at these AOCs are considered acceptable (low) and, therefore, manageable through ICs that address potential MEC hazards throughout Adak. Additional active remedies to address MEC in the AOC are not required. The ICs are currently tied to the OU B-1 ROD, which includes an island-wide educational awareness program and an island-wide MEC discovery reporting process. However, if a more comprehensive set of ICs is needed to manage uncertainty about residual MEC at the Category 1 sites after MEC is removed, these more comprehensive ICs will also apply to the Category 2 areas within OU B-2.  
**Category 3 – Institutional Control Only Areas** – This category includes AOCs that were fully investigated in accordance with the RI/FS Work Plan and found to have acceptable (low) potential explosive hazards that are manageable through ICs alone. Active remedies to address MEC are not required. The ICs are currently tied to the OU B-1 ROD, which includes an island-wide educational awareness program and an island-wide MEC discovery reporting process. However, if a more comprehensive set of ICs is needed to manage uncertainty about residual MEC at the Category 1 sites after MEC is removed, these more comprehensive ICs will also apply to the Category 3 areas within OU B-2.
- **Category 4 – Additional Investigation Areas** – This category includes an AOC that was investigated in accordance with the RI/FS Work Plan and found to have acceptable (low) potential explosive hazards based on presumed use as a bombing range. However, historical archive information found in 2011 identified additional site activities that could have resulted in MEC contamination from munitions disposal operations. The affected AOC is Andrew Lake Beach Crater Area (ALDA-02). A reconnaissance of ALDA-02 to determine whether evidence exists of munitions disposal activities is planned for 2012. Depending on the outcome of the reconnaissance, ALDA-02 will be assigned to the FS Area category (Category 1) or the IC Only Area category (Category 3).

## 3.1 Remedial Action Areas

The Category 1 FS Area AOCs were assembled into RAAs on the basis of similarities in CSMs and proximity to each other. The boundaries for active remediation (i.e., MEC removal) within each RAA were developed according to the overall CSM for the AOCs, as follows:

- **Disposal Areas** – The RAA boundaries for ALDA-01 coincide with the extent of geophysical anomalies identified through 100 percent DGM surveys conducted during the 1999 SI. The RAA boundary for OB/OD-01

encompasses the demolition craters identified on aerial photography and extends outward to meet adjacent AOC boundaries. The RAA boundary at ALSW-01 includes all terrestrial and intertidal areas where MEC or MPPEH has been found during previous Navy explosive ordnance disposal beach sweeps, as well as the part of Andrew Bay where the MEC that washes up on the seawall may have been historically disposed.

- **Target/Impact Areas** – The process for refining RAA boundaries at the target/impact AOCs was developed in consultation with the EPA and ADEC during a meeting and series of conference calls in fall 2011 and included analysis of previously collected intrusive investigation data using geographic information (GIS) and visual sampling plan (VSP) analyses. MEC density within the AOC was used to define target/impact areas and adjacent target/impact areas were combined into RAAs. The analyses also eliminated large areas of the AOCs where no MEC or evidence of target/impact use (for example, no fuzes, rocket motors, or mortar fins) had been found from the RAAs.

The different RAAs are described below and shown in Figures 24 through 28.

### 3.1.1 RAA-01 – Open Burn/Open Detonation Area (OB/OD-01)

RAA-01 consists of the former OB/OD area at the Andrew Lake Range Complex. The area was identified as a separate RAA because operations in the OB/OD area differed significantly from those of the surrounding target/impact areas and because, as a RCRA interim status hazardous waste treatment unit, the AOC is subject to specific closure requirements.

RAA-01 is an approximately 19-acre parcel of land that encompasses all of the OB/OD-01 AOC, plus small portions of RR-02 and MI-03 that were included in the 1999 site inspection (SI) investigation at OB/OD-01. The precise locations and extent of past operations within the OB/OD-01 area are unknown; the original AOC boundary was intended to be large enough to encompass the operating area, plus a substantial buffer zone for kick-outs. However, evidence of possible kick-outs from the OB/OD area has been found in the adjoining target/impact area AOCs (MI-03, RG-01, and RR-01). The potential presence of kick-outs beyond the boundary of RAA-01 is not a concern because the adjoining AOCs have either been fully cleared (RG-01) or are part of another RAA (see descriptions for RAA-03 West and RAA-03 East).

The RAA is located at the terminus of the general Andrew Lake Range Complex access road and is bordered by several target/impact area AOCs. The ground surface is relatively flat, but contains hummocks and craters related to historical detonation of munitions in the area. Wetland vegetation and soils have been mapped in the central and southern portions of RAA. Collapsed wooden structures and an abandoned bridge over Moffett Creek are considered cultural resources in RAA-01.

### 3.1.2 RAA-02 – Combat Range 1 Mortar Impact Area

RAA-02 contains the apparent target/impact area for munitions (20-mm, 37-mm, and 40-mm projectiles; 60-mm and 81-mm mortars) fired into the former Combat Range 1 Mortar Impact Area (C1-01). The area was identified as a separate RAA because of its isolated location, away from the other OU B-2 target/impact areas.

The 74-acre target/impact area was identified through GIS and VSP analyses of previously collected intrusive investigation data for C1-01 and the characteristics of the types of munitions fired. Two outlier grids, centered on MD and MPPEH finds indicative of possible target/impact areas are also included in the RAA.

The impact area is located on a sloping plateau, above the Andrew Lake Seawall Area, on the eastern flank of Mount Moffett. The RAA is isolated from other portions of OU B-2 and surrounded by steep slopes. There are no roads that lead to the area. Tundra and grasses cover much of the RAA. The elevation of C1-01 is higher than that of the rest of OU B-2 and there may be greater potential for frost heave and erosion from snowmelt. RAA-02 contains several small, discontinuous wetlands that are generally located in or near ephemeral drainage channels. No cultural resources were identified within RAA-02.

### 3.1.3 RAA-03 West – Former Andrew Lake Range Complex West

RAA-03 West contains the apparent target/impact areas for munitions fired in the western part of the Former Andrew Lake Range Complex. All of MI-01 and MI-02, and portions of MI-03 are located in the RAA. The three AOCs were grouped into a single RAA because they have similar CSMs with respect to MEC source and transport mechanisms, site conditions, and land uses, and likely will require the same types of remedial action to mitigate potential explosive hazards.

The 71-acre area was identified through GIS and VSP analyses of previously collected intrusive investigation data for MI-01, MI-02, and MI-03, and the characteristics of the types of munitions found in the AOCs. The RAA is made up of four subareas:

- A 52-acre main target/impact area encompassing all of MI-01 and MI-02, and the eastern portion of MI-03. High densities of UXO and DMM, including 2.36-inch and 3.5-inch rockets, 60- and 81-mm mortars, 40-mm projectiles, and other munitions have been found throughout the area.
- A 15-acre secondary target/impact area in the west-central portion of MI-03. A 40-mm projectile and high densities of MD from 81-mm mortars were found in this area.
- A 3.4-acre possible impact area on a ridge north of the main target/impact area. The area is located on the border between MI-03 and RR-02 and was added to the RAA because mortar-related MD was found in the area.
- A 30-m by 30-m (0.2-acre) expansion grid in the west central portion of MI-03. This expansion grid is centered on a 40-mm projectile found during the 1999 SI.

The impact areas occupy the valley drained by Moffett Creek and include both the valley floor and the bounding valley walls (which are steep, greater than 30 degrees), as well as steeply sloped creek banks. Tundra and grasses cover much of the RAA. Soils in the lower elevations of the RAA are saturated within a few inches of the surface. Wetland vegetation and soils are present throughout much of the main target/impact area. A diversion dam located on Moffett Creek is the only cultural resource located in the vicinity of RAA-03 West.

### 3.1.4 RAA-03 East – Former Andrew Lake Range Complex East

RAA-03 East contains the apparent target/impact areas for munitions fired in the eastern part of the Former Andrew Lake Range Complex. All of HG-01 and portions of RR-01 are located in the RAA. The two AOCs were grouped into a single RAA because they have similar CSMs with respect to MEC source and transport mechanisms, site conditions, and land uses, and likely will require the same types of remedial action to mitigate potential explosive hazards.

The 78-acre area was identified through GIS and VSP analyses of previously collected intrusive investigation data for RR-01 and HG-01 and the characteristics of the types of munitions found in the AOCs. The RAA is made up of two subareas:

- A 76-acre target/impact area encompassing much of RR-01. High densities of UXO, including 40-mm high explosive projectiles; 2.36-inch rockets, 40-mm grenades, and a 37-mm projectile, as well as DMM and possible kick-outs from the OB/OD area, have been found in the area. Note, the portion of RR-01 northeast of the Known Distance Range where no MEC has been found, and the portion of RR-01 cleared during the 2008 RG-01 NTCRA are not included in the RAA.
- A 1.8-acre area comprising HG-01. Approximately 80 percent of the AOC was previously surveyed and cleared, with limited UXO finds (one 40-mm projectile, two 40-mm grenades, and a 60-mm mortar) and a few MPPEH finds that appear to be kick-outs from the OB/OD area. All of HG-01 is included in RAA-03 because of the inherent difficulties in resurveying the missed area.

The impact areas occupy the east-central portion of the valley drained by Moffett Creek. Tundra and grasses cover much of the RAA. Soils are saturated within a few inches of the surface. Wetland vegetation and soils are present throughout much of the RAA. The known-distance rifle range at RR-01 and the grenade range at HG-01 were identified as cultural resources within RAA-03 East.

### 3.1.5 RAA-04 – Source Area 93 Multiple Impact Area

RAA-04 consists of apparent target/impact areas for munitions fired in the Source Area 93 Multiple Impact Area (SA93-01) and the Source Area 93 Firing Point (SA93-03) northwest of Andrew Lake. The 104-acre area was identified through GIS and VSP analyses of previously collected intrusive investigation data for SA93-01, information about MEC finds in the adjacent AOC (SA93-02), and the characteristics of the types of munitions found in the AOCs. The RAA is made up of three subareas:

- A 96-acre main target/impact area encompassing most of the southern half of SA93-01. High densities of UXO, including 2.36-inch rockets, 37-mm projectiles, 57-mm projectiles, 75-mm projectiles, 60-mm mortars, 81-mm mortars, and associated MD and MPPEH have been found in the area.
- An 8-acre possible impact area north of the main target/impact area. The area is located on the border between SA93-01 and SA93-02 and was added to the RAA because a 76-mm projectile and rocket-related MD were found in the area.
- Expansion grids along the eastern and southern boundaries of SA93-03. These areas are included in RAA-04 because the procedure used to establish buffers around MEC found along the boundary of SA93-03 in 2008 (step-out transects) was not the same procedure used previously in OU B-2 (expansion grids).

The impact area occupies the plateau drained by Mitchell Creek and portions of the ravine drained by Mitchell Creek. The ground surface of RAA-04 is covered with a thick layer of tundra. Wetland vegetation and soils are present throughout much of the main and secondary target/impact areas. No cultural resources have been identified in the vicinity of RAA-04.

### 3.1.6 RAA-05 – Andrew Lake Seawall Area

RAA-05 consists of the northern portion of OU B-2 that borders Andrew Bay. Two AOCs are located within the RAA, the Andrew Lake Disposal Area (ALDA-01) and the Andrew Lake Seawall (ALSW-01). RAA-05 consists of the portion of ALDA-01 where a 1999 DGM survey found extensive geophysical anomalies (4.7 acres), the portion of ALSW-01 where MEC is deposited along the shoreline and seawall (approximately 21 acres), and the offshore transport zone for MEC adjacent to the shoreline and seawall. Wetland vegetation and soil are present in the southern portion of ALDA-01. Cultural resources identified within and in the vicinity of RAA-05 include WWII bunker and Quonset hut foundations.

Review of recently acquired aerial photographs and historical documents indicate that a gravel road formerly extended northwest from ALDA-01 through ALDA-02 and into the surf zone at Andrew Bay. At least one detonation event occurred in the vicinity of the former road. The boundaries of RAA-05 may be adjusted to include this area, following a thorough visual reconnaissance of the area in 2012.

## 3.2 Identification and Screening of Technologies

General response actions (GRAs) and associated technologies and process options to address MEC hazards at OU B-2 were developed to achieve the following remedial action objective and remedial action goals:

- **Remedial Action Objective:** Provide protection to human health and the environment by reducing and/or mitigating the risk associated with MEC exposure during future use of the area for wildlife management, subsistence, and recreational activities.
- **Remedial Action Goals:**
  - Achieving an ESHA score of “B” or better (or an equivalent low score derived from an EPA-approved explosive hazard scoring system, such as the MEC HA) to achieve acceptable (low) risk for future land use as a wildlife refuge
  - Restricting access to the site(s) until active remedial measures are completed as defined in the ROD.

- Educating island residents and visitors/workers of the potential presence of MEC and the appropriate response and notification procedures
- Minimizing the need for land use controls (LUC) after active remedies are complete

The assembled GRAs, technologies and process options were then screened for implementability, effectiveness and cost for use at OU B-2, as summarized in Table 4.

### 3.3 Remedial Action Alternatives

Technology and process options that passed the screening-level evaluation were assembled into remedial action alternatives, which were further evaluated for use at OUB-2. Key concepts associated with each of the alternatives are summarized below:

- **Alternative 1 – No Action.** No additional site-specific remedial actions, including the location, removal, disposal of MEC, or LUCs would occur. This alternative is not compatible with the remedial action objective (RAO) defined for OU B-2, but it is required by the National Contingency Plan (NCP) to be carried forward for comparison against other alternatives.
- **Alternative 2 – Surface MEC Removal to 0.5 Foot below Top of Mineral Soil and LUCs.** Consists of a one-time removal of surface MEC to a depth of 0.5 foot below the top of mineral soil with implementation of LUCs after the removal action. The LUCs include land use restrictions to limit activities that may extend below the 0.5-foot depth of clearance, periodic erosion monitoring along uninvestigated/uncleared steep slopes within and adjacent to the RAAs, engineering controls (ECs), as well as general ICs that address uncertainty about MEC at former munitions sites.

**Alternative 3 – Surface and Subsurface MEC Removal to Depth of Detection (Maximum of 2 Feet below Top of Mineral Soil) and LUCs.** Consists of a one-time surface and subsurface MEC removal to the depth of detection (to a maximum depth of 2 feet below the top of mineral soil) within each RAA, with implementation of LUCs after the removal action. Under this alternative, once a targeted anomaly has been investigated and acquired, and no additional anomalies are detected to a depth of 2 feet at the location, the subsurface investigation will cease. If anomalies are detected below a depth of 2 feet, the location of the residual anomaly will be recorded and the Navy will decide whether to continue to intrusively investigate the anomaly or to manage uncertainty about the source or the anomaly with LUCs. The LUCs for Alternative 3 include land use restrictions to limit activities that may extend below the maximum depth of clearance in areas where residual anomalies are left uninvestigated, periodic erosion monitoring along uninvestigated/uncleared steep slopes within and adjacent to the RAAs, ECs, and ICs specific to the alternative, as well as general ICs that address uncertainty about MEC at former munitions sites.

- **Alternative 4 – Surface and Subsurface MEC Removal to Depth of Detection (Maximum of 4 Feet below Top of Mineral Soil) and LUCs.** Consists of the same elements as Alternative 3, but the depth of investigation before considering additional investigation or LUCs is 4 feet.
- **Alternative 5 – Surface and Subsurface MEC Removal to Depth of Detection and LUCs.** Consists of a one-time surface and subsurface MEC removal to the depth of detection within each RAA, with implementation of limited LUCs after the removal action. Under this alternative, all targeted anomalies will be investigated to depth of detection (taking into consideration the size of the predominant munitions found in the RAA). Implementation of this alternative allows for unrestricted activities associated with wildlife refuge land use. The LUCs for Alternative 5 are limited to periodic erosion monitoring along uninvestigated/uncleared steep slopes within and adjacent to the RAA, and general ICs that address uncertainty about MEC at former munitions sites.

**TABLE 4**  
**Retained GRAs, Technologies, and Process Options for OU B-2**  
*Summary of Remedial Investigation and Feasibility Study Reports for OU B-2 Sites, Former Adak NAF, Adak, Alaska*

General Remedial Action	Retained Remedial Technology	Retained Process Option	Area	Description
No Action	None	None	5,624 acres	All of OU B-2, including Category 1, 2 and 3 AOCs
LUCs	Institutional controls	Access controls and land use restrictions with monitoring and repairs/updates as required Educational awareness with monitoring and updates as needed	5,624 acres	All of OU B-2, including Category 1, 2 and 3 AOCs
	Engineering controls	Fencing, gates, and signs with monitoring and repairs as needed		
Removal (Terrestrial)	Detection	Visual	374 acres	All of RAA-01 (17 acres), RAA-02 (74 acres), RAA-03 West (71 acres), RAA-03 East (78 acres), RAA-04 (104 acres), and RAA-05 (26 acres – terrestrial)
		Analog geophysical systems, including hand-held metal detectors		
		DGM systems, including land-based carried or towed DGM platform equipment		
	Removal	Manual excavation Mechanical excavation		
	Screening	Manual screening of excavated materials		
Removal (Offshore)	Detection	Visual	Up to 250 acres	Marine portion of RAA-05 – estimate, based on bathymetry and shoreline morphology
		Camera-aided inspection		
		Towed arrays with one or several magnetometers, electromagnetic inductance sensors, or a combination of both.		
	Removal	Mechanical dredging		
	Screening	Manual screening of dredged materials		
Removal (Terrestrial and Offshore)	Disposition (terrestrial and offshore)	Blow-in-place open detonation	374 acres (terrestrial)	All of RAA-01 (17 acres), RAA-02 (74 acres), RAA-03 West (71 acres), RAA-03 East (78 acres), RAA-04 (104 acres), and RAA-05 (26 acres – terrestrial, up to 250 acres – marine)
		Consolidation and open detonation	Up to 250 acres (offshore)	
		Thermal treatment of MD		
		MD and metal scrap processing, inspection, certification and disposal		

## Notes:

Category 1 – AOCs that require remedial action because MEC found in the AOC poses unacceptable explosive safety risks to future land users

Category 2 – AOCs that were found to contain MEC and that were fully investigated and cleared as part of the RI or a removal action

Category 3 – AOCs that were fully investigated in accordance with the RI/FS Work Plan and found to have acceptable (low) potential explosive hazards that are manageable through ICs alone

- **Alternative 6 – Beach Sweeps, MEC Removal at ALDA-01, and RAA-specific LUCs.** This alternative was developed specifically to address the ongoing deposition of MEC along intertidal and terrestrial portions of ALSW-01 (MEC is expected to wash up and be deposited along ALSW-01 for as long as mobile MEC remains in the offshore area), as well as the presence of previously deposited or disposed MEC in ALDA-01. The alternative is divided into two sub-alternatives developed to address the depth of MEC removal in the ALDA-01 portion of RAA-05:
  - Alternative 6A – Beach Sweeps, MEC Removal to 2 Feet below Top of Mineral Soil at ALDA-01 and RAA-specific LUCs
  - Alternative 6B – Beach Sweeps, MEC Removal to 4 Feet below Top of Mineral Soil at ALDA-01 and RAA-specific LUCs

Under Alternative 6A, the same activities described for MEC removal under Alternative 3 would be implemented for the removal of MEC to 2 feet at ALDA-01 and for the beach sweeps. Under Alternative 6B, the same activities described for MEC removal under Alternative 4 would be implemented for the removal of surface and subsurface MEC at ALDA-01. Under both Alternatives 6A and 6B, beach sweeps would be conducted using visual inspection aided either by handheld analog geophysical sensors or by other geophysical detection equipment. Initially, beach sweeps would be conducted annually. If MEC deposition along the shoreline and nearby uplands is reduced over time, the frequency of sweeps would be reduced. The beach sweep program would be discontinued when MEC is no longer found during the beach sweeps. The Navy will retain responsibility for all or part of the RAA-05 area until beach sweeps cease. During that time, access will be restricted to Navy-approved personnel only.

The LUC programs to be implemented with Alternatives 6A and 6B will be specific to RAA-05, with a separate LUC program for the beach sweep period and a separate program that will be implemented after MEC is no longer found during the beach sweeps. This is because the ongoing nature of MEC deposition along the seawall and nearby uplands in RAA-05 requires more stringent access controls to limit possible exposure to re-occurring explosive hazards. The LUC programs for both periods will also address potential exposure to any MEC that might remain in the subsurface at ALDA-01, potential erosion of MEC from the beach headwall at ALDA-01, and general uncertainty about MEC at former munitions sites.

- **Alternative 7 – Dredging, Periodic Beach Sweeps, MEC Removal at ALDA-01 and RAA-specific LUCs.** Alternative 7 was developed specifically to address the source of MEC in the offshore portion of ALSW-01, the ongoing deposition of MEC along intertidal and terrestrial portions of ALSW-01, and the presence of previously deposited or disposed MEC in ALDA-01. The only difference between Alternatives 6A and 7A is the addition of remedial actions to address the source of MEC in the offshore portion of ALSW-01. The beach sweep program, MEC removal to 2 feet at ALDA-01, and LUC program described for Alternatives 6A make up the terrestrial remedial action portion of Alternative 7A. The terrestrial portion of Alternative 7B incorporates the same beach sweep and LUC program as 6A and 7A, but includes MEC removal from the surface to depth of detection at ALDA-01. Removal of MEC to depth of detection at ALDA-01 will incorporate the same activities described for MEC removal under Alternative 5. The offshore components of the alternative consist of dredging, sorting and screening of MEC from recovered sediments, and treatment and disposal of recovered MEC.

With the exception of Alternative 1 and Alternatives 7A and 7B, all of the remedial action alternatives considered for use at OU B-2 were found to be compliant with the RAO, and individually implementable, effective, and exhibited reasonable relative costs, and thus were retained for further evaluation. Alternative 1 was retained for compliance with the NCP, and despite concerns about implementability of dredging and high costs, Alternatives 7A and 7B were also retained for further evaluation because of agreements reached between the Navy and the EPA and ADEC during informal dispute resolution.

### 3.4 Summary of Alternatives Evaluations

Detailed and comparative analyses to CERCLA criteria were performed for each alternative and RAA. The results of the comparative analyses are summarized in Tables 5 through 10.

**TABLE 5**  
**Results of Comparative Analysis of Remedial Action Alternatives for RAA-01 (OB/OD-01)**  
*Summary of Remedial Investigation and Feasibility Study Reports for OU B-2 Sites, Former Adak NAF, Adak, Alaska*

Criteria		Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5
Threshold Criteria	Overall protection of human health and the environment	Lowest	Medium	High	High	High
	Compliance with ARARs/TBCs	Lowest	Medium	Medium	Medium	Medium
Balancing Criteria	Long-term effectiveness and permanence	Lowest	Low	High	High	High
	Reduction of toxicity, mobility, or volume through treatment	Lowest	Low	High	High	High
	Short-term effectiveness	Low	Highest	High	Medium	Medium
	Implementability	Highest	High	Medium	Medium	Medium
Cost	Capital	\$0	\$1,400,000	\$1,700,000	\$1,700,000	\$1,700,000
	O&M	\$0	\$300,000	\$300,000	\$300,000	\$300,000
	Total	\$0	\$1,700,000	\$2,000,000	\$2,000,000	\$2,000,000
Overall Rating		Lowest	Medium	High	Medium	Medium

## Notes:

Alternative 1 – No Action

Alternative 2 – Surface MEC Removal to 0.5 Foot below Top of Mineral Soil and LUCs

Alternative 3 – Surface and Subsurface MEC Removal to Depth of Detection (Maximum of 2 Feet below Top of Mineral Soil) and LUCs

Alternative 4 – Surface and Subsurface MEC Removal to Depth of Detection (Maximum of 4 Feet below Top of Mineral Soil) and LUCs

Alternative 5 – Surface and Subsurface MEC Removal to Depth of Detection and LUCs

ARAR = applicable or relevant and appropriate requirement

TBC = to be considered

**TABLE 6**  
**Results of Comparative Analysis of Remedial Action Alternatives for RAA-02 (C1-01)**  
*Summary of Remedial Investigation and Feasibility Study Reports for OU B-2 Sites, Former Adak NAF, Adak, Alaska*

Criteria		Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5	
Threshold Criteria	Overall protection of human health and the environment	Lowest	Medium	High	High	High	
	Compliance with ARARs/TBCs	Lowest	Medium	Medium	Medium	Medium	
Balancing Criteria	Long-term effectiveness and permanence	Lowest	Low	High	High	High	
	Reduction of toxicity, mobility, or volume through treatment	Lowest	Low	High	High	High	
	Short-term effectiveness	Low	Highest	High	Medium	Medium	
	Implementability	Highest	High	Medium	Medium	Medium	
	Cost	Capital	\$0	\$2,700,000	\$4,700,000	\$4,700,000	\$4,700,000
		O&M	\$0	\$300,000	\$300,000	\$300,000	\$300,000
		Total	\$0	\$3,000,000	\$5,000,000	\$5,000,000	\$5,000,000
	Overall Rating		Lowest	Medium	High	Medium	Medium

## Notes:

Alternative 1 – No Action

Alternative 2 – Surface MEC Removal to 0.5 Foot below Top of Mineral Soil and LUCs

Alternative 3 – Surface and Subsurface MEC Removal to Depth of Detection (Maximum of 2 Feet below Top of Mineral Soil) and LUCs

Alternative 4 – Surface and Subsurface MEC Removal to Depth of Detection (Maximum of 4 Feet below Top of Mineral Soil) and LUCs

Alternative 5 – Surface and Subsurface MEC Removal to Depth of Detection and LUCs

**TABLE 7**  
**Results of Comparative Analysis of Remedial Action Alternatives for RAA-03 West (MI-01, MI-02, MI-03)**  
*Summary of Remedial Investigation and Feasibility Study Reports for OU B-2 Sites, Former Adak NAF, Adak, Alaska*

Criteria		Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5	
Threshold Criteria	Overall protection of human health and the environment	Lowest	Medium	High	High	High	
	Compliance with ARARs/TBCs	Lowest	Medium	Medium	Medium	Medium	
Balancing Criteria	Long-term effectiveness and permanence	Lowest	Low	High	High	High	
	Reduction of toxicity, mobility, or volume through treatment	Lowest	Low	High	High	High	
	Short-term effectiveness	Low	Highest	High	Medium	Medium	
	Implementability	Highest	High	Medium	Medium	Medium	
	Cost	Capital	\$0	\$4,000,000	\$7,200,000	\$7,400,000	\$7,400,000
		O&M	\$0	\$300,000	\$300,000	\$300,000	\$300,000
		Total	\$0	\$4,300,000	\$7,500,000	\$7,700,000	\$7,700,000
	Overall Rating		Lowest	Medium	High	Medium	Medium

**Notes:**

Alternative 1 – No Action

Alternative 2 – Surface MEC Removal to 0.5 Foot below Top of Mineral Soil and LUCs

Alternative 3 – Surface and Subsurface MEC Removal to Depth of Detection (Maximum of 2 Feet below Top of Mineral Soil) and LUCs

Alternative 4 – Surface and Subsurface MEC Removal to Depth of Detection (Maximum of 4 Feet below Top of Mineral Soil) and LUCs

Alternative 5 – Surface and Subsurface MEC Removal to Depth of Detection and LUCs

**TABLE 8**  
**Results of Comparative Analysis of Remedial Action Alternatives for RAA-03 East (RR-01 and HG-01)**  
*Summary of Remedial Investigation and Feasibility Study Reports for OU B-2 Sites, Former Adak NAF, Adak, Alaska*

Criteria		Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5	
Threshold Criteria	Overall protection of human health and the environment	Lowest	Medium	High	High	High	
	Compliance with ARARs/TBCs	Lowest	Medium	Medium	Medium	Medium	
Balancing Criteria	Long-term effectiveness and permanence	Lowest	Low	High	High	High	
	Reduction of toxicity, mobility, or volume through treatment	Lowest	Low	High	High	High	
	Short-term effectiveness	Low	Highest	High	Medium	Medium	
	Implementability	Highest	High	Medium	Medium	Medium	
	Cost	Capital	\$0	\$3,200,000	\$6,100,000	\$6,400,000	\$6,400,000
		O&M	\$0	\$300,000	\$300,000	\$300,000	\$300,000
		Total	\$0	\$3,500,000	\$6,400,000	\$6,700,000	\$6,700,000
	Overall Rating		Lowest	Medium	High	Medium	Medium

## Notes:

Alternative 1 – No Action

Alternative 2 – Surface MEC Removal to 0.5 Foot below Top of Mineral Soil and LUCs

Alternative 3 – Surface and Subsurface MEC Removal to Depth of Detection (Maximum of 2 Feet below Top of Mineral Soil) and LUCs

Alternative 4 – Surface and Subsurface MEC Removal to Depth of Detection (Maximum of 4 Feet below Top of Mineral Soil) and LUCs

Alternative 5 – Surface and Subsurface MEC Removal to Depth of Detection and LUCs

**TABLE 9**  
**Results of Comparative Analysis of Remedial Action Alternatives for RAA-04 (SA93-01 and SA93-03)**  
*Summary of Remedial Investigation and Feasibility Study Reports for OU B-2 Sites, Former Adak NAF, Adak, Alaska*

Criteria		Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5	
Threshold Criteria	Overall protection of human health and the environment	Lowest	Medium	Medium	High	High	
	Compliance with ARARs/TBCs	Lowest	Medium	Medium	Medium	Medium	
Balancing Criteria	Long-term effectiveness and permanence	Lowest	Low	Medium	High	High	
	Reduction of toxicity, mobility, or volume through treatment	Lowest	Low	Medium	High	High	
	Short-term effectiveness	Low	Highest	High	Medium	Medium	
	Implementability	Highest	High	Medium	Medium	Medium	
	Cost	Capital	\$0	\$3,600,000	\$6,800,000	\$7,000,000	\$7,000,000
		O&M	\$0	\$300,000	\$300,000	\$300,000	\$300,000
		Total	\$0	\$3,900,000	\$7,100,000	\$7,300,000	\$7,300,000
	Overall Rating		Lowest	Medium	Medium	High	Medium

## Notes:

Alternative 1 – No Action

Alternative 2 – Surface MEC Removal to 0.5 Foot below Top of Mineral Soil and LUCs

Alternative 3 – Surface and Subsurface MEC Removal to Depth of Detection (Maximum of 2 Feet below Top of Mineral Soil) and LUCs

Alternative 4 – Surface and Subsurface MEC Removal to Depth of Detection (Maximum of 4 Feet below Top of Mineral Soil) and LUCs

Alternative 5 – Surface and Subsurface MEC Removal to Depth of Detection and LUCs

**TABLE 10**  
**Results of Comparative Analysis of Remedial Action Alternatives for RAA-05 (ALDA-01 and ALSW-01)**  
*Summary of Remedial Investigation and Feasibility Study Reports for OU B-2 Sites, Former Adak NAF, Adak, Alaska*

Criteria		Alternative 1	Alternative 6A	Alternative 6B	Alternative 7A	Alternative 7B
Threshold Criteria	Overall protection of human health and the environment	Lowest	High	High	Medium	Medium
	Compliance with ARARs/TBCs	Lowest	Medium	Medium	Low	Low
Balancing Criteria	Long-term effectiveness and permanence	Lowest	Medium	Medium	Medium	Medium
	Reduction of toxicity, mobility, or volume through treatment	Lowest	Medium	Medium	Medium	High
	Short-term effectiveness	Low	Medium	Medium	Lowest	Lowest
	Implementability	Highest	High	High	Low	Lowest
	Cost	Capital	\$0	\$1,400,000	\$1,600,000	\$165,500,000
O&M		\$0	\$3,600,000	\$3,600,000	\$3,600,000	\$3,600,000
Total		\$0	\$5,000,000	\$5,200,000	\$169,100,000	\$169,100,000
Overall Rating		Lowest	High	High	Low	Low

## Notes:

Alternative 1 – No Action

Alternative 6A – Beach Sweeps, MEC Removal to 2 Feet below Top of Mineral Soil at ALDA-01 and RAA-specific LUCs

Alternative 6B – Beach Sweeps, MEC Removal to 4 Feet below Top of Mineral Soil at ALDA-01 and RAA-specific LUCs

Alternative 7A – Dredging, Beach Sweeps, MEC Removal to 2 Feet below Top of Mineral Soil at ALDA-01 and RAA-specific LUCs

Alternative 7B – Dredging, Beach Sweeps, MEC Removal to Depth of Detection at ALDA-01 and RAA-specific LUCs

## 3.5 Summary of Navy Preferred Approaches

The Navy's recommended approach for each RAA and rationale for selection are summarized below.

- **RAA-01 (OB/OD-01)** – Alternative 3, Surface and Subsurface MEC Removal to Depth of Detection (Maximum of 2 Feet below Top of Mineral Soil) and LUCs, for the following reasons:
  - Alternative 3 removes surface and subsurface MEC exposure hazards to the depths at which they are most likely to be present based on the previous intrusive investigations and the CSM for RAA-01. Combined with LUCs that include land use restrictions to limit activities that may extend below the maximum depth of clearance in areas of unresolved anomalies, this alternative provides protection to human health and the environment for the expected future land use as a wildlife refuge.
  - The Navy believes that investigation and removal to a depth of 2 feet, with allowances for investigation of deeper anomalies based on site-specific conditions, will address most, if not all, of the detectable MEC at RAA-01. Considering the results of the previous intrusive investigations and the absence of historical operating information for the OB/OD area, there is some uncertainty about the CSM as it relates to the distribution of MEC at depth at RAA-01. The allowance for investigation of deeper anomalies takes this uncertainty into account. The Navy desires to reduce its operational footprint on Adak Island and acknowledges that Alternative 5 meets that objective more than Alternatives 3 or 4 (the difference being a permit program for intrusive activities). However, given the uncertainty of the MEC distribution modeling based on the previous investigations, number of metallic saturated areas, and extensive areas of saturated soil, Alternative 3 provides appropriate protection with the least uncertainty. If during the course of the field work the additional removal to depth is found to be reasonably attainable within seasonal and budget constraints, the Navy would likely continue the anomaly removal to greater depth. Maintenance of flexibility for field conditions and decisions on Adak is critical when all considered alternatives are protective of human health and the recommended approach is most protective of the local environment.
  - In addition to land use restrictions in areas of unresolved anomalies, the LUC program would manage uncertainty and minimize explosive safety risks related to residual MEC through the educational awareness program, MEC discovery and management process, land transfer documentation, periodic inspections, and 5-year reviews. Periodic reviews would be conducted to demonstrate that the remedial action remains protective of human health, safety, and the environment. The Navy believes that the LUC program is a reasonable and practical means of dealing with MEC uncertainty and is consistent with or exceeds LUCs implemented elsewhere at Adak and at MEC sites in more populated areas of the United States.
  - As a RCRA interim status hazardous waste unit, Alternative 3 would be compliant with corrective action and closure requirements for OB/OD-1 pursuant to 40 Code of Federal Regulations 265, Subpart G Closure and Post-Closure. No post-closure care would be required.
  - The components of Alternative 3 are consistent with the FFA, CERCLA, NCP, and Executive Order 12580, and are compliant with DoD 6055.09-M regarding protection of personnel.
  - Potential conflicts with location- and action-specific ARARs related to cultural resources and protection of Moffett Creek and related wetlands would be resolved through site work approaches that address cultural and natural resources, and be followed by site restoration activities. Alternative 3 has the least potential to affect these resources, as compared to Alternatives 4 or 5.
  - The surface and subsurface MEC removal technologies are proven reliable and are expected to meet performance standards. Trained personnel and equipment to carry out the removal action are available. The current island-wide MEC educational awareness program in place at OU B-1 can be easily adopted or enhanced for use at RAA-01 (and elsewhere at OU B-2), and resources to implement the remaining Alternative 3 LUC components are readily available.

- When the data for RAA-01 are analyzed assuming implementation of Alternative 3, the ESHA score is A and the MEC HA score is 4. Both hazard evaluation results indicate the lowest relative hazard level and MEC conditions at RAA-01 would be compatible with reasonably anticipated future land uses.
- **RAA-02 (C1-01)** – Alternative 3, Surface and Subsurface MEC Removal to Depth of Detection (Maximum of 2 Feet below Top of Mineral Soil) and LUCs, for the following reasons:
  - Alternative 3 removes surface and subsurface MEC exposure hazards to the depths at which they are most likely to be present based on the previous intrusive investigations and the CSM for RAA-02. Combined with LUCs, which include land use restrictions to limit activities that may extend below the maximum depth of clearance in areas with unresolved anomalies, this alternative provides protection to human health and the environment for the expected future land use as a wildlife refuge.
  - The Navy believes that investigation and removal to a depth of 2 feet, with allowances for investigation of deeper anomalies based on site-specific conditions, will address most, if not all, of the detectable MEC at RAA-02, regardless of whether the MEC is related to use of the area as a range or kick-outs from detonation of MEC in the ALDA-01 and ALDA-02 area. The Navy desires to reduce its operational footprint on Adak Island and acknowledges that Alternative 5 meets that objective more than Alternatives 3 or 4 (the difference being a permit program for intrusive activities). However, given the uncertainty of the MEC distribution modeling based on the previous investigations and the extensive areas of saturated soil, Alternative 3 provides appropriate protection with the least uncertainty. If during the course of the field work the additional removal to depth is found to be reasonably attainable within seasonal and budget constraints, the Navy would likely continue the anomaly removal to greater depth. Maintenance of flexibility for field conditions and decisions on Adak is critical when all considered alternatives are protective of human health and the recommended approach is most protective of the local environment.
  - In addition to land use restrictions in areas of unresolved anomalies, the LUC program would manage uncertainty and minimize explosive safety risks related to residual MEC through the educational awareness program, MEC discovery and management process, land transfer documentation, periodic inspections, and 5-year reviews. Periodic reviews would be conducted to demonstrate that the remedial action remains protective of human health, safety, and the environment. The Navy believes that the LUC program is a reasonable and practical means of dealing with MEC uncertainty and is consistent with or exceeds LUCs implemented elsewhere at Adak and at MEC sites in more populated areas of the United States.
  - The components of Alternative 3 are consistent with the FFA, CERCLA, NCP, and Executive Order 12580, and are compliant with DoD 6055.09-M regarding protection of personnel.
  - Potential conflicts with location- and action-specific ARARs related to ecology and environmental protection of fragile upland tundra and ephemeral streams at RAA-02 would be resolved through site work approaches that address and protect natural resources and be followed by site restoration activities. Alternative 3 has the least potential to affect these resources, as compared to Alternatives 4 or 5.
  - The surface and subsurface MEC removal technologies are proven reliable and are expected to meet performance standards. Trained personnel and equipment to carry out the removal action are available. The current island-wide MEC educational awareness program in place at OU B-1 can be easily adopted or enhanced for use at RAA-02 (and elsewhere at OU B-2), and resources to implement the remaining Alternative 3 LUC components are readily available.
  - When the data for RAA-02 are analyzed assuming implementation of Alternative 3, the ESHA score is A and the MEC HA score is 4. Both hazard evaluation results indicate the lowest relative hazard level and MEC conditions at RAA-02 would be compatible with reasonably anticipated future land uses.

- **RAA-03 West (MI-01, MI-02, MI-03)** – Alternative 3, Surface and Subsurface MEC Removal to Depth of Detection (Maximum of 2 feet below Top of Mineral Soil) and LUCs, for the following reasons:
  - Alternative 3 removes surface and subsurface MEC exposure hazards to the depths at which they are most likely to be present based on the previous intrusive investigations and the CSM for RAA-03 West. Combined with LUCs, which include land use restrictions to limit activities that may extend below the maximum depth of clearance in areas with unresolved anomalies, this alternative provides protection to human health and the environment for the expected future land use as a wildlife refuge.
  - The Navy believes that investigation and removal to a depth of 2 feet, with allowances for investigation of deeper anomalies based on site-specific conditions, will address most, if not all, of the detectable MEC at RAA-03 West, regardless of whether the MEC is related to use of the area as a range or kick-outs from the OB/OD area. The Navy desires to reduce its operational footprint on Adak Island and acknowledges that Alternative 5 meets that objective more than Alternatives 3 or 4 (the difference being a permit program for intrusive activities). However, given the uncertainty of the MEC distribution modeling based on the previous investigations and the extensive areas of saturated soil, Alternative 3 provides appropriate protection with the least uncertainty. If during the course of the field work the additional removal to depth is found to be reasonably attainable within seasonal and budget constraints, the Navy would likely continue the anomaly removal to greater depth. Maintenance of flexibility for field conditions and decisions on Adak is critical when all considered alternatives are protective of human health and the recommended approach is most protective of the local environment.
  - In addition to land use restrictions in areas of unresolved anomalies, the LUC program would manage uncertainty and minimize explosive safety risks related to residual MEC through the educational awareness program, MEC discovery and management process, land transfer documentation, periodic inspections, and 5-year reviews. Periodic reviews would be conducted to demonstrate that the remedial action remains protective of human health, safety, and the environment. The Navy believes that the LUC program is a reasonable and practical means of dealing with MEC uncertainty and is consistent with or exceeds LUCs implemented elsewhere at Adak and at MEC sites in more populated areas of the United States.
  - The components of Alternative 3 are consistent with the FFA, CERCLA, NCP, and Executive Order 12580, and are compliant with DoD 6055.09-M regarding protection of personnel.
  - Potential conflicts with location- and action-specific ARARs related to cultural resources and protection of Moffett Creek and related wetlands would be resolved through site work approaches that address cultural and natural resources, and be followed by site restoration activities. Alternative 3 has the least potential to affect these resources, as compared to Alternatives 4 or 5.
  - The surface and subsurface MEC removal technologies are proven reliable and are expected to meet performance standards. Trained personnel and equipment to carry out the removal action are available. The current island-wide MEC educational awareness program in place at OU B-1 can be easily adopted or enhanced for use at RAA-03 West (and elsewhere at OU B-2), and resources to implement the remaining Alternative 3 LUC components are readily available.
  - When the data for RAA-03 West AOCs are reanalyzed assuming implementation of Alternative 3, the ESHA score is A and the MEC HA score is 4. Both hazard evaluation results indicate the lowest relative hazard level and MEC conditions at RAA-03 West would be compatible with reasonably anticipated future land uses.
- **RAA-03 East (RR-01 and HG-01)** – Alternative 3, Surface and Subsurface MEC Removal to Depth of Detection (Maximum of 2 Feet below Top of Mineral Soil) and LUCs, for the following reasons:
  - Alternative 3 removes surface and subsurface MEC exposure hazards to the depths at which they are most likely to be present based on the previous intrusive investigations and the CSM for RAA-03 East. Combined with LUCs, which include land use restrictions to limit activities that may extend below the

maximum depth of clearance in areas with unresolved anomalies, this alternative provides protection to human health and the environment for the expected future land use as a wildlife refuge.

- The Navy believes that investigation and removal to a depth of 2 feet, with allowances for investigation of deeper anomalies based on site-specific conditions, will address most, if not all, of the detectable MEC at RAA-03 East, regardless of whether the MEC is related to use of the area as a range or kick-outs from the OB/OD area. The Navy desires to reduce its operational footprint on Adak Island and acknowledges that Alternative 5 meets that objective more than Alternatives 3 or 4 (the difference being a permit program for intrusive activities). However, given the uncertainty of the MEC distribution modeling based on the previous investigations and the extensive areas of saturated soil, Alternative 3 provides appropriate protection with the least uncertainty. If during the course of the field work the additional removal to depth is found to be reasonably attainable within seasonal and budget constraints, the Navy would likely continue the anomaly removal to greater depth. Maintenance of flexibility for field conditions and decisions on Adak is critical when all considered alternatives are protective of human health and the recommended approach is most protective of the local environment.
- In addition to land use restrictions in areas of unresolved anomalies, the LUC program would manage uncertainty and minimize explosive safety risks related to residual MEC through the educational awareness program, MEC discovery and management process, land transfer documentation, periodic inspections, and 5-year reviews. Periodic reviews would be conducted to demonstrate that the remedial action remains protective of human health, safety, and the environment. The Navy believes that the LUC program is a reasonable and practical means of dealing with MEC uncertainty and is consistent with or exceeds LUCs implemented elsewhere at Adak and at MEC sites in more populated areas of the United States.
- The components of Alternative 3 are consistent with the FFA, CERCLA, NCP, and Executive Order 12580, and are compliant with DoD 6055.09-M regarding protection of personnel.
- Potential conflicts with location- and action-specific ARARs related to cultural resources and protection of Moffett Creek and related wetlands would be resolved through site work approaches that address cultural and natural resources, and be followed by site restoration activities. Alternative 3 has the least potential to affect these resources when compared to Alternatives 4 or 5.
- The surface and subsurface MEC removal technologies are proven reliable and are expected to meet performance standards. Trained personnel and equipment to carry out the removal action are available. The current island-wide MEC educational awareness program in place at OU B-1 can be easily adopted or enhanced for use at RAA-03 East (and elsewhere at OU B-2), and resources to implement the remaining Alternative 3 LUC components are readily available.
- When the data for RAA-03 East AOCs are reanalyzed assuming implementation of Alternative 3, the ESHA score is A and the MEC HA score is 4. Both hazard evaluation results indicate the lowest relative hazard level and MEC conditions at RAA-03 East would be compatible with reasonably anticipated future land uses.
- **RAA-04 (SA93-01 and SA93-03)** – Alternative 4, Surface and Subsurface MEC Removal to Depth of Detection (Maximum of 4 Feet below Top of Mineral Soil) and LUCs, for the following reasons:
  - Alternative 4 removes surface and subsurface MEC exposure hazards to the depths at which MEC is most likely to be present based on the previous intrusive investigations and the CSM for RAA-04. Combined with LUCs, which include land use restrictions to limit activities that may extend below the maximum depth of clearance in areas with unresolved anomalies, this alternative provides protection to human health and the environment for the expected future land use as a wildlife refuge.
  - The Navy believes that investigation and removal to a depth of 4 feet, with allowances for investigation of deeper anomalies based on site-specific conditions, will address most, if not all, of the detectable MEC at RAA-04. Such a removal meets or exceeds MEC clearance objectives elsewhere at Adak and at MEC sites

in more populated areas of the United States. The Navy desires to reduce its operational footprint on Adak Island and acknowledges that Alternative 5 meets that objective more than Alternative 4 (the difference being a permit program for intrusive activities). However, given the uncertainty of the MEC distribution modeling based on the previous investigations and the extensive areas of saturated soil, Alternative 4 provides appropriate protection with the least uncertainty. If during the course of the field work the additional removal to depth is found to be reasonably attainable within seasonal and budget constraints, the Navy would likely continue the anomaly removal to greater depth. Maintenance of flexibility for field conditions and decisions on Adak is critical when all considered alternatives are protective of human health and the recommended approach is most protective of the local environment.

- In addition to land use restrictions in areas of unresolved anomalies, the LUC program would manage uncertainty and minimize explosive safety risks related to residual MEC through the educational awareness program, MEC discovery and management process, land transfer documentation, periodic inspections, and 5-year reviews. Periodic reviews would be conducted to demonstrate that the remedial action remains protective of human health, safety, and the environment. The Navy believes that the LUC program is a reasonable and practical means of dealing with MEC uncertainty and is consistent with or exceeds LUCs implemented elsewhere at Adak and at MEC sites in more populated areas of the United States.
- The components of Alternative 4 are consistent with the FFA, CERCLA, NCP, and Executive Order 12580, and are compliant with DoD 6055.09-M regarding protection of personnel.
- Potential conflicts with location- and action-specific ARARs related to cultural resources and ecology and environmental protection of upland tundra, Mitchell Creek, and related wetlands would be resolved through site work approaches that address and protect natural resources and be followed by site restoration activities. Alternative 4 has less potential to affect these resources, as compared to Alternative 5.
- The surface and subsurface MEC removal technologies are proven reliable and are expected to meet performance standards. Trained personnel and equipment to carry out the removal action are available. The current island-wide MEC educational awareness program in place at OU B-1 can be easily adopted or enhanced for use at RAA-04 (and elsewhere at OU B-2), and resources to implement the remaining Alternative 4 LUC components are readily available.
- When the data for RAA-04 are reanalyzed assuming implementation of Alternative 4, the ESHA score is A and the MEC HA score is 4. Both hazard evaluation results indicate the lowest relative hazard level and MEC conditions at RAA-04 would be compatible with reasonably anticipated future land uses.
- **RAA-05 (ALDA-01 and ALSW-01)** – Alternative 6A, Beach Sweeps, MEC Removal to 2 Feet below Top of Mineral Soil at ALDA-01 and RAA-specific LUCs, for the following reasons:
  - The RAA-specific LUCs will restrict access to the area and limit exposure to MEC at RAA-05 until MEC is no longer transported to and deposited on the shoreline and seawall and beach sweeps are no longer required. The Navy will retain responsibility for the area and manage the LUCs during the beach sweep period.
  - The beach sweeps will reduce the overall volume of surface MEC along the shoreline and seawall. Removal of detectable MEC to a depth of 2 feet in the ALDA-01 portion of RAA-05 will also reduce the overall volume of MEC beyond the depth of reasonable intrusion by future land users. Although the debris layer at ALDA-01 appears to be approximately 4 feet thick, rare occurrences of MEC are limited to the upper 1.5 feet. The Navy believes that any MEC that may be present in the debris layer at greater depths will not be accessible to future land users, because heavy equipment is needed to penetrate even the upper few inches of the ground surface at ALDA-01, and there are no activities consistent with wildlife refuge use that involve excavation with heavy equipment. Resolution of anomalies and removal of MEC to a depth of 2 feet will also limit the amount of MEC that could be exposed by erosion along the beach

headwall and other sloped areas within ALDA-01. Any MEC that is exposed will be removed as part of the beach sweep program.

- Uncertainty about possible MEC disposal and demolition activities west of ALSW-01 and ALDA-01 will be resolved by conducting a thorough visual reconnaissance of the area during 2012.
- The beach sweeps will include the shoreline west of ALSW-01 and ALDA-01 to ensure coverage of areas where MEC may have been historically disposed or deposited.
- The educational awareness program, MEC discovery and management process, land transfer documentation, periodic inspections, and 5-year review components of the post-beach sweep period LUCs would minimize explosive safety risks related to residual MEC at ALDA-01 and elsewhere at RAA-05. These components would also provide periodic reviews to demonstrate that the remedial action remains protective of human health, safety, and the environment.
- The surface MEC removal technologies associated with Alternative 6A are proven reliable and are expected to meet performance standards. Trained personnel and equipment to carry out the removal action and components of RAA-specific LUCs are available.
- Alternative 6A is consistent with the FFA, CERCLA, NCP, and Executive Order 12580, and is compliant with DoD 6055.09-M regarding protection of personnel.
- Potential conflicts with location- and action-specific ARARs related to cultural resources and protection of shoreline and marine ecosystems would be resolved through site work approaches that address natural resources, as well as with site restoration activities following MEC removal at ALDA-01 and elsewhere at RAA-05 if additional disposal or demolition areas are found during reconnaissance activities.
- When the data for RAA-05 are analyzed assuming completion of beach sweeps and MEC removal to 2 feet at ALDA-01, the ESHA scores are C (ALDA-01) and A (ALSW-01) and the MEC HA scores are 4 (ALDA-01) and 3 (ALSW-01). The ESHA methodology does not account for conditions that might limit exposure to MEC at depth, such as the large rocks and cobbles at ALDA-01. Therefore, the ESHA score of C for ALDA-01 is highly conservative and likely overstates the hazard to potential future users. The MEC HA results indicate a lower relative hazard level, indicating that MEC conditions at RAA-05 possess a moderate potential for explosive hazard, but are considered safe for future land uses.



## SECTION 4

# References

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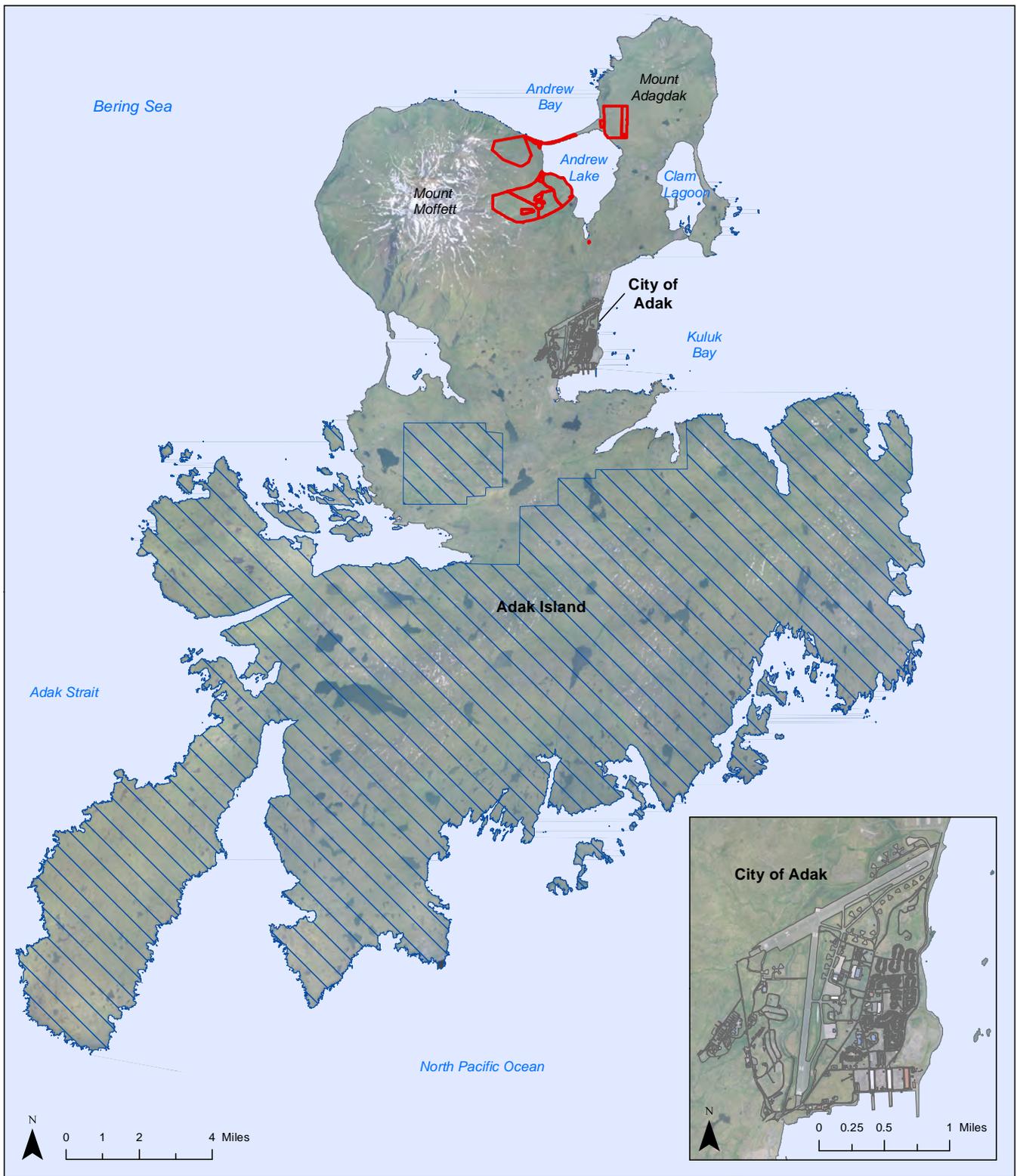
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**Figures**

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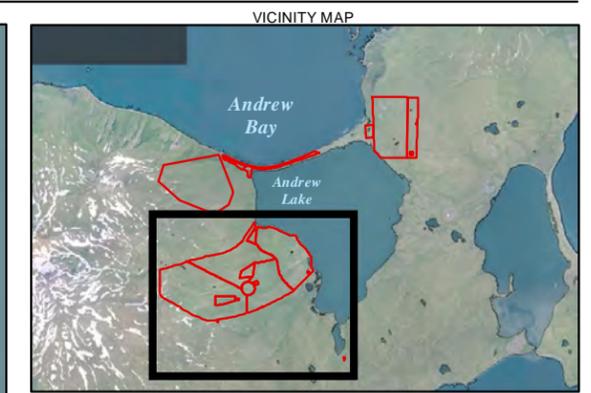
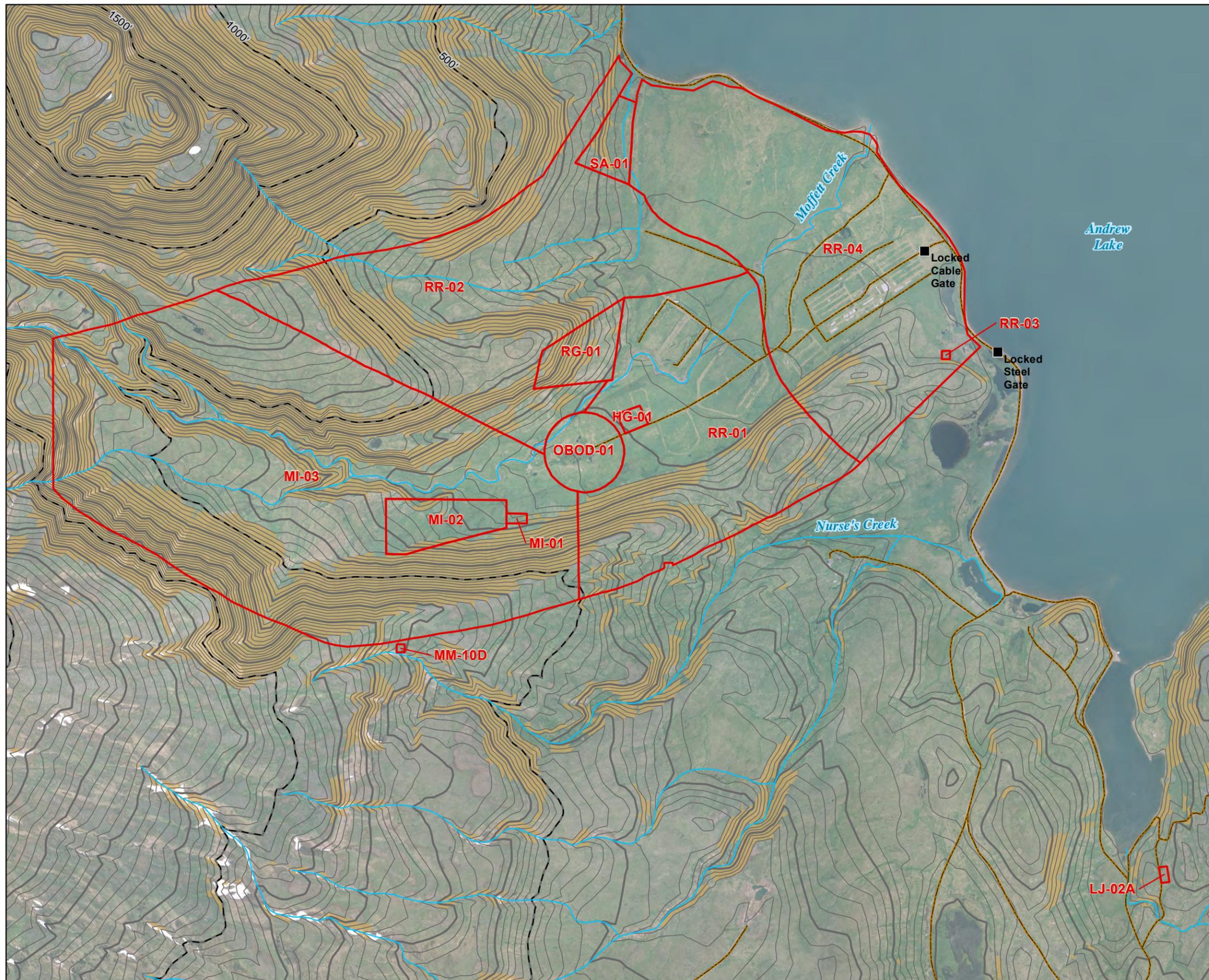


Source: Aerial photography (2008) USA Environmental; City of Adak (2009) CH2M HILL; AMNWR (2010) Critigen; Land and Graticules (2006) ESRI.

**Legend**

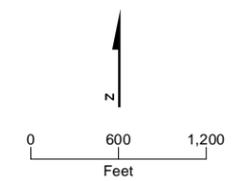
- Operable Unit B-2 Sites
- City of Adak
- Alask Maritime National Wildlife Refuge (AMNWR)

**FIGURE 1**  
**Adak Island Overview Map**  
 OU B-2 RI/FS Report -  
 Executive Summary  
*Adak Island, Alaska*

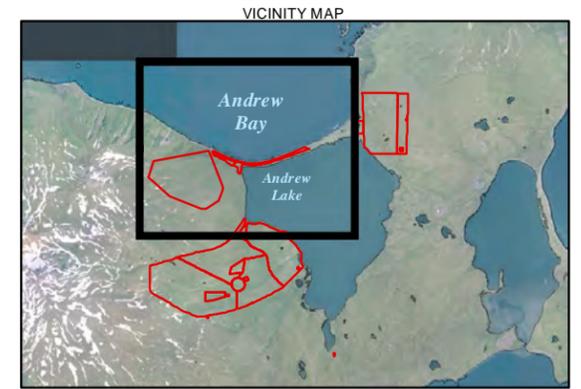


- LEGEND**
- Gate
  - ~ 20-ft Contour
  - ~ 100-ft Contour
  - ~ 500-ft Contour
  - Stream
  - ⚡ Road
  - ⊠ Area of Concern (AOC)
  - ⚡ Slopes Greater Than 30 Degrees (as calculated from terrain model)

Notes:  
 1. Aerial photography: 2000 fly-over (AEROMAP)

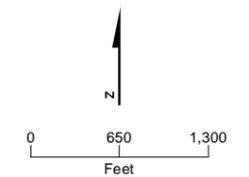


**FIGURE 2**  
**Topography and AOCs –**  
**Range Complex at Andrew Lake**  
 OU B-2 RI/FS Report - Executive Summary  
 Adak Island, Alaska

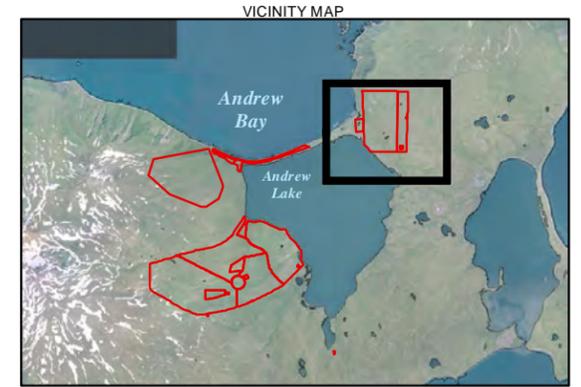
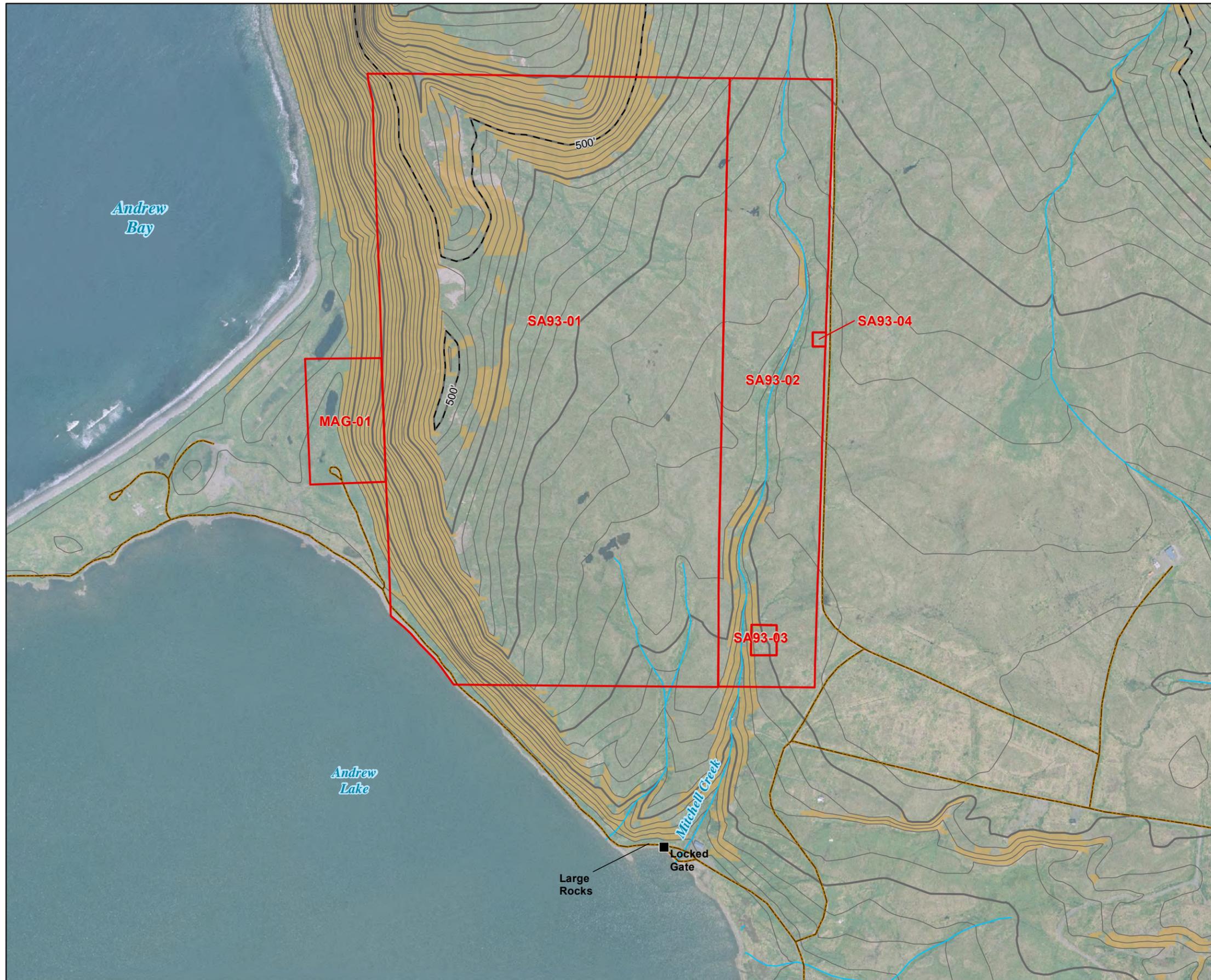


- LEGEND**
- Gate
  - ~ 20-ft Contour
  - ~ 100-ft Contour
  - ~ 500-ft Contour
  - ~ Stream
  - ~ Road
  - Area of Concern (AOC)
  - ~ Slopes Greater Than 30 Degrees (as calculated from terrain model)

Notes:  
 1. Aerial photography: 2000 fly-over (AEROMAP)

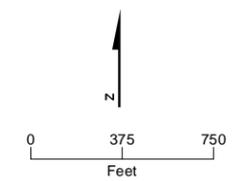


**FIGURE 3**  
**Topography and AOCs –**  
**Andrew Bay Seawall Area**  
 OU B-2 RI/FS Report - Executive Summary  
 Adak Island, Alaska

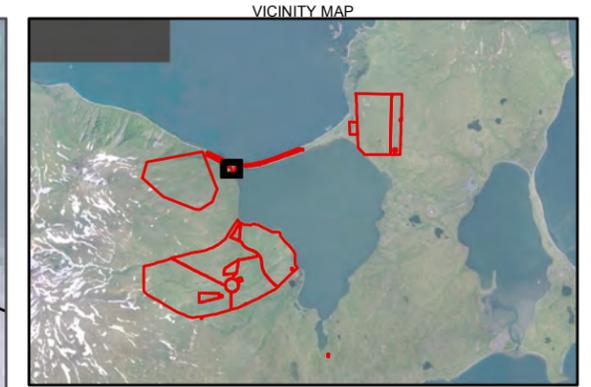


- LEGEND**
- Gate
  - ~ 20-ft Contour
  - ~ 100-ft Contour
  - ~ 500-ft Contour
  - ~ Stream
  - ~ Road
  - Area of Concern (AOC)
  - Slopes Greater Than 30 Degrees (as calculated from terrain model)

Notes:  
 1. Aerial photography: 2000 fly-over (AEROMAP)



**FIGURE 4**  
**Topography and AOCs –**  
**SA93 Area**  
 OU B-2 RI/FS Report - Executive Summary  
 Adak Island, Alaska

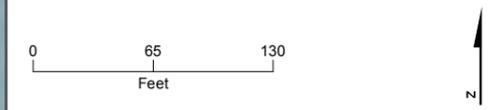


- MEC Investigation**
- \* 2008 Unexploded Ordnance (UXO)
  - ALSW-01 West Recon Transect
  - Grid
  - Instrument Aided Visual Reconnaissance

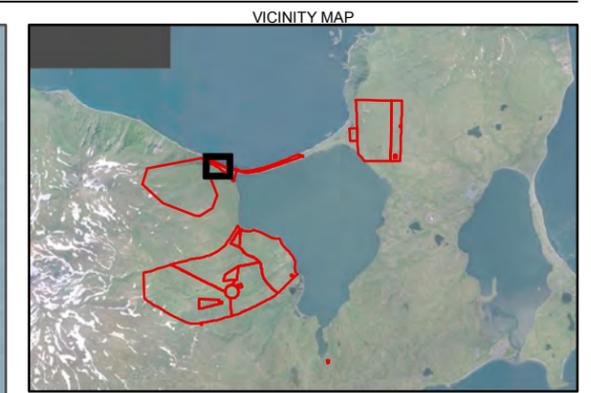
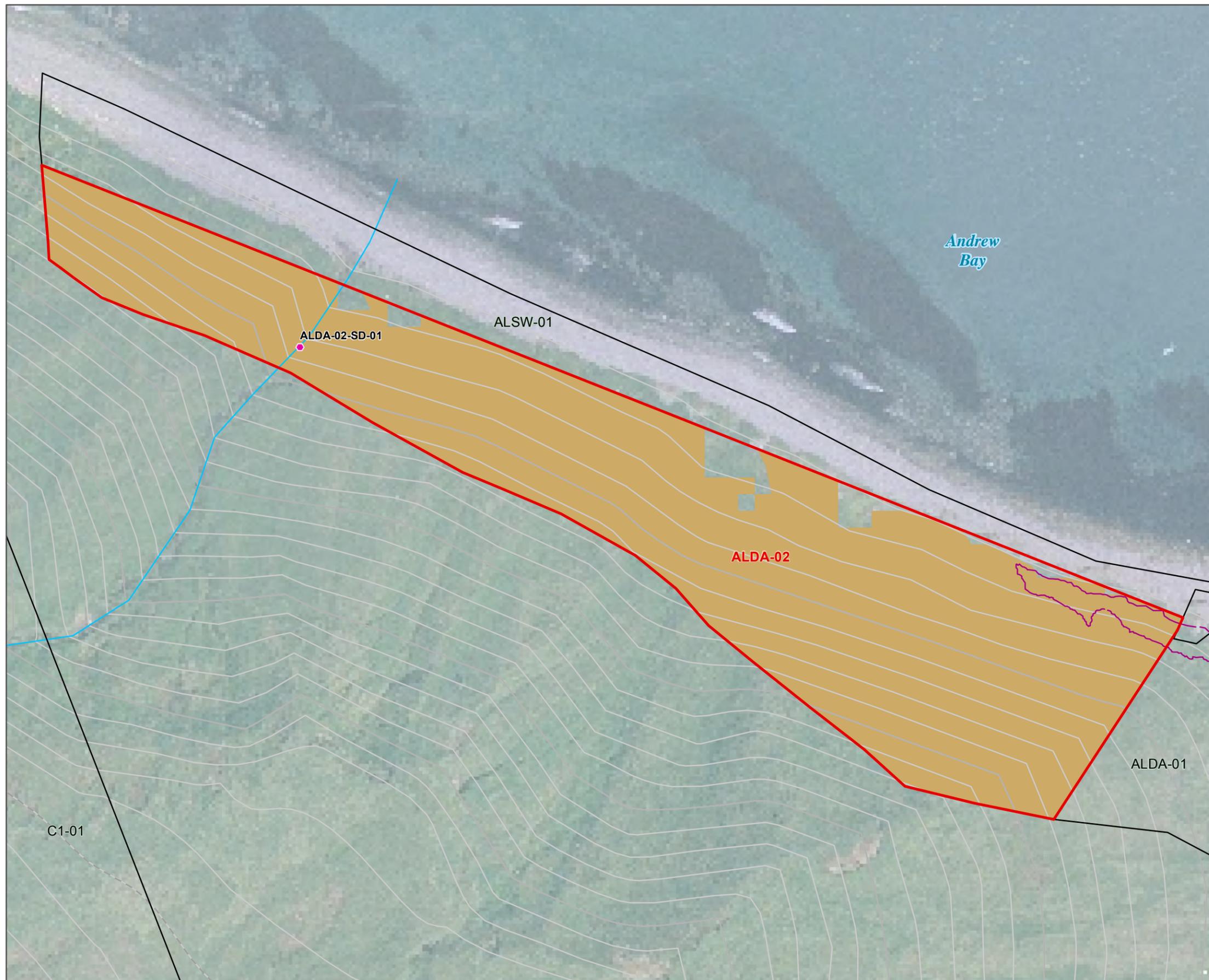
- MC Investigation**
- 2008 Soil Sample

- Topography and Site Features**
- Subject AOC
  - AOC
  - Slopes Greater Than 30 Degrees (As calculated from terrain model)
  - 500-ft Contour
  - 100-ft Contour
  - 20-ft Contour
  - Road
  - ~ Stream
  - Standing Water

Notes:  
Aerial photography: 2000 fly-over (AEROMAP)

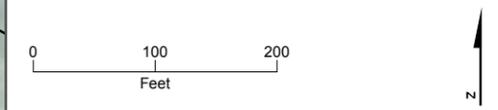


**FIGURE 5**  
**ALDA-01 2008 Investigation Results and Sample Locations**  
OU B-2 RI/FS Report - Executive Summary  
Adak Island, Alaska

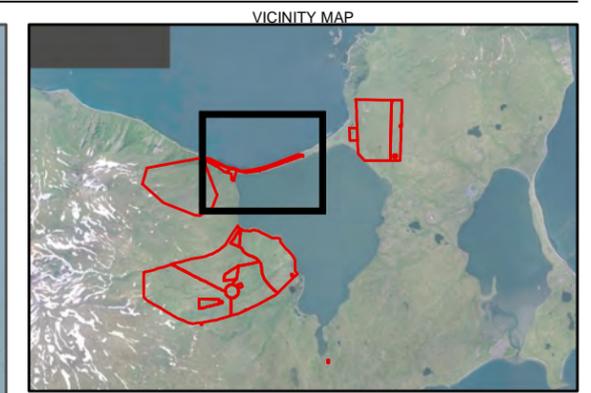
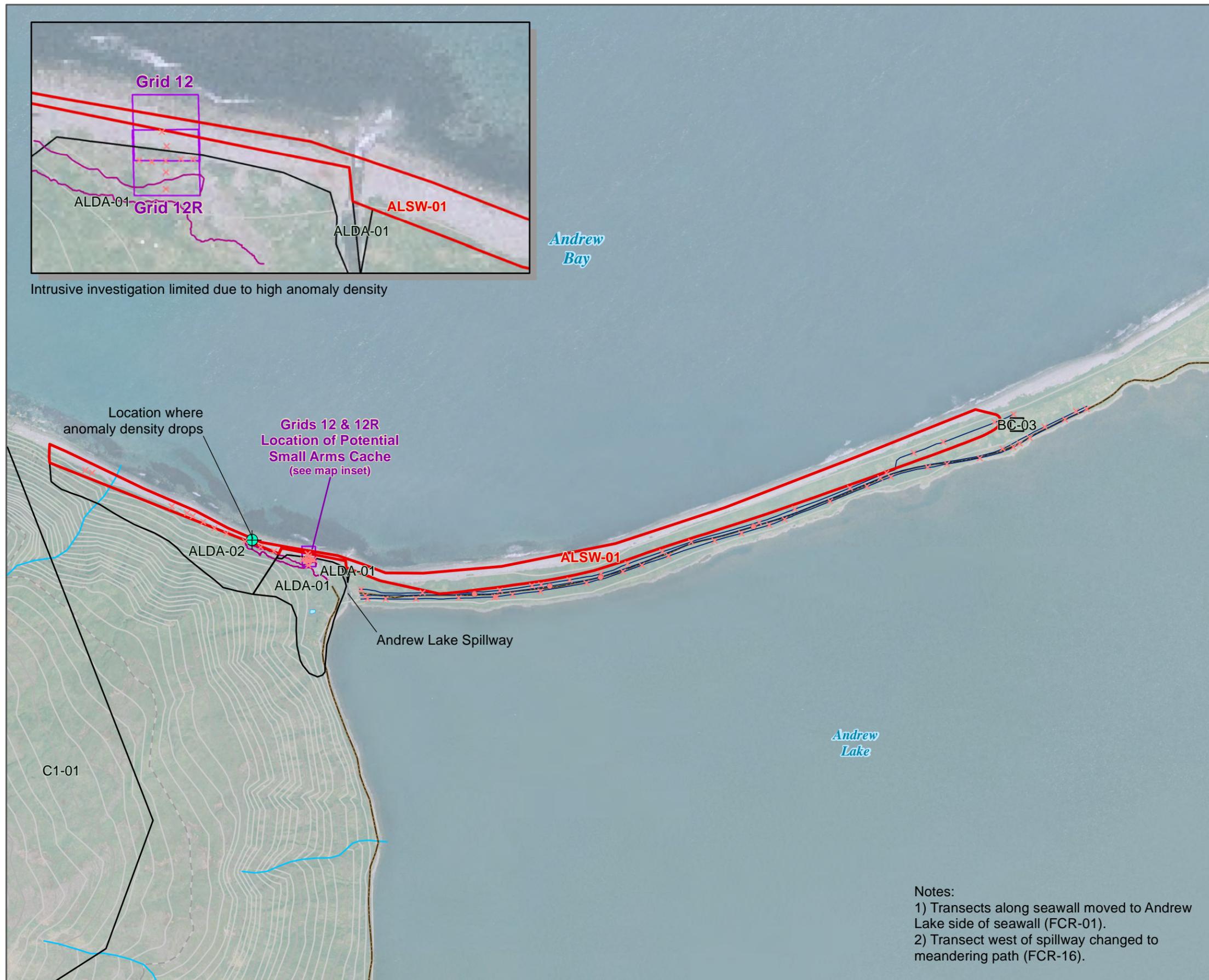


- MEC Investigation**
- ALSW-01 West Recon Transect
- MC Investigation**
- 2008 Sediment Sample
- Topography and Site Features**
- Subject AOC
  - AOC
  - Slopes Greater Than 30 Degrees (As calculated from terrain model)
  - 500-ft Contour
  - 100-ft Contour
  - 20-ft Contour
  - Road
  - Stream
  - Standing Water

Notes:  
Aerial photography: 2000 fly-over (AEROMAP)



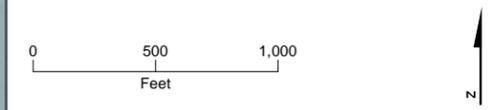
**FIGURE 6**  
**ALDA-02 2008 Sample Locations**  
OU B-2 RI/FS&A [c- Executive Summary  
Adak Island, Alaska



- MEC Investigation**
- 2008 Munitions Debris (MD)
  - × 2008 Other (not munitions-related material)
  - ALSW-01 West Recon Transect
  - Grid

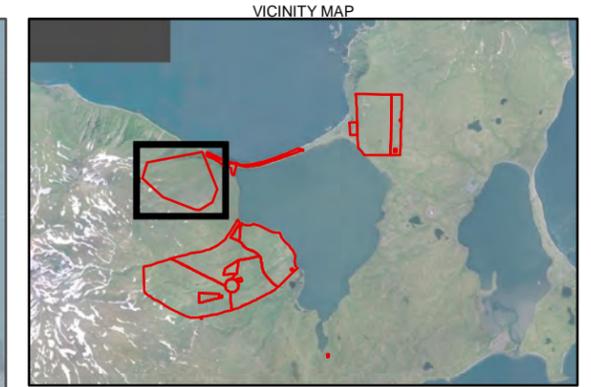
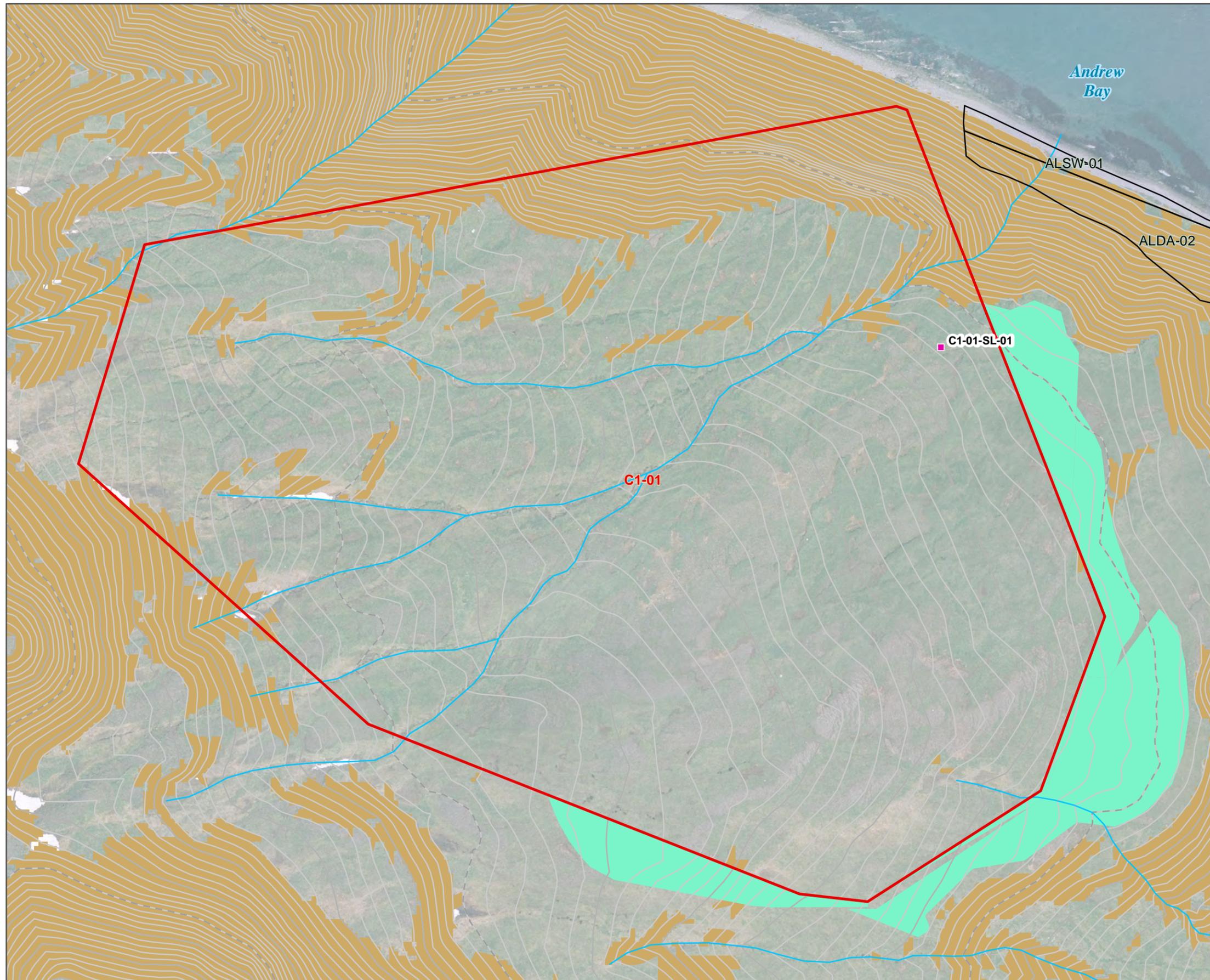
- Topography and Site Features**
- ⊕ Subject AOC
  - ⊕ AOC
  - Slopes Greater Than 30 Degrees (As calculated from terrain model)
  - ~ 500-ft Contour
  - ~ 100-ft Contour
  - ~ 20-ft Contour
  - Road
  - ~ Stream
  - ~ Standing Water

Notes:  
Aerial photography: 2000 fly-over (AEROMAP)



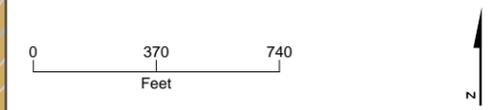
- Notes:
- 1) Transects along seawall moved to Andrew Lake side of seawall (FCR-01).
  - 2) Transect west of spillway changed to meandering path (FCR-16).

**FIGURE 7**  
**ALSW-01 2008 Investigation Results**  
OU B-2 RI/FS Report - Executive Summary  
Adak Island, Alaska

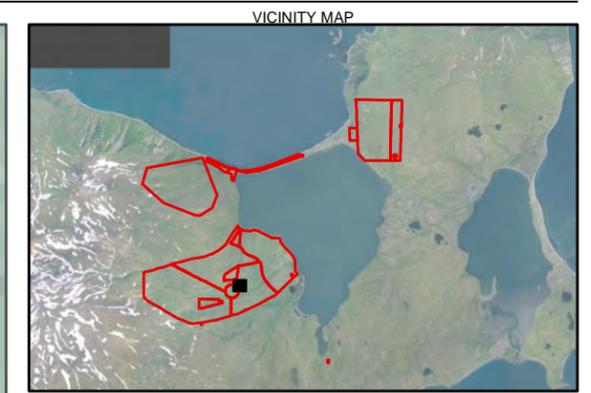
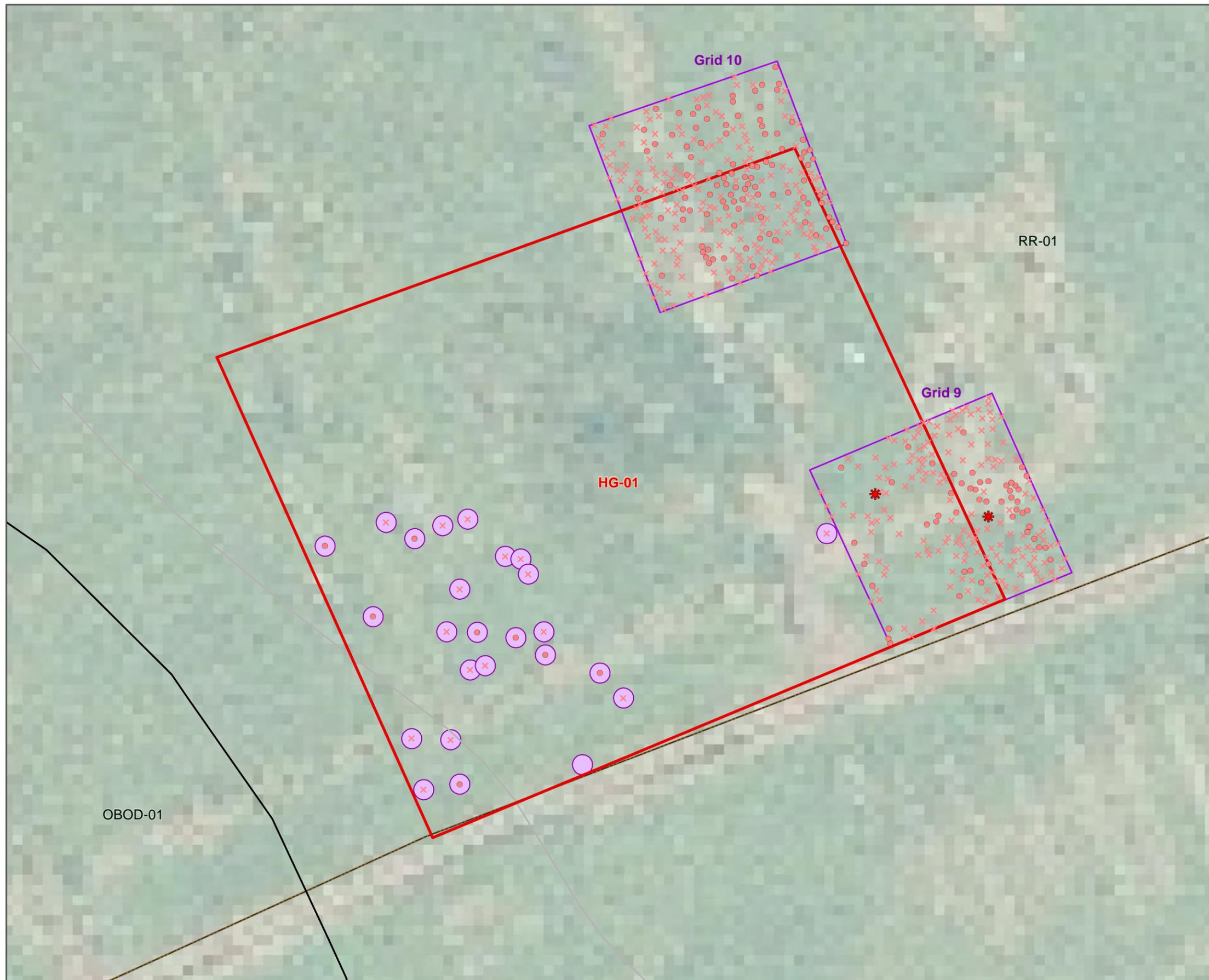


- MEC Investigation**
- Accessibility Survey Area, Slopes Greater Than 30 Degrees
- MC Investigation**
- 2008 Soil Sample
- Topography and Site Features**
- Subject AOC
  - AOC
  - Slopes Greater Than 30 Degrees (As calculated from terrain model)
  - 500-ft Contour
  - 100-ft Contour
  - 20-ft Contour
  - Road
  - Stream
  - Standing Water

Notes:  
Aerial photography: 2000 fly-over (AEROMAP)



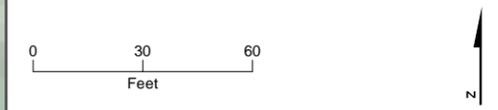
**FIGURE ,**  
**C1-01 2008 Sample Locations**  
OU B-2 RI/FS Report - Executive Summary  
Adak Island, Alaska



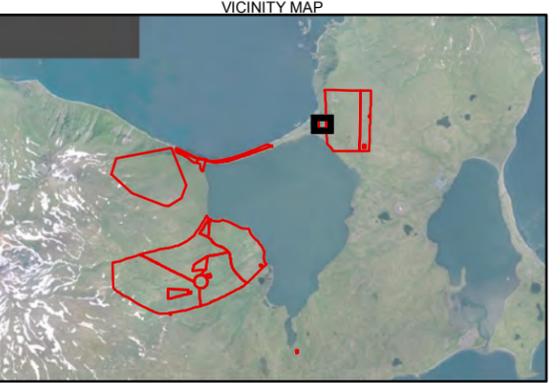
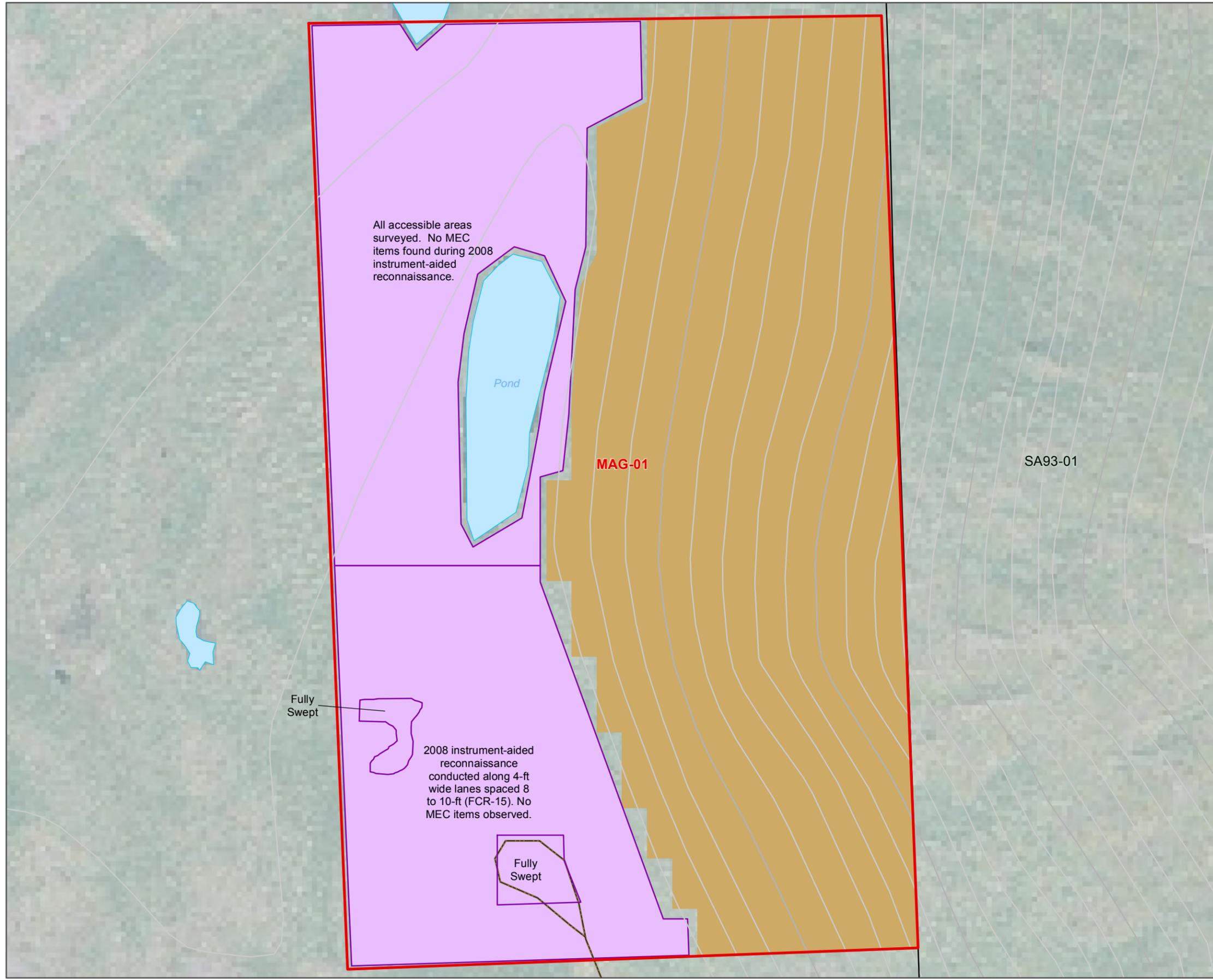
- MEC Investigation**
- \* 2008 Unexploded Ordnance (UXO)
  - 2008 Munitions Debris (MD)
  - × 2008 Other (not munitions-related material)
  - Grid
  - Previously Identified Uninvestigated Anomaly

- Topography and Site Features**
- ⊕ Subject AOC
  - ⊕ AOC
  - ~ 500-ft Contour
  - ~ 100-ft Contour
  - ~ 20-ft Contour
  - Road
  - ~ Stream
  - ~ Standing Water

Notes:  
Aerial photography: 2000 fly-over (AEROMAP)

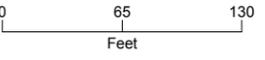


**FIGURE 9**  
**HG-01 2008 Investigation Results**  
OU B-2 RI/FS Report - Executive Summary  
Adak Island, Alaska

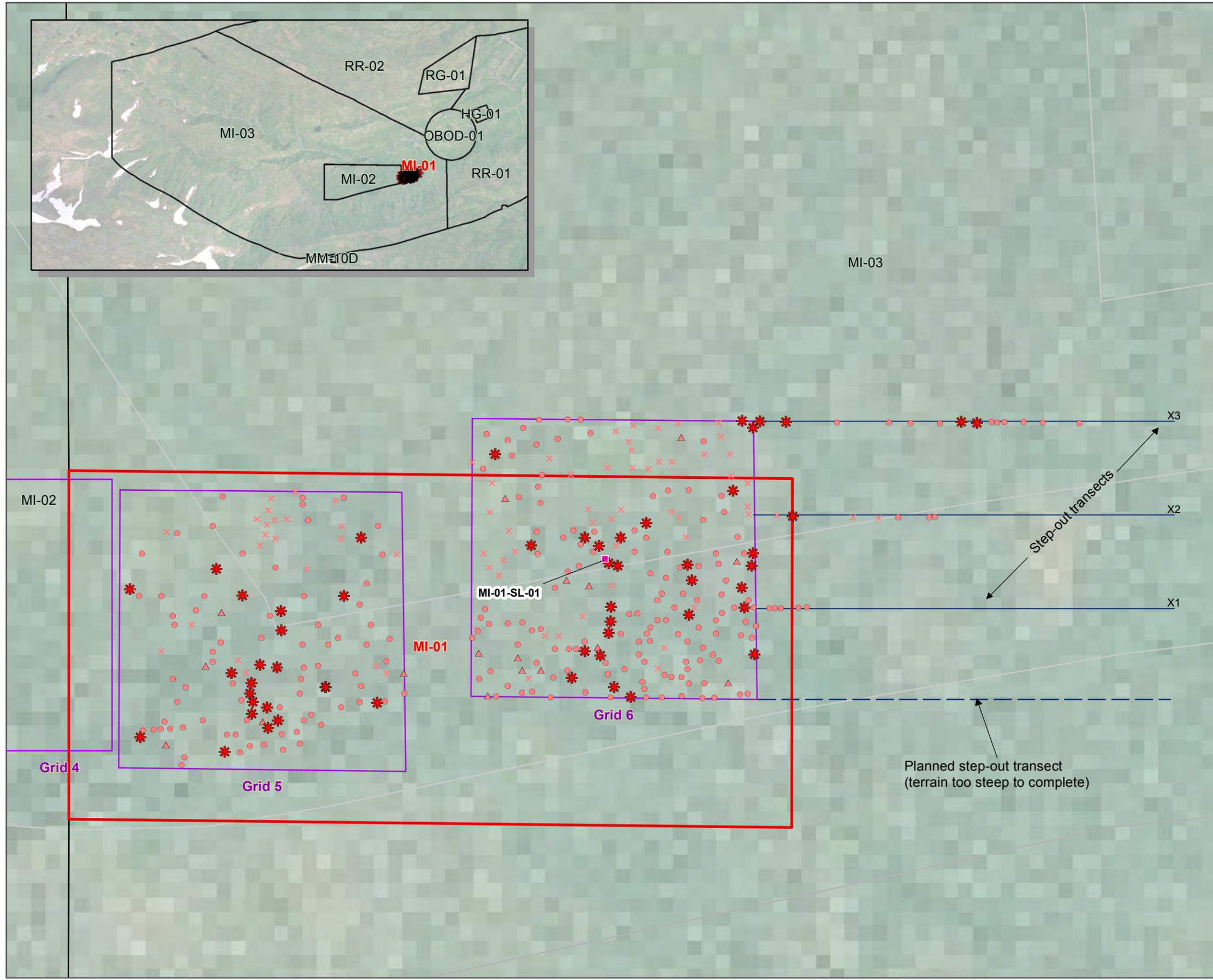
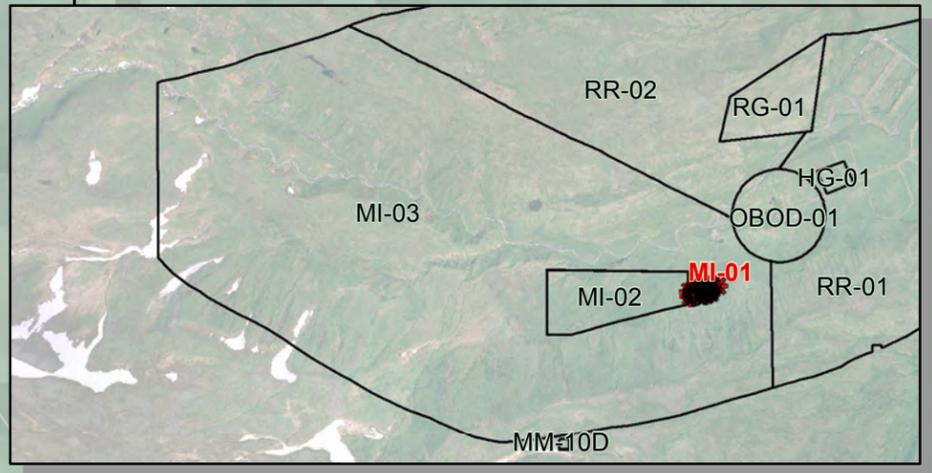


- MEC Investigation**
- Instrument Aided Visual Reconnaissance
- Topography and Site Features**
- Subject AOC
  - AOC
  - Slopes Greater Than 30 Degrees (As calculated from terrain model)
  - 500-ft Contour
  - 100-ft Contour
  - 20-ft Contour
  - Road
  - Stream
  - Standing Water

Notes:  
Aerial photography: 2000 fly-over (AEROMAP)



**FIGURE 10**  
**MAG-01 2008 Investigation Results**  
OU B-2 RI/FS Report - Executive Summary  
Adak Island, Alaska



**MEC Investigation**

- 2008 Unexploded Ordnance (UXO)
- 2008 Material Presenting Potential Explosive Hazard (MPPEH)
- 2008 Munitions Debris (MD)
- 2008 Other (not munitions-related material)
- 2008 Geophysical Survey Transect
- Grid
- Instrument Aided Visual Reconnaissance

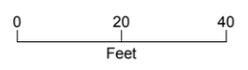
**MC Investigation**

- 2008 Soil Sample

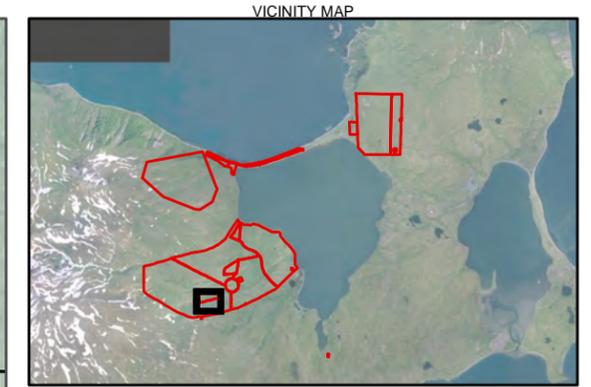
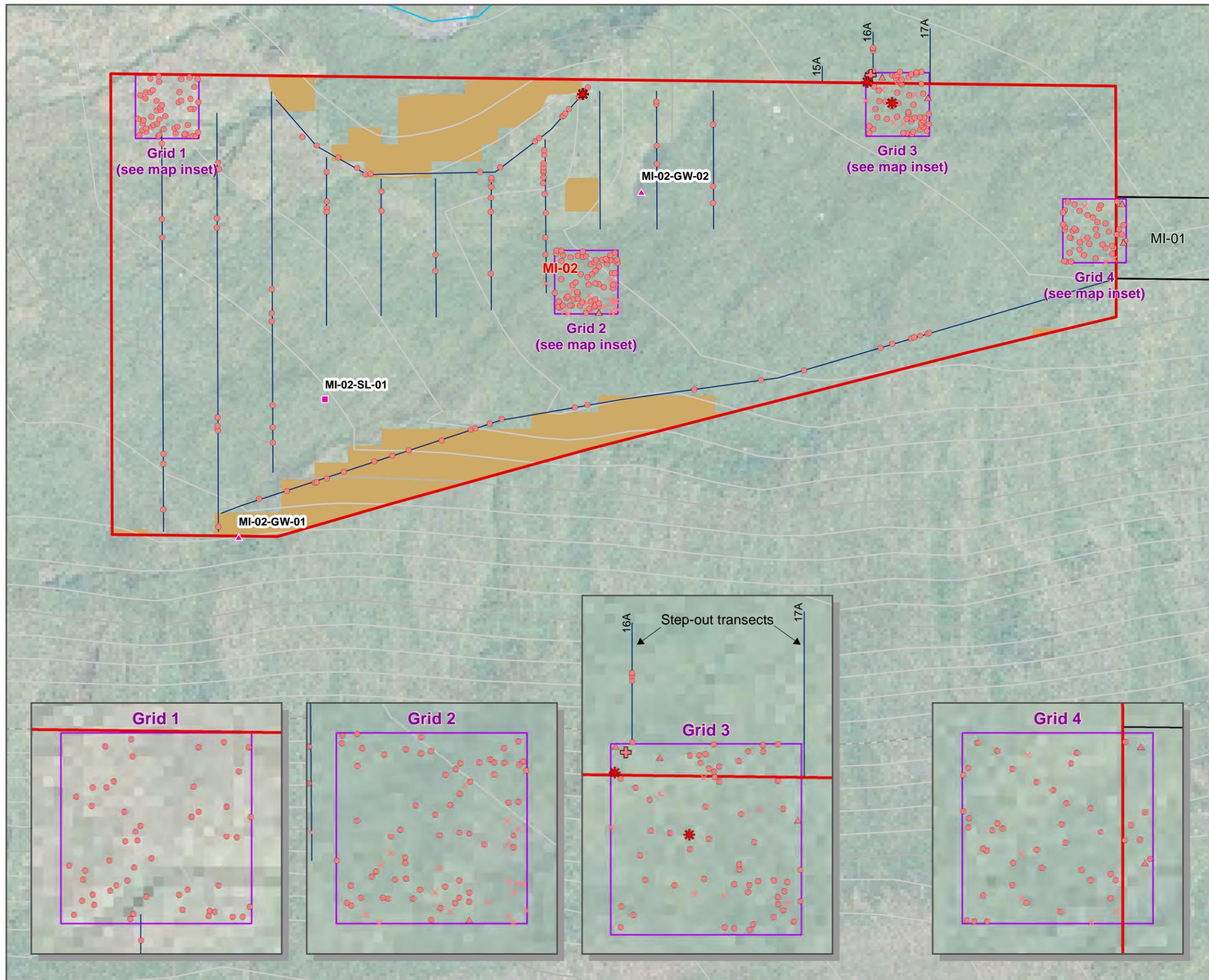
**Topography and Site Features**

- Subject AOC
- AOC
- 500-ft Contour
- 100-ft Contour
- 20-ft Contour
- Road
- Stream
- Standing Water

Notes:  
Aerial photography: 2000 fly-over (AEROMAP)

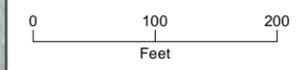


**FIGURE 11**  
**MI-01 2008 Investigation Results and Sample Locations**  
OU B-2 RI/FS Report - Executive Summary  
Adak Island, Alaska

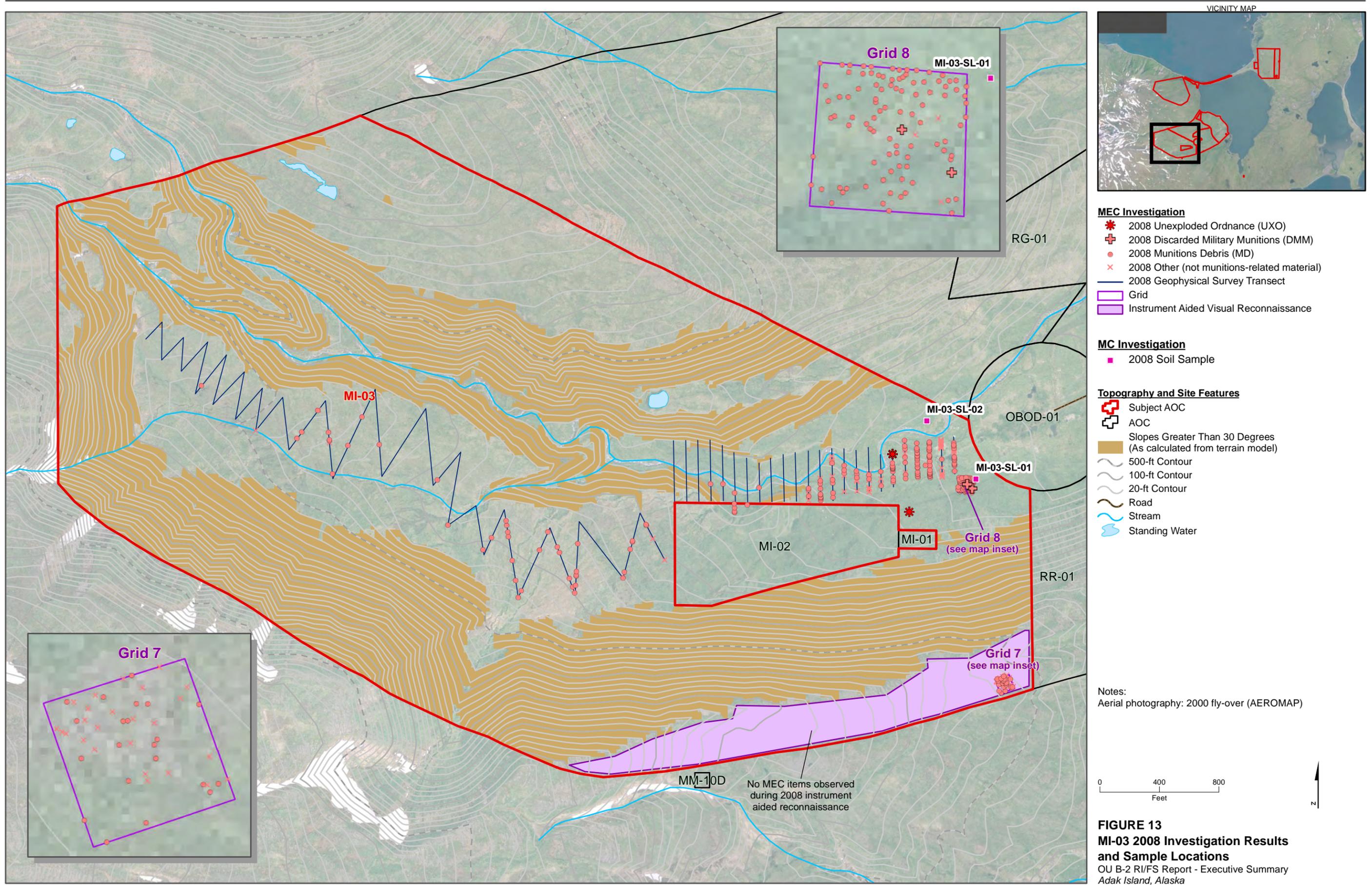


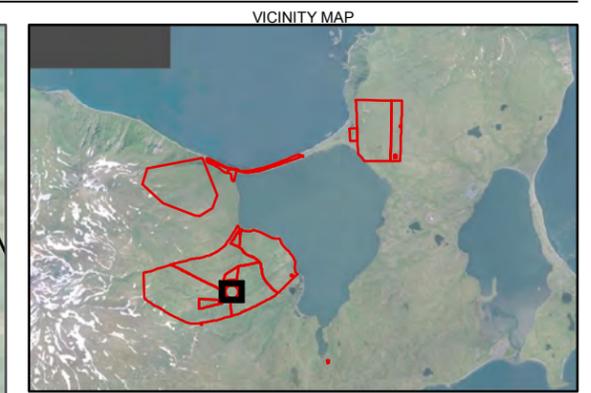
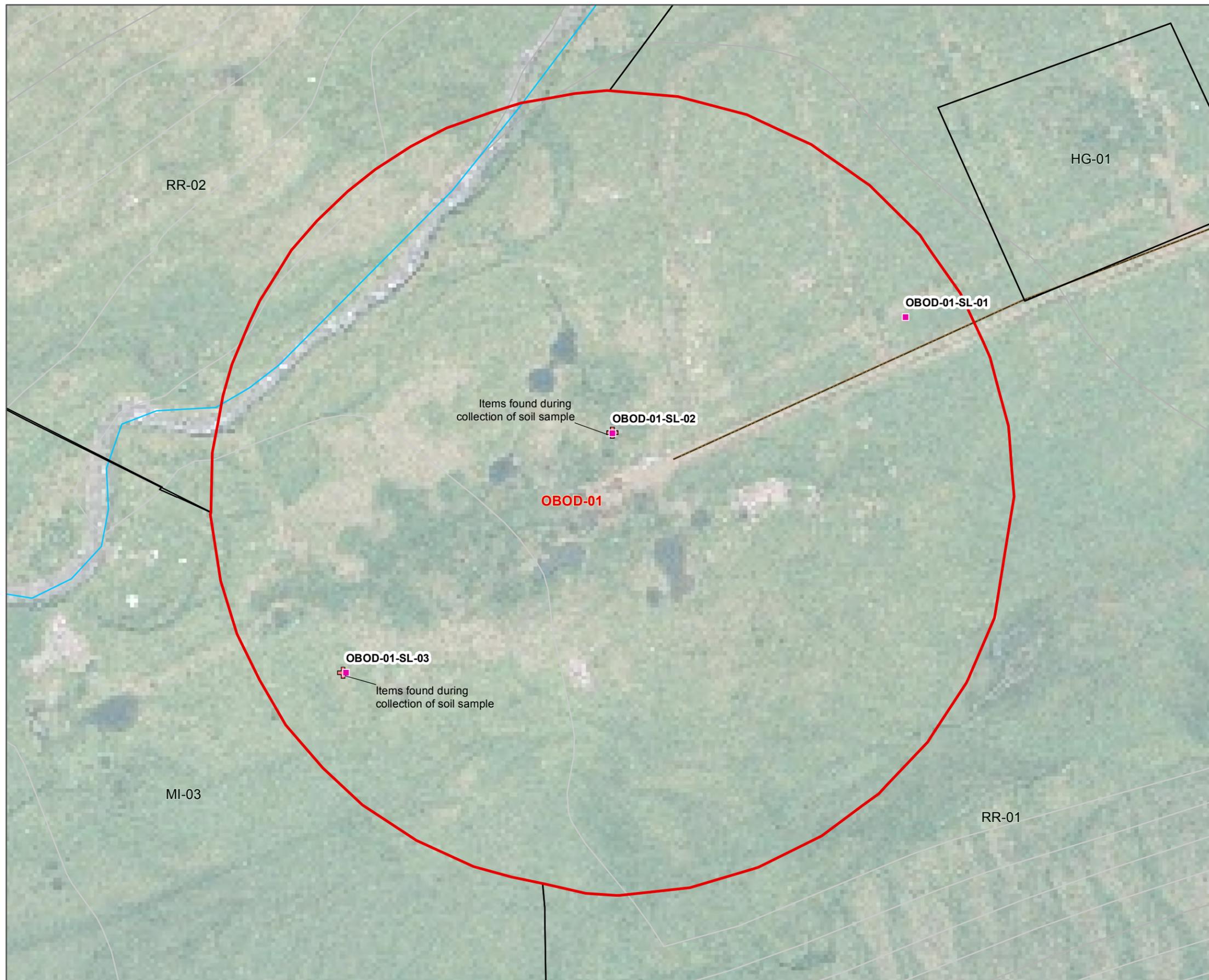
- MEC Investigation**
- \* 2008 Unexploded Ordnance (UXO)
  - + 2008 Discarded Military Munitions (DMM)
  - ▲ 2008 Material Presenting Potential Explosive Hazard (MPPEH)
  - 2008 Munitions Debris (MD)
  - × 2008 Other (not munitions-related material)
  - 2008 Geophysical Survey Transect
  - Grid
- MC Investigation**
- ▲ 2008 Groundwater Sample
  - 2008 Soil Sample
- Topography and Site Features**
- ⊕ Subject AOC
  - ⊕ AOC
  - Slopes Greater Than 30 Degrees (As calculated from terrain model)
  - ~ 500-ft Contour
  - ~ 100-ft Contour
  - ~ 20-ft Contour
  - Road
  - ~ Stream
  - ~ Standing Water

Notes:  
Aerial photography: 2000 fly-over (AEROMAP)



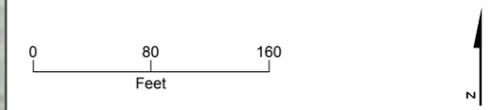
**FIGURE 12**  
**MI-02 2008 Investigation Results and Sample Locations**  
OU B-2 RI/FS Report - Executive Summary  
Adak Island, Alaska



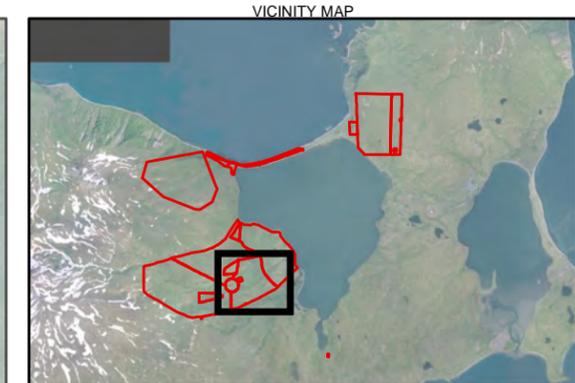
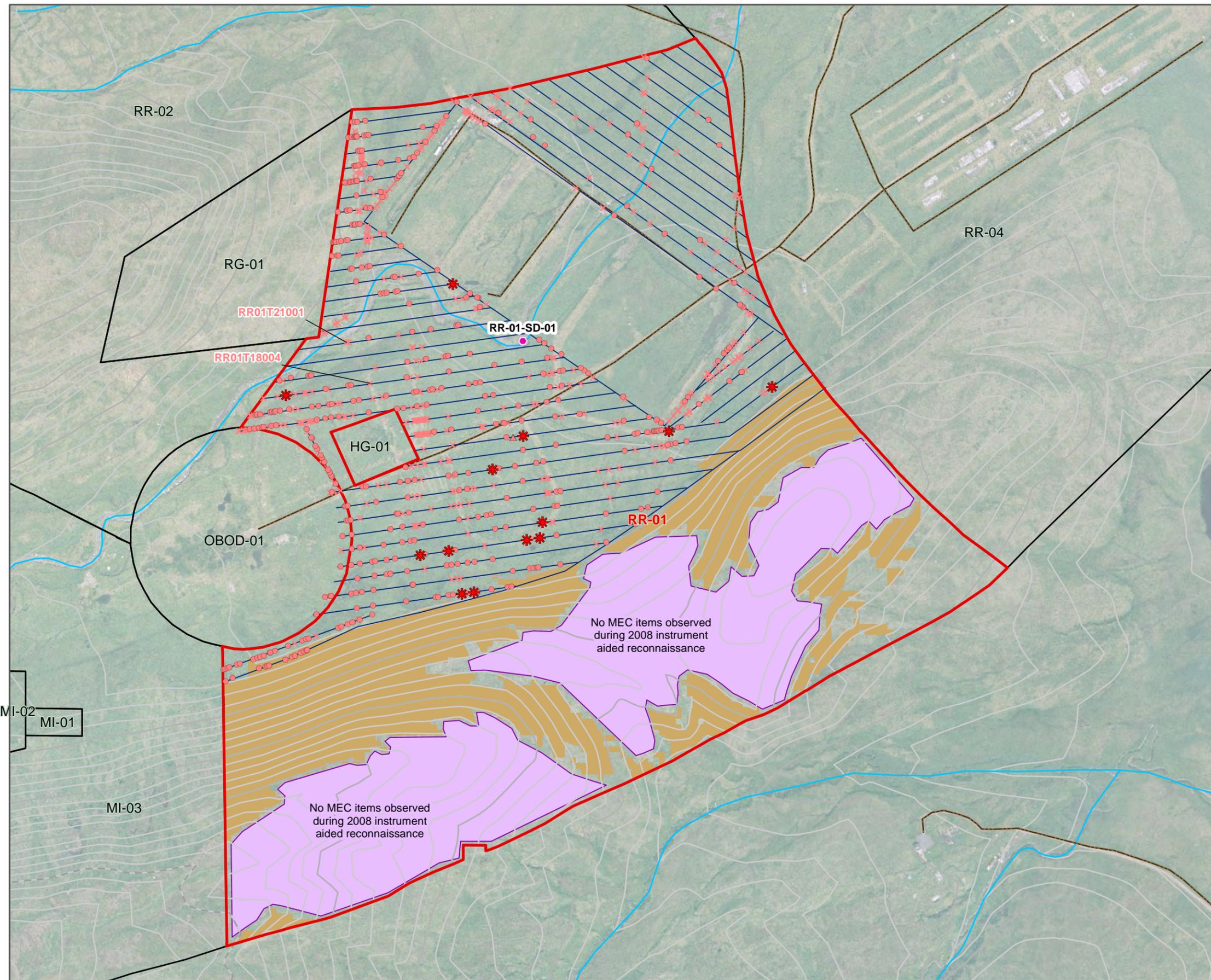


- MEC Investigation**
- 2008 Discarded Military Munitions (DMM)
- MC Investigation**
- 2008 Soil Sample
- Topography and Site Features**
- Subject AOC
  - AOC
  - 500-ft Contour
  - 100-ft Contour
  - 20-ft Contour
  - Road
  - Stream
  - Standing Water

Notes:  
Aerial photography: 2000 fly-over (AEROMAP)



**FIGURE 14**  
**OB/OD-01 2008 Sample Locations**  
OU B-2 RI/FS Report - Executive Summary  
Adak Island, Alaska



**MEC Investigation**

- \* 2008 Unexploded Ordnance (UXO)
- ▲ 2008 Material Presenting Potential Explosive Hazard (MPPEH)
- 2008 Munitions Debris (MD)
- × 2008 Other (not munitions-related material)
- 2008 Geophysical Survey Transect
- Instrument Aided Visual Reconnaissance

**MC Investigation**

- 2008 Sediment Sample

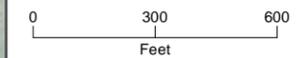
**Topography and Site Features**

- Subject AOC
- AOC
- Slopes Greater Than 30 Degrees (As calculated from terrain model)
- 500-ft Contour
- 100-ft Contour
- 20-ft Contour
- Road
- Stream
- Standing Water

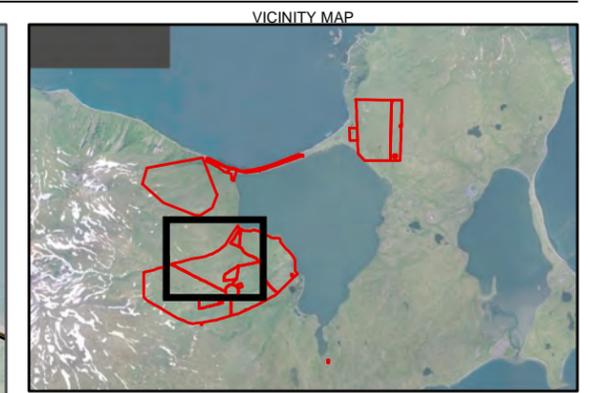
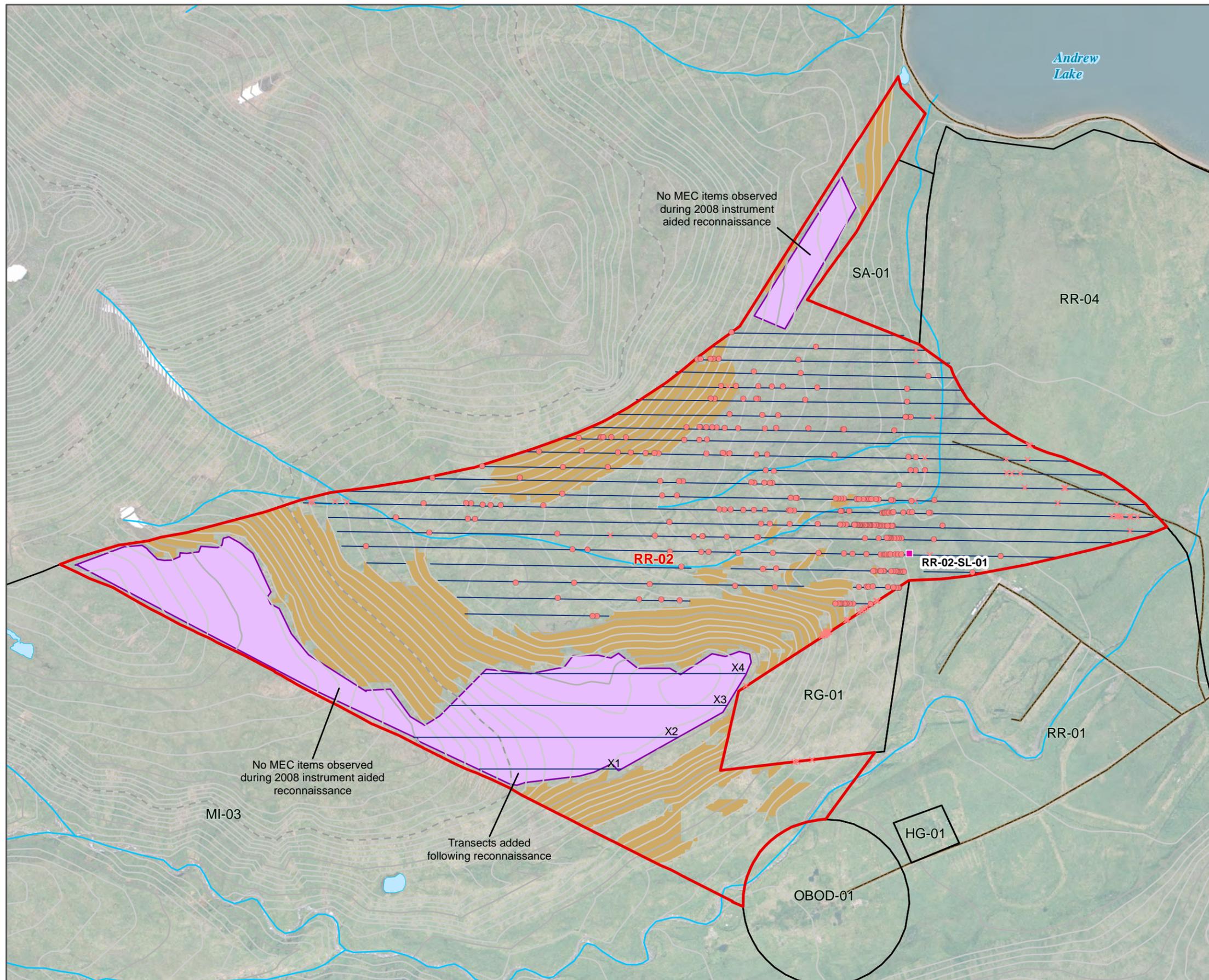
**Notes:**

Aerial photography: 2000 fly-over (AEROMAP)

The labeled anomalies are locations where the target appeared to be greater than 2 feet below mineral soil.

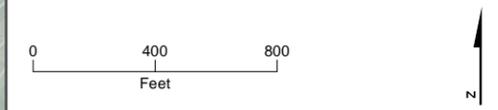


**FIGURE 15**  
**RR-01 2008 Investigation Results and Sample Locations**  
 OU B-2 RI/FS Report - Executive Summary  
 Adak Island, Alaska

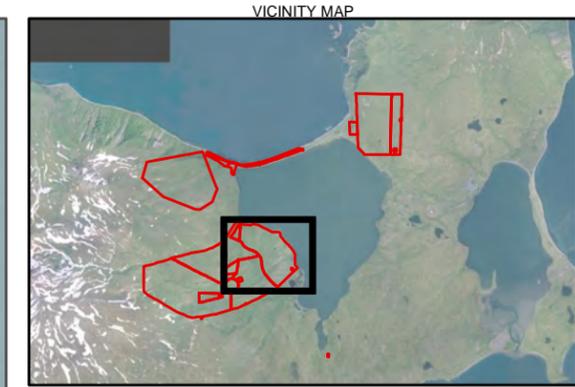
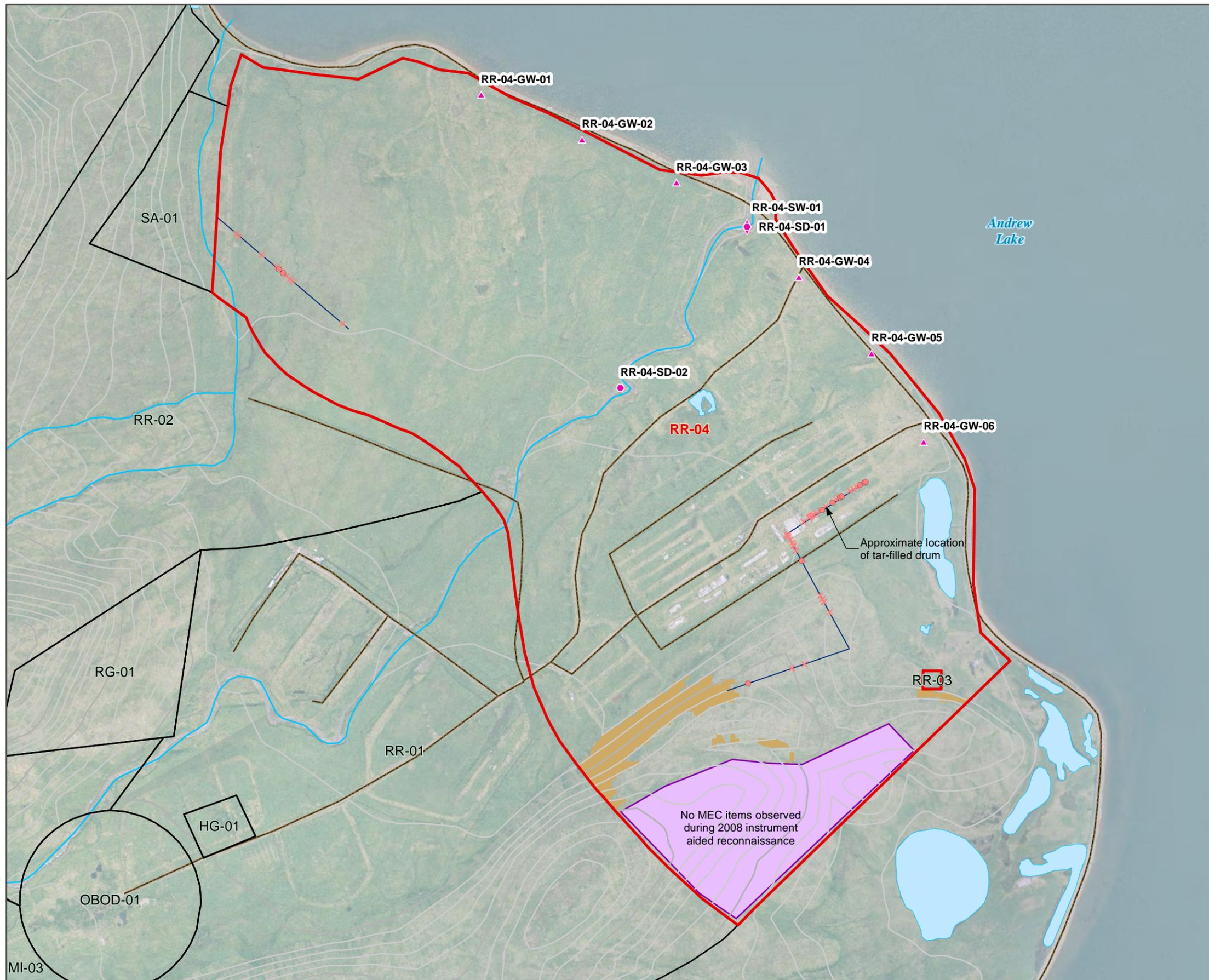


- MEC Investigation**
- 2008 Munitions Debris (MD)
  - × 2008 Other (not munitions-related material)
  - 2008 Geophysical Survey Transect
  - Instrument Aided Visual Reconnaissance
- MC Investigation**
- 2008 Soil Sample
- Topography and Site Features**
- Subject AOC
  - AOC
  - Slopes Greater Than 30 Degrees (As calculated from terrain model)
  - 500-ft Contour
  - 100-ft Contour
  - 20-ft Contour
  - Road
  - Stream
  - Standing Water

Notes:  
Aerial photography: 2000 fly-over (AEROMAP)

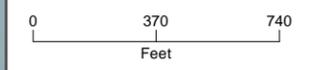


**FIGURE 16**  
**RR-02 2008 Investigation Results and Sample Locations**  
OU B-2 RI/FS Report - Executive Summary  
Adak Island, Alaska

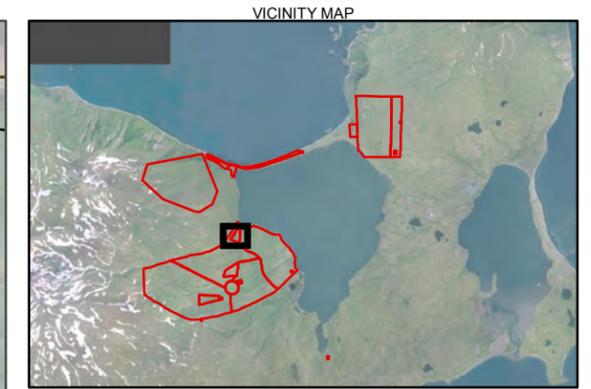
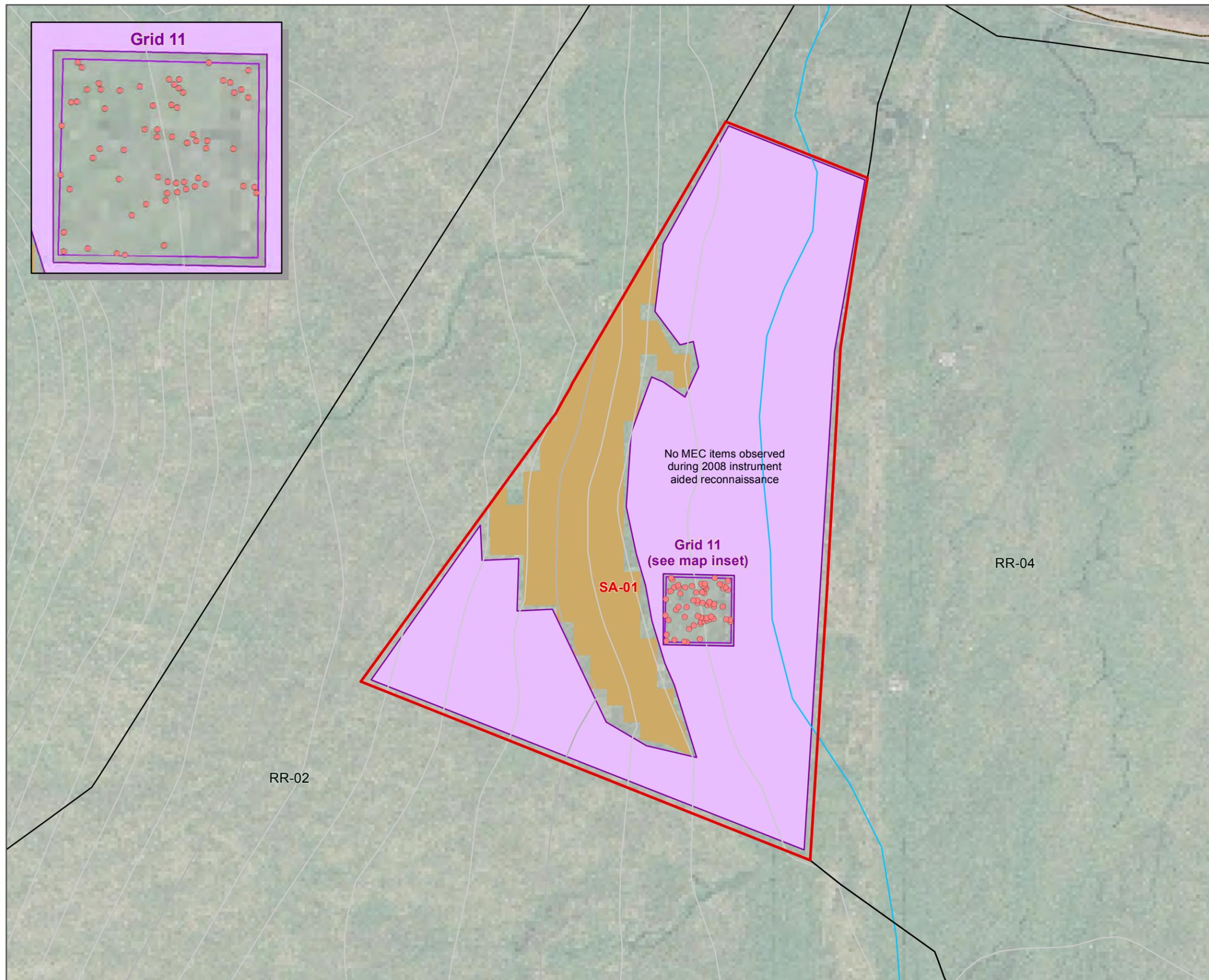


- MEC Investigation**
- 2008 Munitions Debris (MD)
  - ✕ 2008 Other (not munitions-related material)
  - 2008 Geophysical Survey Transect
  - ▭ Instrument Aided Visual Reconnaissance
- MC Investigation**
- ▲ 2008 Groundwater Sample
  - ◆ 2008 Surface Water Sample
  - 2008 Sediment Sample
- Topography and Site Features**
- ▭ Subject AOC
  - ▭ AOC
  - ▭ Slopes Greater Than 30 Degrees (As calculated from terrain model)
  - 500-ft Contour
  - 100-ft Contour
  - 20-ft Contour
  - Road
  - Stream
  - Standing Water

Notes:  
Aerial photography: 2000 fly-over (AEROMAP)



**FIGURE 17**  
**RR-04 2008 Investigation Results and Sample Locations**  
OU B-2 RI/FS Report - Executive Summary  
Adak Island, Alaska



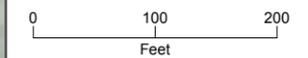
**MEC Investigation**

- 2008 Munitions Debris (MD)
- Grid
- Instrument Aided Visual Reconnaissance

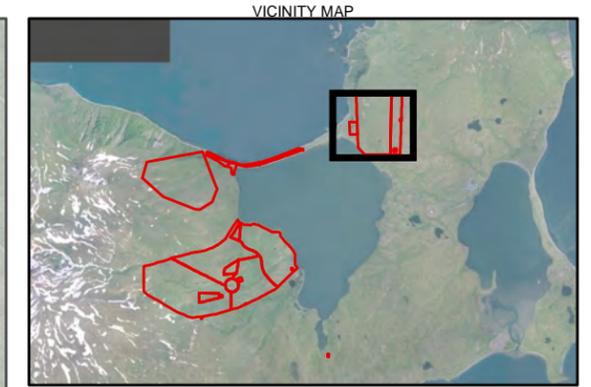
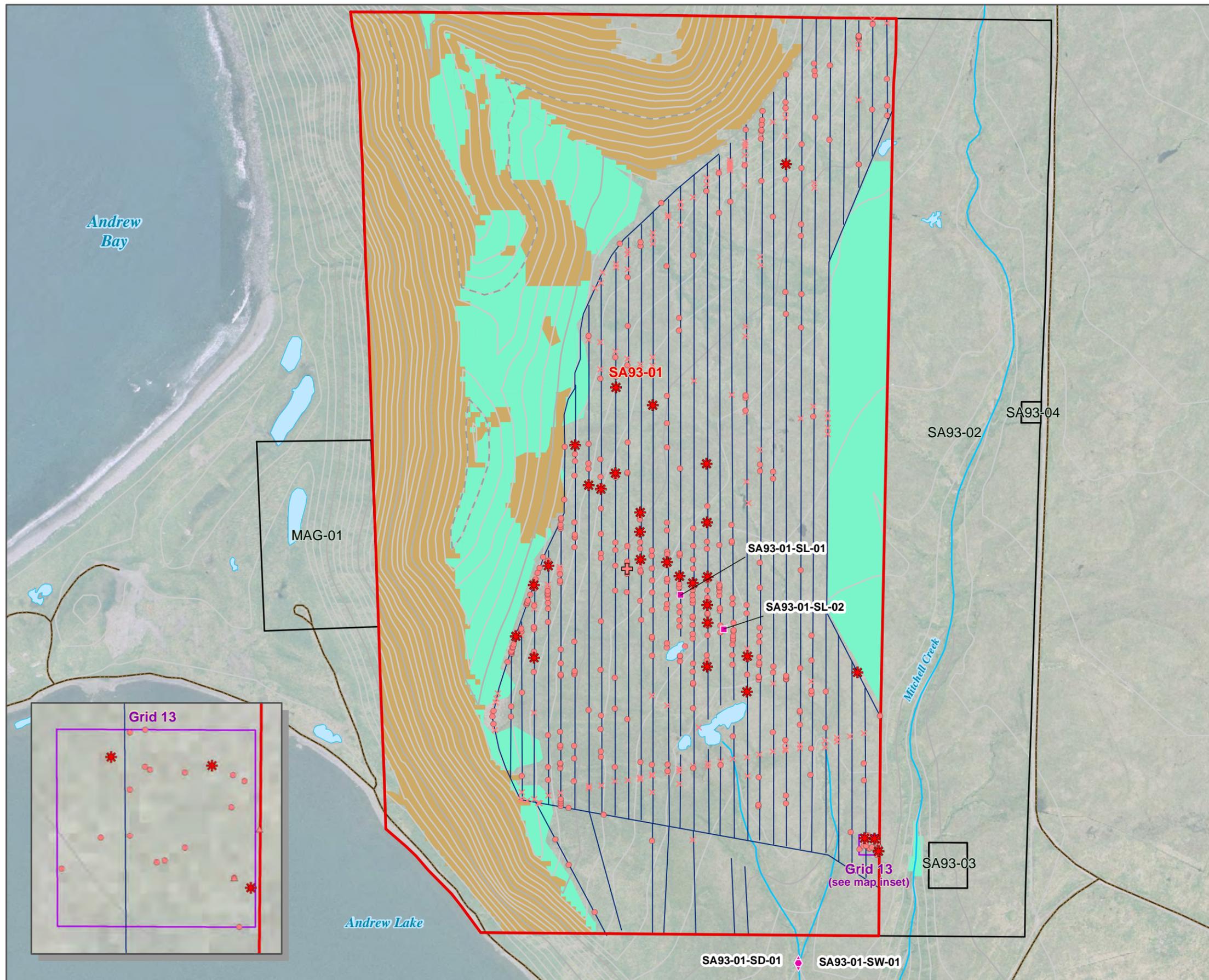
**Topography and Site Features**

- ⊕ Subject AOC
- AOC
- Slopes Greater Than 30 Degrees (As calculated from terrain model)
- ~ 500-ft Contour
- ~ 100-ft Contour
- ~ 20-ft Contour
- Road
- ~ Stream
- ~ Standing Water

Notes:  
Aerial photography: 2000 fly-over (AEROMAP)



**FIGURE 18**  
**SA-01 2008 Investigation Results**  
OU B-2 RI/FS Report - Executive Summary  
Adak Island, Alaska

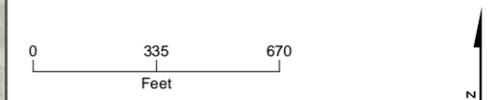


- MEC Investigation**
- \* 2008 Unexploded Ordnance (UXO)
  - + 2008 Discarded Military Munitions (DMM)
  - ▲ 2008 Material Presenting Potential Explosive Hazard (MPPEH)
  - 2008 Munitions Debris (MD)
  - × 2008 Other (not munitions-related material)
  - 2008 Geophysical Survey Transect
  - Grid
  - Accessibility Survey Area, Slopes Greater Than 30 Degrees

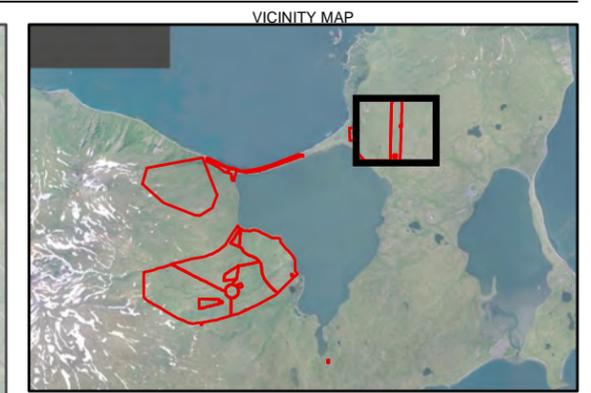
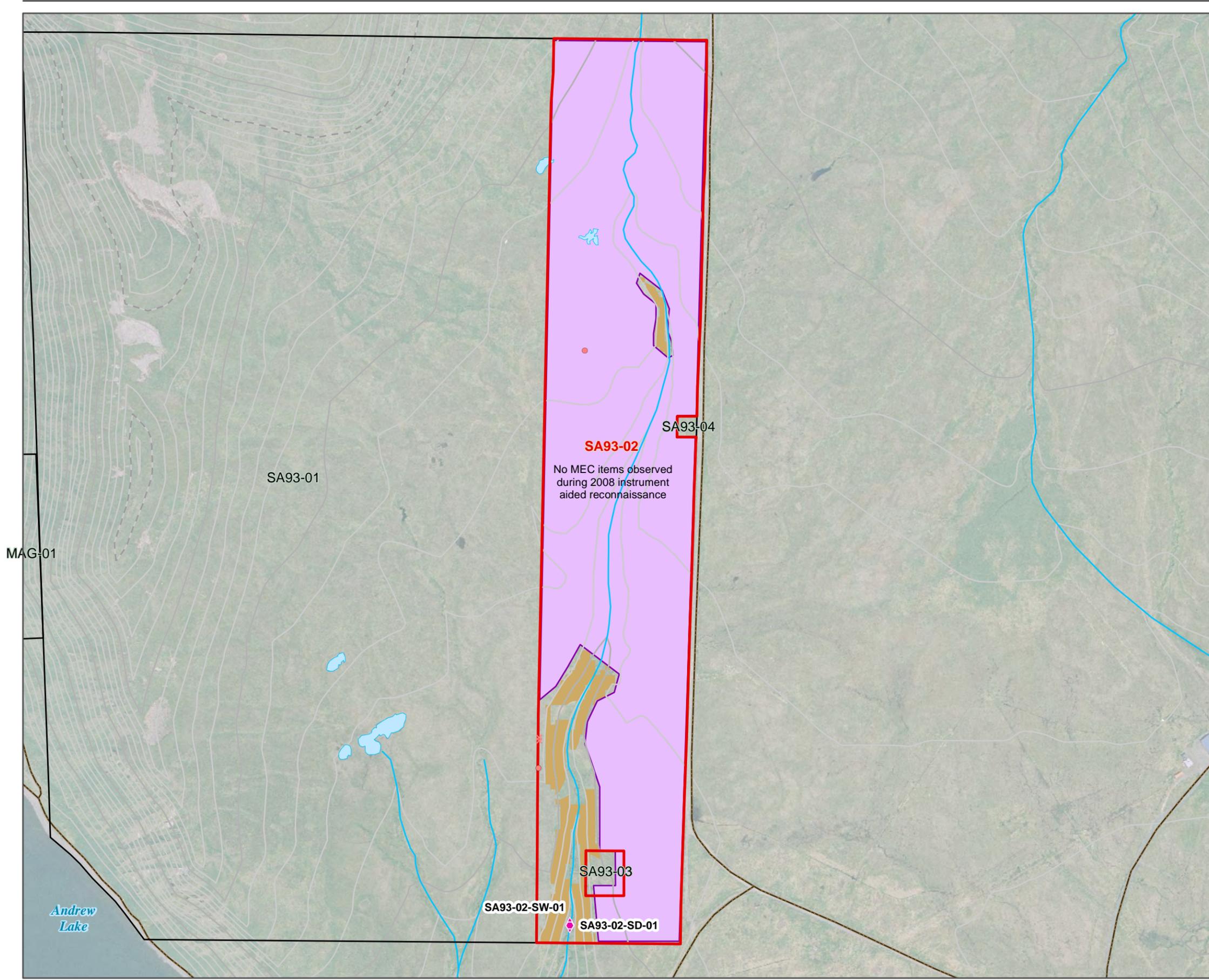
- MC Investigation**
- ◆ 2008 Surface Water Sample
  - 2008 Sediment Sample
  - 2008 Soil Sample

- Topography and Site Features**
- Subject AOC
  - AOC
  - Slopes Greater Than 30 Degrees (As calculated from terrain model)
  - 500-ft Contour
  - 100-ft Contour
  - 20-ft Contour
  - Road
  - Stream
  - Standing Water

Notes:  
Aerial photography: 2000 fly-over (AEROMAP)



**FIGURE 19**  
**SA93-01 2008 Investigation Results and Sample Locations**  
OU B-2 RI/FS Report - Executive Summary  
Adak Island, Alaska

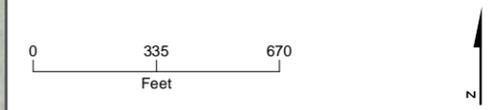


- MEC Investigation**
- 2008 Munitions Debris (MD)
  - × 2008 Other (not munitions-related material)
  - Instrument Aided Visual Reconnaissance

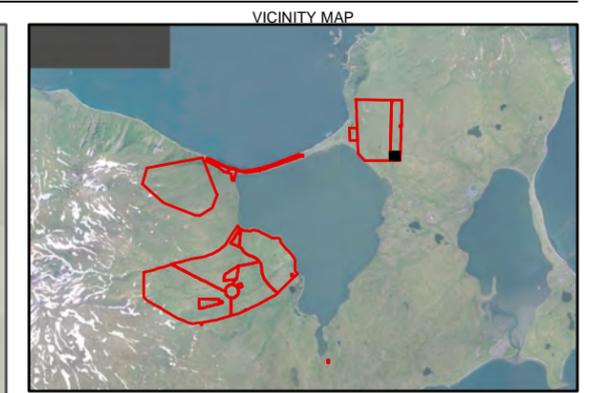
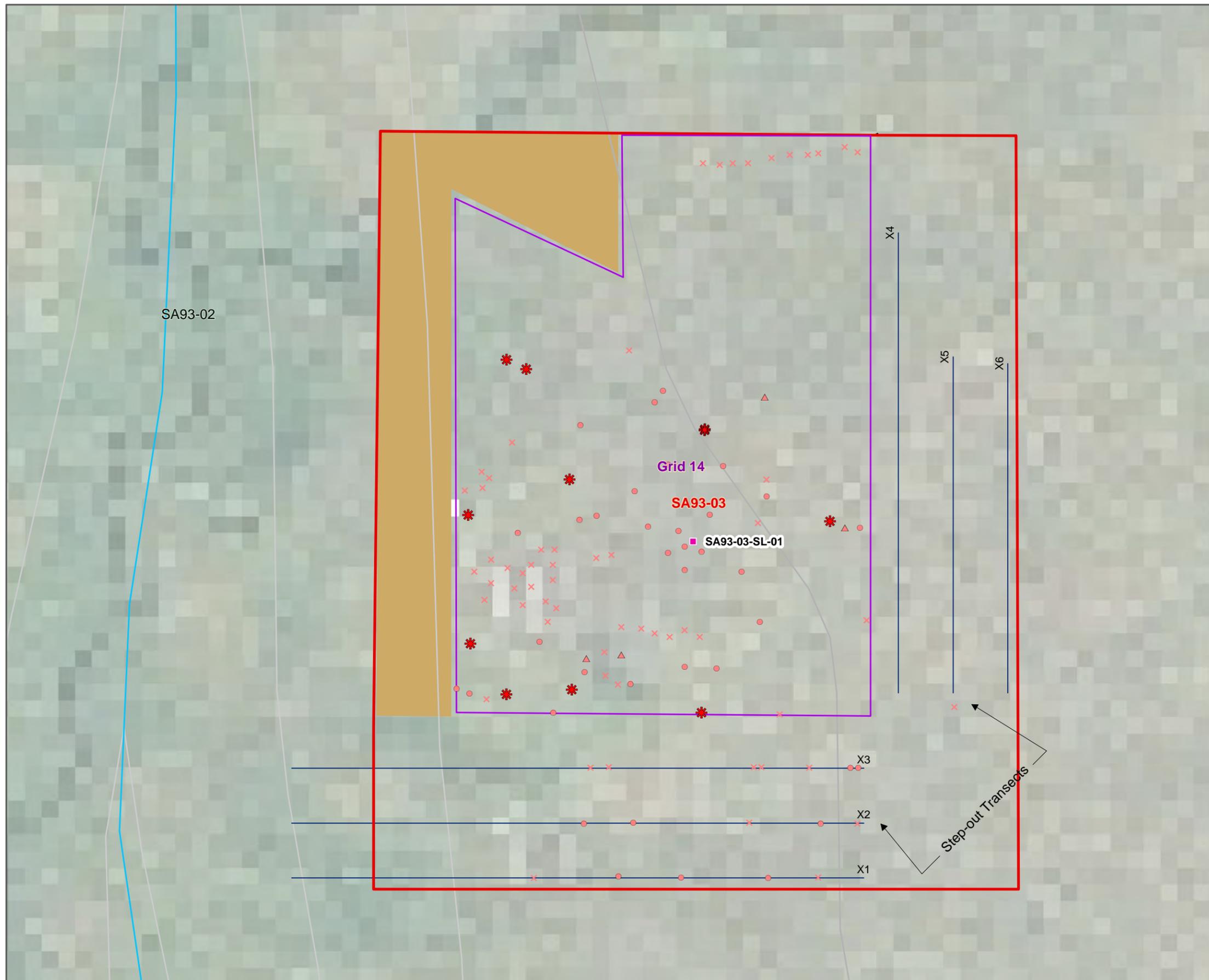
- MC Investigation**
- ◆ 2008 Surface Water Sample
  - 2008 Sediment Sample

- Topography and Site Features**
- Subject AOC
  - AOC
  - Slopes Greater Than 30 Degrees (As calculated from terrain model)
  - 500-ft Contour
  - 100-ft Contour
  - 20-ft Contour
  - Road
  - Stream
  - Standing Water

Notes:  
Aerial photography: 2000 fly-over (AEROMAP)



**FIGURE 20**  
**SA93-02 2008 Investigation Results and Sample Locations**  
 OU B-2 RI/FS Report - Executive Summary  
 Adak Island, Alaska

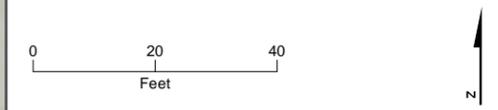


- MEC Investigation**
- \* 2008 Unexploded Ordnance (UXO)
  - 2008 Munitions Debris (MD)
  - × 2008 Other (not munitions-related material)
  - 2008 Geophysical Survey Transect
  - Grid

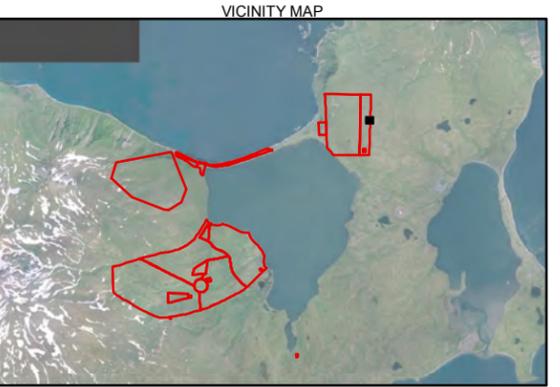
- MC Investigation**
- 2008 Soil Sample

- Topography and Site Features**
- ⊞ Subject AOC
  - ⊞ AOC
  - Slopes Greater Than 30 Degrees (As calculated from terrain model)
  - ~ 500-ft Contour
  - ~ 100-ft Contour
  - ~ 20-ft Contour
  - Road
  - Stream
  - Standing Water

Notes:  
Aerial photography: 2000 fly-over (AEROMAP)



**FIGURE 21**  
**SA93-03 2008 Investigation Results**  
OU B-2 RI/FS Report - Executive Summary  
Adak Island, Alaska



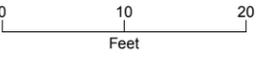
**MEC Investigation**  
 Instrument Aided Visual Reconnaissance

- Topography and Site Features**
- Subject AOC
  - AOC
  - Slopes Greater Than 30 Degrees  
(As calculated from terrain model)
  - 500-ft Contour
  - 100-ft Contour
  - 20-ft Contour
  - Road
  - Stream
  - Standing Water

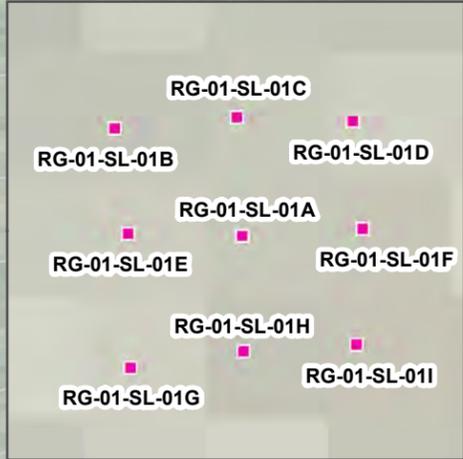
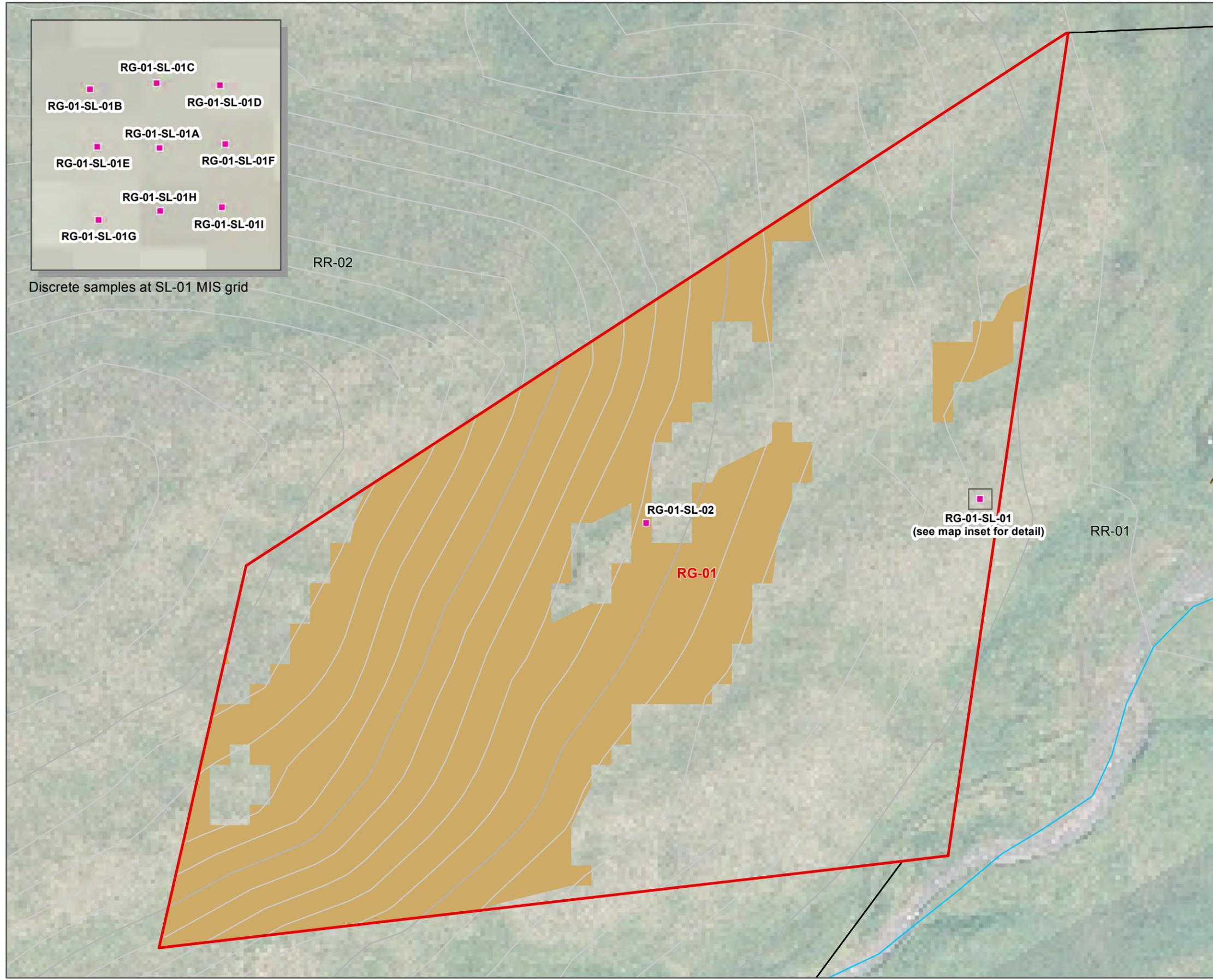
**SA93-04**  
 No MEC items observed  
 during 2008 instrument  
 aided reconnaissance

SA93-02

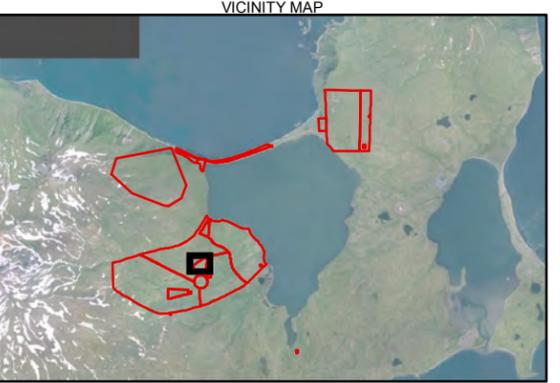
Notes:  
 Aerial photography: 2000 fly-over (AEROMAP)



**FIGURE 22**  
**SA93-04 2008 Investigation Results**  
 OU B-2 RI/FS Report - Executive Summary  
 Adak Island, Alaska



Discrete samples at SL-01 MIS grid



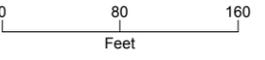
**MC Investigation**

- 2008 Soil Sample

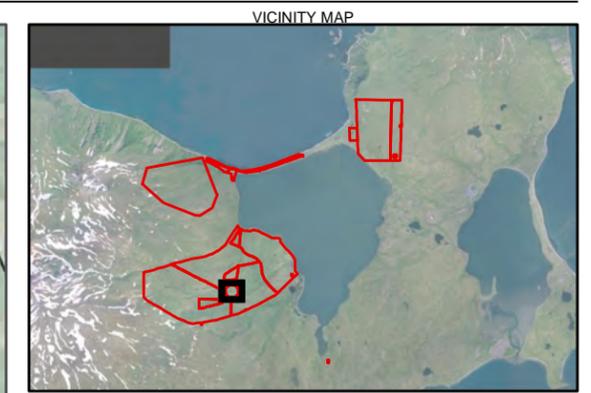
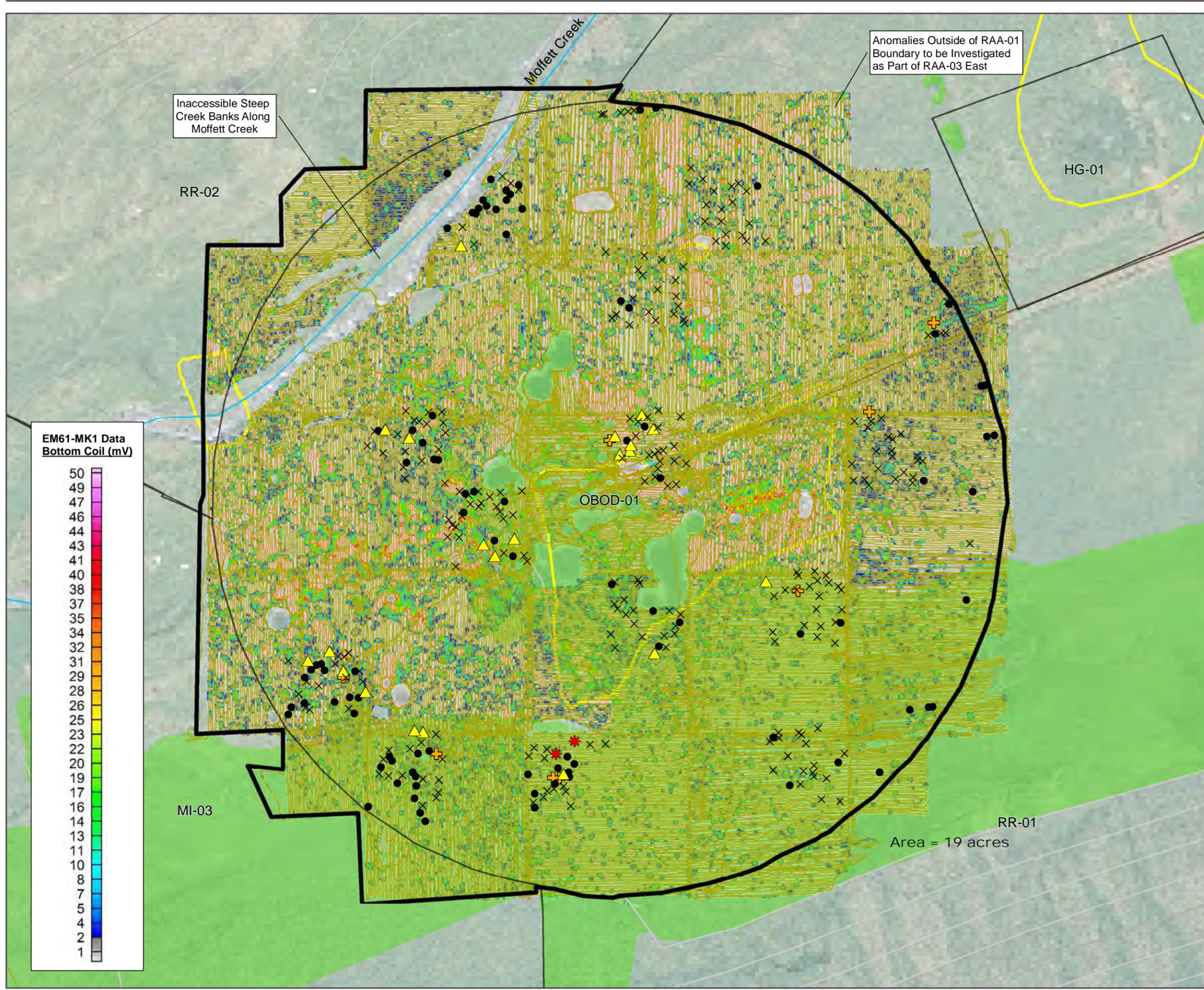
**Topography and Site Features**

- Subject AOC
- AOC
- Slopes Greater Than 30 Degrees (As calculated from terrain model)
- 500-ft Contour
- 100-ft Contour
- 20-ft Contour
- Road
- Stream
- Standing Water

Notes:  
Aerial photography: 2000 fly-over (AEROMAP)



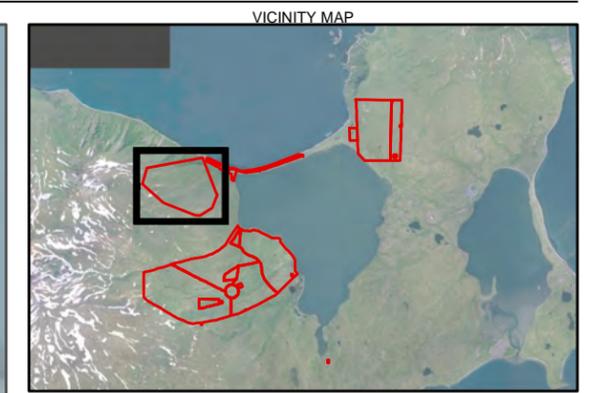
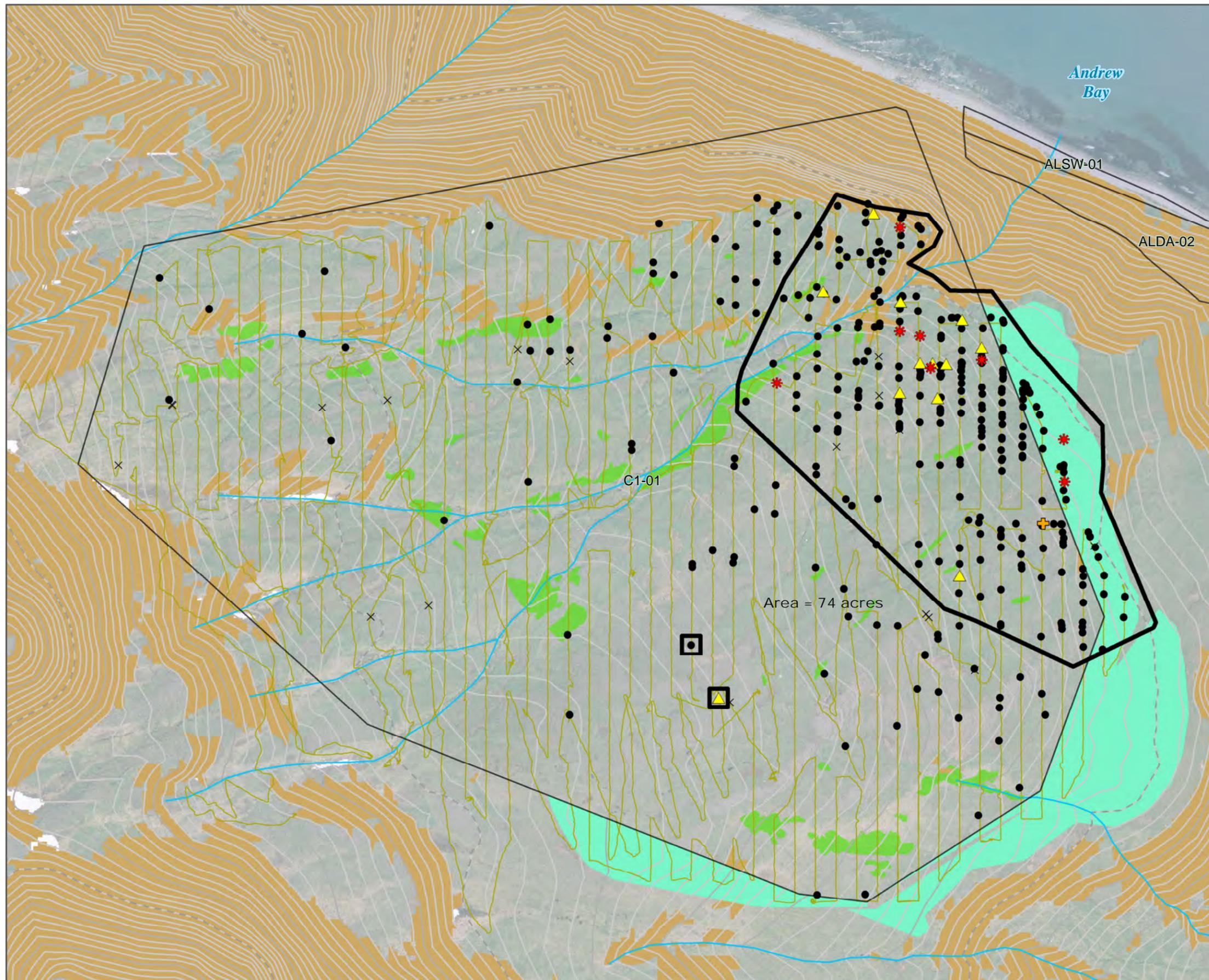
**FIGURE 23**  
**Sample Locations**  
OU B-2 RI/FS Report - Executive Summary  
Adak Island, Alaska



- Remedial Action Area**
- Remedial Action Area
- MEC Investigation**
- Unexploded Ordnance (UXO)
  - Discarded Military Munitions (DMM)
  - Materials Presenting Potential Explosive Hazard (MPPEH)
  - Munitions Debris (MD)
  - Other (not munitions-related material)
  - Pre-2008 Geophysical Survey Transect
  - Accessibility Survey Area, Slopes Greater Than 30 Degrees
- Topography and Site Features**
- AOC Boundary
  - Slopes Greater Than 30 Degrees (As calculated from terrain model)
  - Wetland - as mapped by URS 2011
  - Cultural Resources - as mapped by URS 2011
  - 500-ft Contour
  - 100-ft Contour
  - 20-ft Contour
  - Road
  - Stream

Notes:  
 1. Aerial photography: 2000 fly-over (AEROMAP)

**FIGURE 24**  
**RAA-01 (OB/OD-01)**  
 OU B-2 RI/FS Report - Executive Summary  
 Adak Island, Alaska



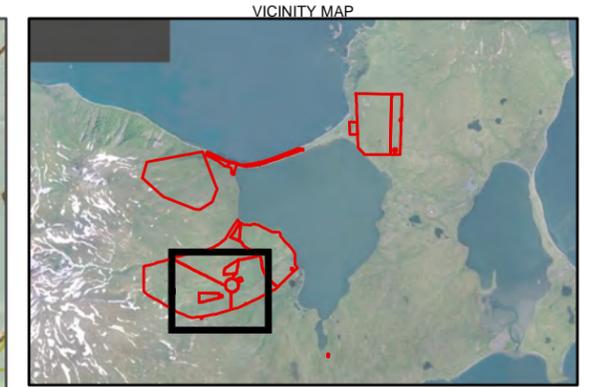
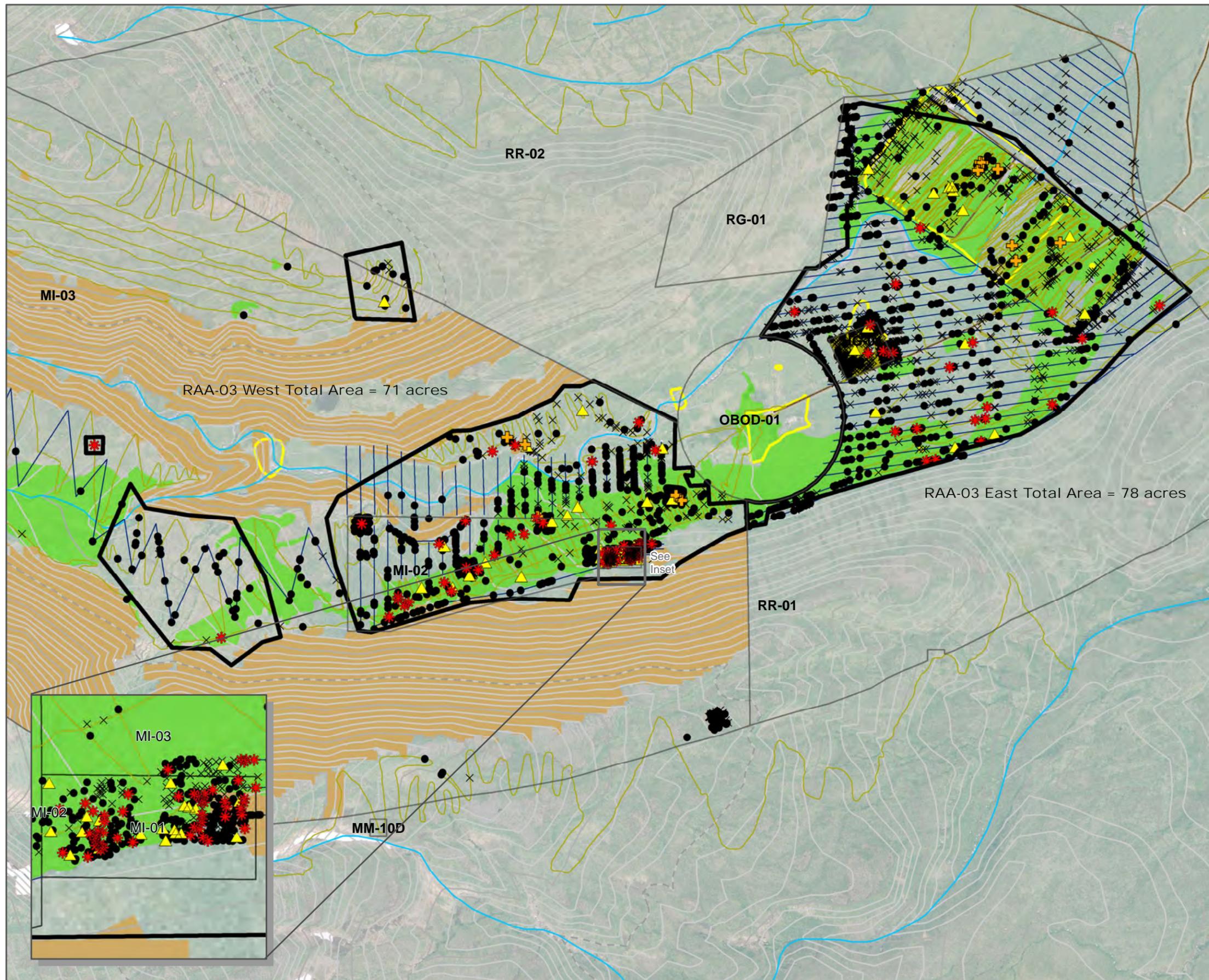
- Remedial Action Area**
- Remedial Action Area
- MEC Investigation**
- Unexploded Ordnance (UXO)
  - Discarded Military Munitions (DMM)
  - Material Presenting Potential Explosive Hazard (MPPEH)
  - Munitions Constituents (MC)
  - Munitions Debris (MD)
  - Other (not munitions-related material)
  - Pre-2008 Geophysical Survey Transect
  - Accessibility Survey Area, Slopes Greater Than 30 Degrees
- Topography and Site Features**
- AOC Boundary
  - Slopes Greater Than 30 Degrees (As calculated from terrain model)
  - Wetland - as mapped by URS 2011
  - Cultural Resources - as mapped by URS 2011
  - 500-ft Contour
  - 100-ft Contour
  - 20-ft Contour
  - Road
  - Stream

Notes:  
 1. Aerial photography: 2000 fly-over (AEROMAP)

0 430 860  
 Feet

N

**FIGURE 25**  
**RAA-02 (C1-01)**  
 OU B-2 RI/FS Report - Executive Summary  
 Adak Island, Alaska



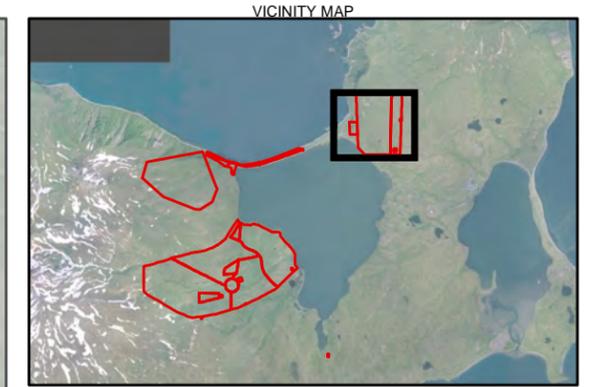
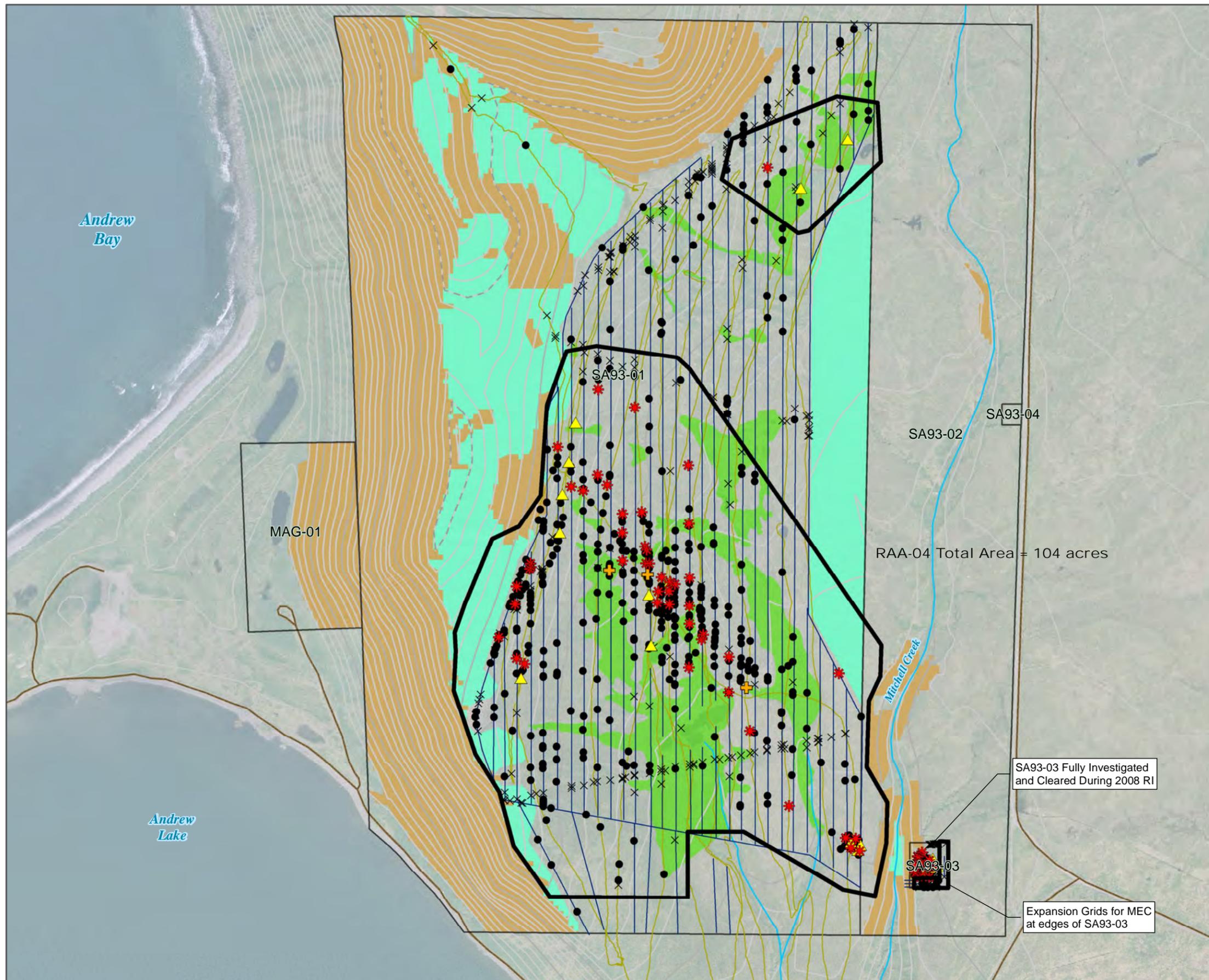
- Remedial Action Area**
- Remedial Action Area
- MEC Investigation**
- Unexploded Ordnance (UXO)
  - Discarded Military Munitions (DMM)
  - Material Presenting Potential Explosive Hazard (MPPEH)
  - Munitions Constituents (MC)
  - Munitions Debris (MD)
  - Other (not munitions-related material)
  - 2008 Geophysical Survey Transect
  - Pre-2008 Geophysical Survey Transect
  - Accessibility Survey Area, Slopes Greater Than 30 Degrees
- Topography and Site Features**
- AOC Boundary
  - Slopes Greater Than 30 Degrees (As calculated from terrain model)
  - Wetland - as mapped by URS 2011
  - Cultural Resources - as mapped by URS 2011
  - 500-ft Contour
  - 100-ft Contour
  - 20-ft Contour
  - Road
  - Stream

Notes:  
 1. Aerial photography: 2000 fly-over (AEROMAP)

0 462.5 925  
 Feet

N

**FIGURE 26**  
**RAA-03 West (MI-01, MI-02, and MI-03) and RAA-03 East (RR-01 and RG-01)**  
 OU B-2 RI/FS Report - Executive Summary  
 Adak Island, Alaska



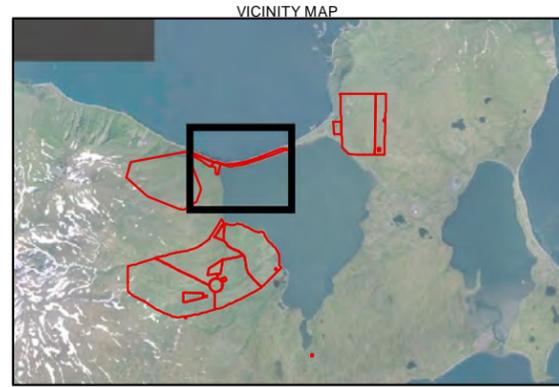
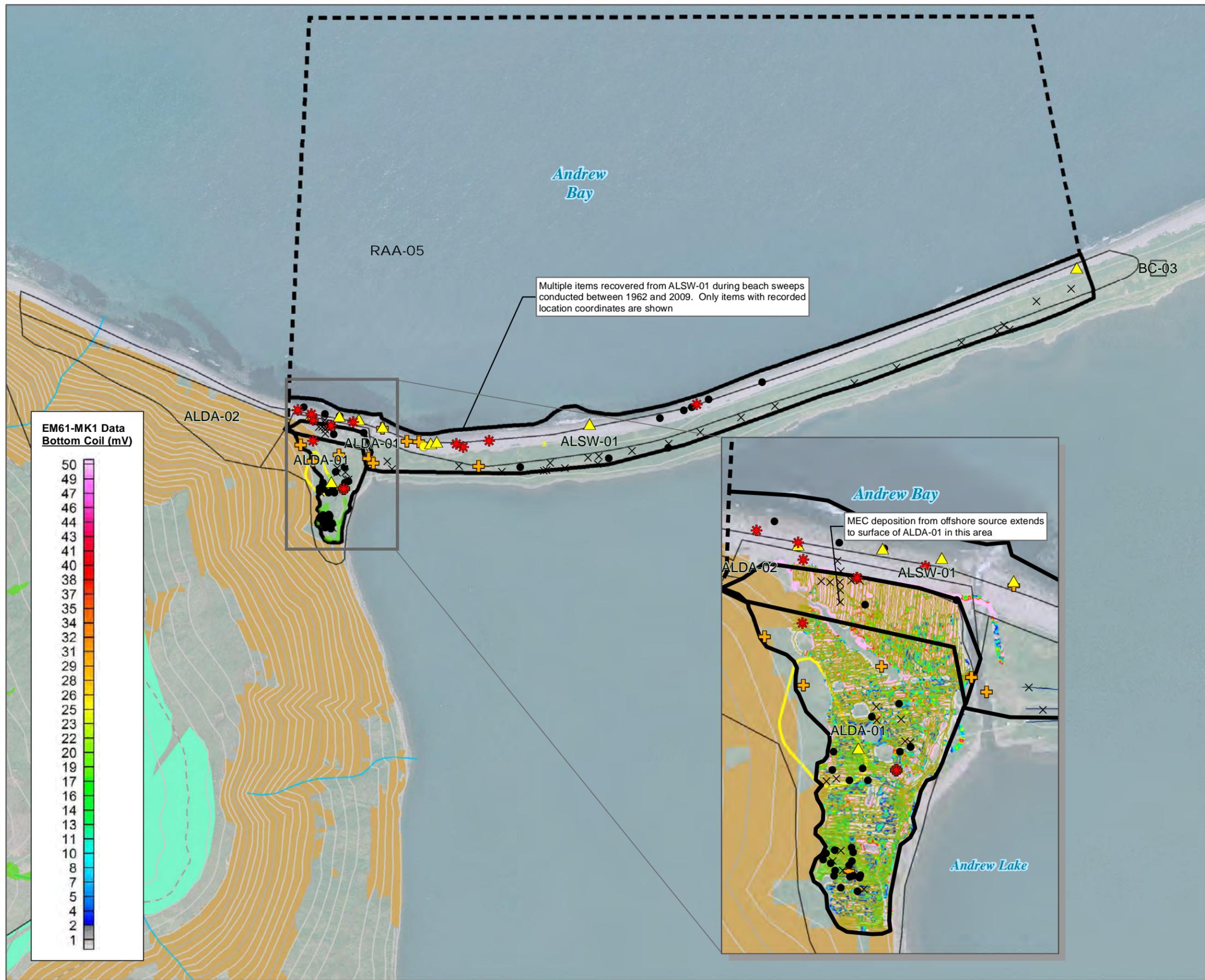
- Remedial Action Area**
- Remedial Action Area
- MEC Investigation**
- Unexploded Ordnance (UXO)
  - Discarded Military Munitions (DMM)
  - Material Presenting Potential Explosive Hazard (MPPEH)
  - Munitions Constituents (MC)
  - Munitions Debris (MD)
  - Other (not munitions-related material)
  - 2008 Geophysical Survey Transect
  - Pre-2008 Geophysical Survey Transect
  - Accessibility Survey Area, Slopes Greater Than 30 Degrees
- Topography and Site Features**
- AOC Boundary
  - Slopes Greater Than 30 Degrees (As calculated from terrain model)
  - Wetland - as mapped by URS 2011
  - Cultural Resources - as mapped by URS 2011
  - 500-ft Contour
  - 100-ft Contour
  - 20-ft Contour
  - Road
  - Stream

Notes:  
 1. Aerial photography: 2000 fly-over (AEROMAP)

0 415 830  
 Feet

N

**FIGURE 27**  
**RAA-04 (SA93-01 and SA93-03)**  
 OU B-2 RI/FS Report - Executive Summary  
 Adak Island, Alaska



- Remedial Action Area**
- Remedial Action Area (dashed where estimated)
- MEC Investigation**
- Unexploded Ordnance (UXO)
  - Discarded Military Munitions (DMM)
  - Material Presenting Potential Explosive Hazard (MPPEH)
  - Munitions Constituents (MC)
  - Munitions Debris (MD)
  - Other (not munitions-related material)
  - 2008 Geophysical Survey Transect
  - Pre-2008 Geophysical Survey Transect
  - Accessibility Survey Area, Slopes Greater Than 30 Degrees
- Topography and Site Features**
- AOC Boundary
  - Slopes Greater Than 30 Degrees (As calculated from terrain model)
  - Wetland - as mapped by URS 2011
  - Cultural Resources - as mapped by URS 2011
  - 500-ft Contour
  - 100-ft Contour
  - 20-ft Contour
  - Road
  - Stream

Notes:  
1. Aerial photography: 2000 fly-over (AEROMAP)



**FIGURE 28**  
**RAA-05 (ALDA-01 and ALSW-01)**  
OU B-2 RI/FS Report - Executive Summary  
Adak Island, Alaska