

**U.S. Army Corps of Engineers  
Omaha District**

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**Final Site-Specific Work Plan  
Fort Flagler Military Reservation  
FUDS ID F10WA0316**

**Site Inspections at Multiple Sites, NWO Region  
Formerly Used Defense Sites, Military Munitions  
Response Program**

**Contract No. W912DY-04-D-0010  
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## TABLE OF CONTENTS

	<u>Page</u>
<b>ABBREVIATIONS AND ACRONYMS</b> .....	<b>iii</b>
<b>1.0 INTRODUCTION</b> .....	<b>1</b>
1.1 Project Authorization .....	1
1.2 Site Name and Location.....	1
1.3 Scope and Objectives .....	1
1.4 Site Inspection Process .....	2
1.5 Munitions Response Site Prioritization Protocol.....	2
1.6 TPP Summary .....	3
1.7 Decision Rules.....	5
1.8 MEC Technical Approach .....	7
1.9 SSWP Organization .....	7
<b>2.0 SITE INFORMATION</b> .....	<b>8</b>
2.1 Installation History .....	8
2.2 Physical Setting .....	8
2.2.1 Access and Land Use .....	8
2.2.2 Topography, Geology, and Climate .....	8
2.2.3 Groundwater and Surface Water.....	9
2.3 Previous Investigations.....	9
2.3.1 Historical Records Searches.....	9
2.4 Munitions and Explosives of Concern and Munitions Constituents.....	10
<b>3.0 PRE-FIELD ACTIVITIES</b> .....	<b>10</b>
3.1 Coordination with State Historic Preservation Office .....	10
3.2 Coordination Regarding Natural Resources .....	11
3.3 Review of Historical Aerial Photographs .....	11
3.4 Coordination of Rights of Entry .....	11
<b>4.0 SITE INSPECTION ACTIVITIES</b> .....	<b>11</b>
4.1 Equipment .....	12
4.2 Communications .....	12
4.3 Training and Briefing .....	12
4.4 Key Personnel.....	12
4.5 Field Reconnaissance .....	13
4.6 Sampling .....	15
4.6.1 Soil .....	16
4.6.2 Sediment.....	18
4.6.3 Background .....	19
4.6.4 Analytical Program.....	19
4.6.5 Quality Assurance/Quality Control Samples .....	20
4.6.6 Sample Preservation, Packaging, and Shipping .....	20
<b>5.0 INVESTIGATION DERIVED WASTE</b> .....	<b>20</b>
<b>6.0 PROPOSED SCHEDULE</b> .....	<b>20</b>
<b>7.0 REFERENCES</b> .....	<b>21</b>

## **List of Figures**

- Figure 1 Site Location
- Figure 2 Ft. Flagler Military Reservation AOC Location Map
- Figure 3 Range Complex Area of Concern
- Figure 4 Area of Concern, Demolition Area
- Figure 5 Area of Concern, Rifle Grenade/Anti-Tank Rocket Range
- Figure 6 Area of Concern, Live and Practice Grenade Courts
- Figure 7 Area of Concern, Transition Range 1
- Figure 8 Area of Concern, Transition Range 2
- Figure 9 Area of Concern, Rifle Range
- Figure 10 Area of Concern, Quartermaster Wharf Disposal Area
- Figure 11 Background Sample Locations

## **List of Tables**

- Table 1 Munitions Information
- Table 2 Rights of Entry Status
- Table 3 Sample Location Rationale
- Table 4 Proposed Sampling Approach
- Table 5 Sample Designations and Analyses
- Table 6 Human Health Soil and Sediment Screening Criteria and Selected Values for Potential Contaminants of Concern
- Table 7 Ecological Soil Screening Criteria and Selected Values for Potential Contaminants of Concern
- Table 8 Ecological Sediment Screening Criteria and Selected Values for Potential Contaminants of Concern

## **List of Attachments**

- Attachment A State Park Historic Map

## **List of Appendices**

- Appendix A Conceptual Site Model
- Appendix B USACE Interim Guidance Document 06-05 and Safety Advisory 06-2
- Appendix C Site Safety and Health Plan Addendum

## ABBREVIATIONS AND ACRONYMS

AOC	area of concern
ASR	Archives Search Report
bgs	below ground surface
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CRREL	Cold Regions Research and Engineering Laboratory
CSM	Conceptual Site Model
DERP	Defense Environmental Restoration Program
DFW	Department of Fish and Wildlife
DMM	discarded military munitions
DoD	U.S. Department of Defense
DQO	Data Quality Objective
EOD	Explosive Ordnance Disposal
°F	degrees Fahrenheit
FS	Feasibility Study
FSP	Field Sampling Plan
ft	feet
Ft. Flagler	Ft. Flagler Military Reservation
FUDS	Formerly Used Defense Site
GPS	Global Positioning System
HMX	octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine
HRS	Hazard Ranking System
HTRW	Hazardous, Toxic, and Radioactive Waste
IDW	Investigation-Derived Waste
INPR	Inventory Project Report
MC	munitions constituents
MEC	munitions and explosives of concern
mm	millimeter
MMRP	Military Munitions Response Program
MRA	Munitions Response Area
MRS	Munitions Response Site
MRSPP	Munitions Response Site Prioritization Protocol
MS/MSD	matrix spike/matrix spike duplicate
NCP	National Contingency Plan
NOAA	National Oceanic & Atmospheric Administration
NDAI	No Department of Defense Action Indicated
NG	nitroglycerin
NWO	U.S. Army Corps of Engineers, Omaha District Military Munitions Design Center
OB/OD	Open Burning/Open Detonation
PA	Preliminary Assessment
PCOC	Potential Contaminant of Concern
PETN	pentaerythritol tetranitrate
PQL	Practical Quantitation Limit
QA/QC	Quality Assurance/Quality Control
QAPP	Quality Assurance Project Plan
QC	Quality Control

## ABBREVIATIONS AND ACRONYMS (CONT.)

RAC	Risk Assessment Code
RDX	hexahydro-1,3,5-trinitro-1,3,5-triazine
RI	Remedial Investigation
ROE	Right of Entry
SAP	Sampling and Analysis Plan
Shaw	Shaw Environmental, Inc.
SHPO	State Historic Preservation Office
SI	Site Inspection
SOP	Standard Operating Procedure
SSHP	Site Safety and Health Plan
SSWP	Site-Specific Work Plan
State Parks	Washington State Parks
TCRA	time-critical removal action
Tetryl	methyl-2,4,6-trinitrophenylnitramine
TNT	2,4,6-trinitrotoluene
TPP	Technical Project Planning
U.S.	United States
USACE	U.S. Army Corps of Engineers
USEPA	U.S. Environmental Protection Agency
UXO	unexploded ordnance
UTL	upper tolerance limit
WA	Washington
WDOE	Washington Department of Ecology

## **1.0 INTRODUCTION**

This Site-Specific Work Plan (SSWP) presents the information necessary to conduct field activities associated with a Site Inspection (SI) planned at the former Fort Flagler Military Reservation (Ft. Flagler).

### **1.1 Project Authorization**

The United States (U.S.) Army Corps of Engineers (USACE) is conducting environmental response activities at Formerly Used Defense Sites (FUDS) in accordance with Engineer Regulation 200-3-1 (USACE, 2004a) and U.S. Department of Defense (DoD) guidance document, *Management Guidance for the Defense Environmental Restoration Program* (DERP) (DoD, 2001). USACE is conducting these activities under provision of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), Executive Orders 12580 and 13016, and the National Oil and Hazardous Substances Pollution Control Plan, which is commonly referred to as the National Contingency Plan (NCP). As such, USACE is required to conduct remedial preliminary assessments (PAs) and SIs (U.S. Environmental Protection Agency [USEPA], 2005a, 2005b) to evaluate hazardous substance releases or threatened releases from eligible FUDS.

USACE is evaluating FUDS that were historically used for military training and testing under the DERP's Military Munitions Response Program (MMRP). Based on historical records, these FUDS may contain munitions and explosives of concern (MEC) or munitions constituents (MC). MEC are military munitions that may pose unique explosives safety risks, such as unexploded ordnance (UXO), discarded military munitions (DMM), or MC present in high enough concentrations to pose an explosive hazard. MC are any materials originating from UXO, DMM, or other military munitions, including explosive and non-explosive materials, and emission, degradation, or breakdown elements of such ordnance or munitions (U.S. Department of Army, 2005, and DoD, 2003).

Shaw Environmental, Inc. (Shaw) has prepared this SSWP for the USACE, under USACE Contract No. W912DY-04-D-0010, as a supplement to the *Final Type I Work Plan, Site Inspections at Multiple Sites, NWO Region, Formerly Used Defense Sites, Military Munitions Response Program (Type I Work Plan)* (Shaw, 2006a). Shaw is responsible for conducting SIs at FUDS in the Northwest Region (Omaha District Military Munitions Design Center [NWO]).

### **1.2 Site Name and Location**

The Ft. Flagler FUDS (ID F10WA0316) is located in Jefferson County, Washington (WA), on the west side of Puget Sound near Port Townsend. The FUDS is located entirely within the boundaries of the Ft. Flagler State Park. The location of the FUDS is shown on Figure 1.

### **1.3 Scope and Objectives**

The scope of the SI is restricted to evaluation of the presence of MEC or MC related to historical use of the FUDS prior to transfer of the property. Potential releases of hazardous, toxic, or radioactive wastes (HTRW) are not addressed within this scope. The intent of the SI is to confirm the presence or absence of contamination from MEC and/or MC. The general approach for each SI is to conduct records review and site reconnaissance in order to evaluate the presence or absence of MEC, and to collect samples at locations where MC might be expected based on the conceptual site model (CSM).

The primary objective of the SI is to determine whether conditions at FT. Flagler warrant further response action pursuant to CERCLA and the NCP. The SI will collect the minimum amount of information necessary to (i) eliminate from further consideration those releases that pose no significant threat to public health or the environment; (ii) determine the potential need for removal action; (iii) collect or develop additional data, as appropriate, for Hazard Ranking System (HRS) scoring by the USEPA (USEPA, 1990); and (iv) collect data, as appropriate, to characterize the release for effective and rapid initiation of the remedial investigation (RI) and feasibility study (FS) process. A secondary objective of the SI is to collect the appropriate data to complete the Munitions Response Site Prioritization Protocol (MRSP) (DoD, 2005).

#### **1.4 Site Inspection Process**

The steps involved in conducting an SI include the following:

- Review of existing data,
- Application of the Technical Project Planning (TPP) process,
- Preparation of an SSWP,
- Performance of SI field activities (site reconnaissance, media sampling, and analysis),
- Preparation of an SI Report.

The TPP process is one through which project objectives and data collection processes are identified, and site stakeholders are brought together to discuss goals and objectives. This process includes the following phases: identification of the current project area, determination of data needs, development of data collection options, and finalization of the data collection program. A multi-disciplinary team of key stakeholders attends a TPP meeting(s) in order to participate in the process so SI activities can be conducted in a timely and efficient manner.

#### **1.5 Munitions Response Site Prioritization Protocol**

The DoD is required to assign a relative priority for each Munitions Response Site (MRS) within a Munitions Response Area (MRA). This process is to be completed for all DoD sites including FUDS which are known or suspected of containing UXO, DMM or MC.

Definitions:

- A Defense Site refers to the entire property that was owned, leased, or otherwise possessed or used by the DoD. This definition includes FUDS.
- An MRA refers to any area on a Defense Site that is known or suspected to contain UXO, DMM, or MC. An MRA can be comprised of one or more MRSs.
- An MRS is a discrete location within an MRA that is known to require a munitions response (e.g., remedial response). An MRSP scoring is completed for each MRS.

Previous documents for FUDS have used the term areas of concern (AOCs). In some cases, one AOC may be identified as a discrete MRS; in other cases it may be logical to group adjacent or overlapping AOCs as a single MRS. The term AOC is retained for this SSWP as it is logical to defer the decision on how to potentially group AOCs until after the SI data collection is complete. Recommendations on how to group AOCs as MRSs will be included in the draft SI Report.

## 1.6 TPP Summary

The TPP Meeting for the Ft. Flagler FUDS was held on July 24, 2006, and conducted in two parts. A daytime meeting was held at the Washington Department of Ecology office located in Lacey, Washington. Representatives from the USACE – Omaha Design Center and Seattle District, the Washington Department of Ecology (WDOE), Washington State Parks Department (State Parks), and Shaw were in attendance. By agreement with the USACE, nearby landowners (other than State Parks) were not present at this meeting.

In the evening, a separate meeting intended to present the SI objectives to nearby landowners or interested members of the public was held at the Retreat Center at Ft. Flagler State Park. This meeting was attended by the same people that attended the earlier meeting, with three additional State Parks volunteers in attendance. No landowners or members of the general public attended. A formal site tour was not conducted as part of this meeting; however some of the areas of interest are readily visible from public roads and the park's paved pathways.

### Agencies Meeting

**AOCs:** There was general agreement among stakeholders on SI objectives and approach. Washington State Parks/WDOE representatives provided a copy of a War Department map (circa 1945) that identified several potential AOCs that were not included in the Archives Search Report (ASR). A copy of the map is included as Attachment A in the TPP Memo. Based on this map and the resulting discussion, the following additional AOCs were included in the TPP Memorandum:

- **Quartermaster Wharf Disposal Area:** The ASR identified the Quartermaster Wharf Disposal Area as a potential AOC. The area appears to be a disposal site where unwanted supplies were discarded on the beach. A park volunteer has found two, five-round .30-caliber ammunition clips on the beach. State Parks has a list of items found in this area that possibly includes a live grenade. During the TPP meeting, the WDOE representative in attendance stated that he believed the ASR suggested this was an Open Burn/Open Detonation (OB/OD) area, and specifically noted that OB/OD was done on the beach at the Fort Townsend site. The former Quartermaster Wharf Disposal Area is used by the public for beachcombing and items found there suggest it was a general garbage disposal area. Stakeholders agreed that a remedial investigation (RI) will be required because MEC has been found. The SI will include one composite sample to be analyzed for explosives.
- **Demolition Area:** Demolition Area was shown on the historic map (Attachment A of the TPP Memo) provided by the State Park. The area is now used for a campground near the spit. The name suggests it is the OB/OD area. Comparison of topography from the old map to current maps suggests that this area has been filled to create a raised flat area for picnicking and camping.
- **Live and Practice Grenade Courts:** The Live and Practice Grenade Courts are shown on the historic map, and are currently located within unused areas of the State Park.
- **Ammunition Bunker:** An Ammunition Bunker is shown on the historic map, and is located between Batteries Calwell and Downes.
- **Transition Range 2:** Transition Range 2 is shown on historic map, and is currently located within an unused area of the State Park.

Other areas shown on the historical map included a Squad Tactical Area and an Embarkation Area. These sites likely did not involve the use or firing of weapons or munitions.

**Sampling:** Shaw agreed with WDOE that visual reconnaissance for MEC should be conducted at the battery locations. At the TPP Meeting in Lacey, Shaw proposed conducting MC sampling around the batteries. However, based on the discussion of the configuration and use of the batteries, and observations made while driving through the park later in the day, Shaw now proposes no MC sampling be conducted around the batteries because of the following reasons:

- The batteries are permanent structures in which the guns were emplaced in concrete structures and serviced by paved roads. It is unlikely that there was casual disposal of MEC in the vicinity of the battery.
- The guns were seldom used.
- Shaw cited research from Cold Regions Research and Engineering Laboratory (CRREL) that there is little MC associated with muzzle deposits (Walsh et. al., 2006).
- Areas around the batteries are paved and contain storm drains. It is extremely unlikely that there are any remaining affected sediments from guns that were operated pre-World War II.

The Ft. Flagler State Park currently obtains water from the public supply. State Parks indicated there may have been a well in the past and will research the possibility.

**Concerns:** One of WDOE representative's main concerns was the camping area at the Rifle Grenade/Anti-Tank Rocket Range AOC. An UXO clearance was conducted in the adjacent wooded area in 1992. Additional review of old aerial photographs and topographic maps will be helpful to evaluate the history of this area.

### **Public Meeting**

- Bob Brown, volunteer archivist for State Parks said that he and another volunteer, Howard Briggs had found "lots of archive material" at USACE Seattle. Mr. Brown found a map in the museum, showing AOCs not included in the ASR (Attachment A of the TPP Memo).
- Rifle Range – Reconstructed exactly as it was when used. Should be lots of lead in the berm in front of the target. There are reports that they had to build a wall on the hill behind the targets to protect the power station below Battery Lee. Mr. Brown thought that the ponds have always been there, but Mr. Briggs thought that there may have been cattle there at one time. Mike Zimmerman (State Parks) noted that the sea washed over this area a year or two ago.
- Demolition Area – Mr. Brown and Mr. Briggs do not know use of this area. Mr. Briggs said that in the 1960's there were warning signs in this area for UXO. Mr. Briggs also said that there was a concrete breakwater in this area that was removed.
- As shown on the map, there was a Transition Range just east of the main gate. An old timer has said that this was an area used for firing.
- Grenade Courts – These are still visible.
- Areas with alder trees and no fir trees signify disturbance.

- Mr. Zimmerman had heard that during the Korean War, amphibious groups landed on the spit and that this may have been the cause of the split in the spit.
- There are two 90-millimeter (mm) sites west of the coast guard house with concrete pads still visible at low tide.
- Comparison of the map found by Mr. Brown and the present topography indicates that fill has been placed in the area of the campsite and the demo area shown on the map. Mr. Zimmerman asked if the Seattle District would have records of this work.
- Mr. Brown thought that he had heard that there was a disposal area across the road south of Bankhead Battery.
- Part of the lagoon area near the Rifle Range is on National Oceanic & Atmospheric Administration (NOAA) property.
- It was suggested that the retired rangers be interviewed. Mr. Zimmerman said that he could provide names.
- Greg Johnson (WDOE) said that he would like to see analysis of older aerial photographs.
- Mr. Brown indicated that it has always been State Parks policy to encourage people to stay on the trails. He and Mr. Briggs noted that there is very dense brush off most of the trails.

Based on the TPP meeting and subsequent evaluation of information obtained at the meeting, 11 AOCs were identified and addressed in the Final Technical Planning Project Memorandum, Fort Flagler Military Reservation (Shaw, 2006b) and this SSWP. The 10 AOCs are:

- Range Complex (coastal artillery batteries)
- Ammunition Bunker
- Transition Range 1
- Transition Range 2
- Gas Chamber
- Rifle Grenade/Anti-Tank Rocket Range
- Live Grenade Court
- Rifle Range
- Demolition Area, and
- Quartermaster Wharf Disposal Area

## **1.7 Decision Rules**

The following is a list of decision rules that will guide Shaw's technical approach at various stages of the SI as the specific AOCs are being evaluated:

- **Based on the presence or absence of MEC, is an NDAI or is an RI/FS warranted?**
  - If no evidence of MEC (non-small arms, munitions debris, or magnetic anomalies) was found during prior investigations and none is observed during SI site reconnaissance, the site will be considered a potential candidate for NDAI with respect to MEC hazard.
  - If MEC was found and/or if abundant or concentrated areas of munitions debris or magnetic anomalies were observed during prior investigations or during SI site reconnaissance, the site will be considered a potential candidate for further investigation with respect to MEC hazard.
  - If any evidence is identified that is inconsistent with the CSM for the site (e.g., if munitions debris indicating the potential use of high explosive (HE) munitions at a site for which the CSM was based on practice munitions), the above decision rules will be revised appropriately.
- **Based on the presence or absence of MC, is an NDAI or is an RI/FS warranted?**
  - If sample results are less than human health and ecological screening values, the site will be recommended for NDAI relative to MC.
  - If sample results exceed both human health screening values and background values, the site will be recommended for additional investigation.
  - If sample results do not exceed human health screening values but do exceed both ecological screening values and background values, additional evaluation of the data will be conducted in conjunction with the stakeholders to determine if additional investigation is warranted.
- **Is a time-critical removal action warranted?**
  - A time-critical removal action may be needed if high MEC hazard is identified. Shaw will immediately report any MEC findings so that USACE can determine the appropriate response. An example of a high hazard would be finding sensitive MEC at the surface in a populated area with no barriers to restrict access.

For purposes of applying these decision rules, USACE has provided guidance that evidence of MEC will generally be a basis of recommending RI/FS. Evidence of MEC may include confirmed presence of MEC from historical sources or SI field work, or presence of munitions debris.

- **Comparison to Human Health Screening Criteria**
  - Comparisons of site analytical data to human health screening criteria will be to those listed on Table 6. Where multiple values are listed, the lowest value is used for comparison.
- **Comparison to Ecological Screening Criteria**
  - For ecological screening, the analytical results will be compared to the “Final Ecological Screening Value” on Tables 7 and 8. The Final Ecological Screening Value” listed on the tables is derived from the following hierarchy:

1. State of Washington Value
2. USEPA Region Washington State is located (Region 10)
3. Lower of Talmage et al. (1999 or Los Alamos National Laboratory (2005) values.

## **1.8 MEC Technical Approach**

If MEC is found during SI field activities, the following excerpted procedures will be followed, per Interim Guidance Document 06-05 and Safety Advisory 06-2 (see Appendix B for complete document):

- The property owner or individual granting rights of entry to the property will be notified of the hazard and advised to call the local emergency response authority (i.e., police, sheriff, or fire department). The individual will also be informed that if they do not call the local response authority within one hour, the individual who identified the UXO item will notify the local emergency response authority.
- The local response authority will decide how to respond to the reported incident, including deciding not to respond (e.g., if the local response authority is already aware of the hazards on the property). If the local response authority decides to respond, the individual who identified the item or his designee will mark the location of the item and provide accurate location information to the emergency response authority. The individual who identified the item or his designee will generally remain in the area until the local response authority arrives, unless specifically indicated by the appropriate response authority that the individual may leave the area.
- Neither the US Army Corps of Engineers personnel, nor their contractors have the authority to call explosive ordnance disposal (EOD) to respond to an explosive hazard. This call is the responsibility of the local emergency response authority for FUDS properties and it must come through the proper chain of command on installations.

The technical approach is based on the *Final Type I Work Plan* (Shaw, 2006a), *Final Technical Planning Project Memorandum, Fort Flagler Military Reservation* (Shaw, 2006b) and the *Formerly Used Defense Sites, Military Munitions Response Program, Site Inspections, Program Management Plan* (USACE, 2005a).

## **1.9 SSWP Organization**

This SSWP supplements the *Final Type I Work Plan* (Shaw, 2006a), which includes an Accident Prevention Plan and Site Safety and Health Plan (SSHP) (Appendix D), and a Sampling and Analysis Plan (SAP) (Appendix E) that includes both the USCAE SAP and the Shaw SAP. The SAPs contain the Field Sampling Plan (FSP) and the Quality Assurance Project Plan (QAPP). The *Final Type I Work Plan* (Shaw, 2006a), as amended by this SSWP, governs work that will be implemented during the SI at the Ft. Flagler FUDS. This SSWP provides additional information not available in the Work Plan, including site information (background information, summary of historical documents evaluated, and resulting data needs), a discussion of activities to be conducted prior to mobilizing to the field, a presentation of field data to be collected, and appendices with supporting documents. Specifically, this SSWP includes the following sections:

- Section 1.0 Introduction
- Section 2.0 Site Information,
- Section 3.0 Pre-Field Activities,
- Section 4.0 Site Inspection Activities,
- Section 5.0 Investigation-Derived Waste,
- Section 6.0 Proposed Schedule,
- Figures,
- Tables,
- Appendix A Conceptual Site Model,
- Appendix B USACE Interim Guidance Document 06-05 and Safety Advisory 06-2,
- Appendix C Site Safety and Health Plan Addendum.

## **2.0 SITE INFORMATION**

### **2.1 Installation History**

The U.S. government acquired 550 acres of land for Ft. Flagler in 1866. Construction of the first coastal batteries did not begin until 1897. Additional acreage was acquired over the years until the site grew to 809 acres.

Between 1900 and 1946, the site was used as a coastal defense installation. During World War II, the Navy also operated an underwater listening station at Ft. Flagler. In 1950, all harbor defenses around Puget Sound were abolished including Ft. Flagler. The site was used for amphibious training and maneuvers after the coastal artillery weapons were removed. In 1953, Ft. Flagler was closed and the property was transferred in 1954 to the State of Washington for use as a state park.

### **2.2 Physical Setting**

#### **2.2.1 Access and Land Use**

The Ft. Flagler FUDS is located in Jefferson County, WA, on the west side of Puget Sound near Port Townsend. Port Townsend, WA, is the nearest incorporated community (population of 8,810 by the 2004 estimated census), and is located approximately 8 miles by road or 4 miles by water from the FUDS. Access to the FUDS is uncontrolled.

The FUDS is located entirely within the boundaries of the Ft. Flagler State Park, and is currently owned by the Washington State Parks Department and the United States Geological Survey, which maintains an experimental station at the site. Campgrounds, picnic areas, buildings, and visitor facilities are currently in use at the FUDS. Ft. Flagler has permanent residents (park employees) and offers camping facilities to recreational users. The area south of Ft. Flagler is populated with private residences.

#### **2.2.2 Topography, Geology, and Climate**

The Ft. Flagler FUDS lies within the Puget Trough Section of the Pacific Border Physiographic Province. The elevation of the area ranges from approximately sea level to 180 feet (ft). The

geology of the area is controlled by the last glaciation period between 12,000 and 15,000 years ago. Glacial deposits consist of thick sequences of glacial till and sand and gravel. Soil at the site consists of coastal beaches, Whidbey gravelly sandy loam, and Dick loamy sand.

The climate at Ft. Flagler FUDS is a west coast marine type with comparatively cool, dry summers and mild but wet and cloudy winters. The area is within the “rain shadow” of the Olympic Mountains and is the driest area in western Washington State. The wettest months are generally November and December, with the driest months being July and August. The highest monthly average temperature for Port Townsend is 72.2 degrees Fahrenheit (°F) in August and the lowest monthly average temperature is 36.3 °F in January. Port Townsend’s average annual precipitation is 19.12 inches per year, with an average annual snowfall of 4 inches.

### **2.2.3 Groundwater and Surface Water**

Depth to groundwater the Ft. Flagler FUDS, based on wells located immediately south of the State Park, is between 58 to 125 ft below ground surface. There are no streams or fresh surface water on the site; however, there are intermittent streams. Puget Sound, an intercoastal saltwater waterway, surrounds the site on three sides (north, east, and west).

## **2.3 Previous Investigations**

### **2.3.1 Historical Records Searches**

Historical documents have been reviewed to collect information about the Ft. Flagler FUDS. A summary of these documents is provided below.

Ft. Flagler was certified as being decontaminated in 1954 by the USACE and again in 1959 by the 170<sup>th</sup> Ordnance Detachment from Fort Lewis, Washington (USACE, 2005).

A Findings and Determination of Eligibility and an Inventory Project Report (INPR) were completed in 1991, which concluded that Ft. Flagler had been formerly used by the War Department.

In 1992, a TCRA was completed to locate anti-tank rockets that were unaccounted during military training and not located during the 1954 and 1959 visual inspections. The USACE determined that because of advances in technology for locating subsurface UXO, an additional survey should be completed to locate the unaccounted for munitions (IT, 1992) and other MEC from the rocket range.

Thirteen underground fuel tanks were removed under the HTRW program (undated). MEC or MC related items were not addressed in that project.

USACE issued an INPR Supplement in 2004, which compiled available information for Ft. Flagler and identified three AOCs: the Range Complex, the Rocket Range, and Transition Range 2 (location unknown). The Range Complex consisted of the nine artillery batteries, Transition Range 1, and the Gas Chamber.

USACE issued an ASR in April 2005 that compiled available information on the history and use of Ft. Flagler, with emphasis on types and areas of ordnance use and disposal. The ASR included a visit to the site in July 2003 (USCAE, 2005b). The primary purpose of the site visit was to assess the presence of MEC through non-intrusive means. The ASR identified two additional AOCs: the Rifle Range and the Quartermaster Wharf Disposal Area. A Risk Assessment Code (RAC) scoring was included in the ASR. The areas scored were grouped by

site usage rather than by AOC name. Possible scores range from 5 (no risk) to 1 (high risk). The RAC scores are presented in the table below.

Area	RAC Score	MEC Found
Rocket Range	5	No
Rifle Range	5	No
Transition Range	5	No
Quartermaster Wharf Disposal Area	3	No – Small Arms Only
Remaining Lands	5	No
Offshore Ordnance Area	5	No

The other AOCs addressed in this SSWP were not identified or scored in the ASR.

#### **2.4 Munitions and Explosives of Concern and Munitions Constituents**

Based on the ASR and the INPR Supplement, and information gathered during the TPP Meeting, the MEC used at Ft. Flagler FUDS consisted of:

- Coastal artillery batteries ranging in size from 3-inch to 12-inch,
- Small arms,
- 37-mm portable anti-aircraft guns,
- Mark II hand grenades,
- M21 practice hand grenades,
- .50-caliber machine guns, and
- 2.36-inch and 3.5-inch anti-tank rockets.

A discussion of MEC and associated MC for the Ft. Flagler FUDS is provided in the CSM included as Appendix A. The MC associated with the type of munitions used at the FUDS is summarized in Table 1.

### **3.0 PRE-FIELD ACTIVITIES**

#### **3.1 Coordination with State Historic Preservation Office**

The Washington State Historic Preservation Office (SHPO) was contacted to determine if there are any areas of cultural or archaeological significance on FUDS property that could be impacted by SI activities at Ft. Flagler. The SHPO recommended that the State Parks and USACE archeologists review the plans and provide comments. The USACE Seattle District project manager reviewed sampling plans with the district archeologist and no concerns were identified.

A copy of the Draft SSWP was provided to the Ft. Flagler State Park for review and comment. No concerns were raised during their review.

The USACE Seattle District contacted local tribes and provided opportunity for their comment on impacts to cultural resources. The tribes commented back that no additional oversight is required. However, if something of cultural significance is identified during field work the tribe shall be notified immediately and the location avoided.

### **3.2 Coordination Regarding Natural Resources**

The Washington Department of Fish and Wildlife (WDFW) was contacted to determine if there are threatened or endangered species that could be impacted by SI activities at Ft. Flagler. Information obtained from the WDFW indicate that there are sensitive habitats along several beaches at Ft. Flagler; however, none in the vicinity of the proposed sampling on the beach at the Quartermaster Wharf Disposal Area. The information provided, also identified two bald eagle nesting trees at Ft. Flagler. The activities proposed in the vicinity of these sites should not cause disturbance.

The USACE Seattle District completed a *Determination of No Effect on Listed Species under the Endangered Species Act during Sediment Sampling at Fort Flagler State Park, Jefferson County, Washington, 2007* (USACE, 2007) for proposed sampling activities at Ft. Flagler. The results of the study were that planned sampling activities will have no effect on listed species.

### **3.3 Review of Historical Aerial Photographs**

Limited historical photography is available for the Ft. Flagler FUDS. Available historical photos were reviewed and considered during the planning process. However, the available aerial photography was not of sufficient resolution or of sufficient scale to determine detailed surface feature such as target berms or firing lines.

### **3.4 Coordination of Rights of Entry**

Per section 2.5.2 of the *Final Type I Work Plan* (Shaw, 2006a) and as the geographic USACE District office for the former Ft. Flagler FUDS, the Project Manager from the USACE, Seattle District is responsible for obtaining the Right of Entry (ROE) for the property where the SI activities will be performed. Access to identified property is necessary for conducting field activities. Table 2 identifies the property of interest, the status of obtaining the ROE, and comments on accessibility.

## **4.0 SITE INSPECTION ACTIVITIES**

Site inspection activities to be conducted include the following:

- Site reconnaissance,
- Soil and sediment sampling,
- Recording sampling and site information using a hand-held global position system (GPS) unit, and
- Photo documentation.

All SI field activities will be conducted in accordance with the *Final Type I Work Plan* (Shaw, 2006a) and SSHP Addendum (Appendix C). The SSHP Addendum is a supplement to the program-wide Accident Prevention Plan and Site Safety and Health Plan contained in the *Final*

*Type I Work Plan* (Shaw, 2006a). All SI field activities will be documented in the field log book.

AOCs identified at former Ft. Flagler are:

- Range Complex (coastal artillery batteries)
- Ammunition Bunker
- Transition Range 1
- Transition Range 2
- Gas Chamber
- Rifle Grenade/Anti-Tank Rocket Range
- Live Grenade Court
- Rifle Range
- Demolition Area, and
- Quartermaster Wharf Disposal Area

#### **4.1 Equipment**

A four-wheel drive vehicle will not be necessary for access and use on the site. A Schoenstedt ferrous metal detector will be used during the field reconnaissance to identify subsurface metallic anomalies that need to be avoided during sampling activities. Additionally, a hand-held GPS receiver unit will be used to document the visual reconnaissance, document any surface munitions debris or subsurface magnetic anomalies, and sampling locations. Digital photographs will be obtained of important features (including MEC, munitions debris, targets, and sampling points).

#### **4.2 Communications**

The primary means of on-site communication will be cellular telephones or radios. A satellite phone will be carried as a backup form of communication. The two-person Field Team (and any other accompanying parties) will remain together throughout all aspects of the field activities.

#### **4.3 Training and Briefing**

Any additional training will be conducted onsite during the Daily Tailgate Safety Briefing, to include awareness of endangered species, culturally sensitive areas, and anticipated ordnance types. In addition, emphasis will be placed on the known presence of biota at the site.

#### **4.4 Key Personnel**

This section identifies key project personnel and their specific roles and responsibilities for each SI activity conducted at the Ft. Flagler FUDS. Additionally, this section defines the responsibilities, authority, and the interrelationships of all personnel who manage, perform, and verify activities affecting quality, particularly for personnel who need the organizational freedom and authority to:

- Initiate action to prevent the occurrence of non-conformance,
- Identify and record and quality problems,

- Initiate, recommend, or provide solutions through designated channels,
- Verify the implementation of solutions, and
- Control further processing, delivery, or installation of non-conforming items until the deficiency or unsatisfactory condition has been corrected.

**Project Manager** – The Shaw Project Manager will have overall responsibility, authority, and accountability for the project. Mr. Peter Kelsall, Shaw, is the Project Manager. He will provide additional management or technical support when needed and will serve as the final reviewer on all technical documents produced for the project.

**Chemical Quality Control Officer** – The Shaw Chemical Quality Control Officer shall ensure that all chemistry related objectives, including responsibilities for data quality objective definitions, sampling and analysis, project requirements for data documentation and validation, and final project reports are attained. Mr. Tim Roth will serve as the Chemical Quality Control Officer for this project.

**Health and Safety Manager** – The Shaw Health and Safety Manager is responsible for the development and implementation of the SSHP for this SI. Ms. Pamela Moore will serve as the Health and Safety Manager for this project.

**Technical Lead** – The Shaw Technical Lead will oversee the technical aspects of the inspection activities. Mr. Dale Landon will serve as the Technical Lead for this site.

**Field Team Leader** – The Shaw Field Team Leader will be responsible for the management and execution of all field project activities in accordance with the approved work plan, and federal, state, and local laws and regulations. Mr. Simon Payne will be the Field Team Lead. The Field Team Lead will function as the primary point of contact for the property owners and field personnel. He will advise the Technical Lead of technical progress, needs, potential problems, and recommended solutions.

**UXO Technician** – The UXO technician will be responsible for the UXO avoidance measures to be implemented during field activities. Mr. Rob Irons will be the UXO Technician.

#### **4.5 Field Reconnaissance**

Three types of field reconnaissance will be conducted for the SI as follows:

- A strictly visual reconnaissance that will be conducted to confirm site conditions, such as the locations of buildings, and areas surrounded by mowed grass. This type of reconnaissance is not intended to assess the presence of MEC or munitions debris, but only to confirm the CSM;
- A visual reconnaissance aided by a handheld magnetometer will be conducted to assess the presence of MEC or munitions debris; and
- A MEC and anomaly avoidance survey, completed at each sampling location will be completed for the purpose of preventing the sampling team from contacting MEC or munitions debris during sampling. This reconnaissance will be visual aided by a handheld magnetometer.

The text below explains where each of these types of survey will be conducted.

**Visual Reconnaissance:** A strictly visual reconnaissance will be conducted around each of the artillery batteries in the Range Complex, the Ammunition Bunker, within Transition Ranges 1 and 2, the Practice Grenade Court, the Rifle Range, and the Quartermaster Wharf Disposal Site to confirm the AOC's CSM that site conditions indicate the presence of MEC or munitions debris is unlikely due to the regulated activity that occurred at the batteries and bunker. A strictly visual reconnaissance will also be conducted in the Demolition Area to confirm that the area was completely backfilled and no MEC or munitions debris are exposed. The survey path will be along the shoreline, at the slope break between the mowed grass area and the beach. Figure 4 shows the approximate location of the break in slope at the shoreline and the proposed reconnaissance path.

**Visual Reconnaissance with Magnetometer:** Visual reconnaissance aided with a hand-held magnetometer will be conducted in areas of the Rifle Grenade/Anti-Tank Rocket Range (Figure 5) and the Live Grenade Court (Figure 6), to assess the presence of MEC or munitions debris. The reconnaissance at the Rifle Grenade/Anti-Tank Rocket Range will be completed within the eastern portion of the AOC where MEC was found during the removal action that occurred in 1992. The approximate locations of the visual reconnaissance at the two AOCs are shown on Figures 5 and 6, respectively. These surveys will be conducted by a qualified UXO technician. Several transects will be walked during which visual observations and magnetic anomalies will be noted. Transects will be recorded using a global positioning system (GPS), and appropriate features influencing the survey will be noted, such as vegetation density and type, topography, etc. If MEC is found, the qualified UXO technician will attempt to make a determination of the hazard, and appropriate notifications will be made as detailed in the *Final Type I Work Plan* (Shaw, 2006a) and this SSWP. Note that the area proposed for the survey is very heavily forested with heavy underbrush and many fallen trees. If during the reconnaissance thick underbrush is encountered, an alternate route will be followed. However, if the underbrush becomes too thick and the safety of the workers is threatened, the survey will be abandoned. If the reconnaissance cannot be completed, the USACE will be notified and the notification will be documented in the field notes along with the rationale for not completing the reconnaissance.

**MEC and Anomaly Avoidance Surveys:** Prior to sampling, a MEC and anomaly avoidance survey will be completed at each sampling location. The visual survey, combined aided by a hand-held magnetometer will be conducted to identify evidence of MEC, munitions debris or magnetic anomalies. The purpose of this survey is to protect the sampling team from contacting MEC during sampling. Although MEC is not expected to be present on the land surface, a magnetometer-assisted, visual inspection will be conducted by a qualified UXO technician at suspect locations within the AOC.

Shaw will document any MEC or munitions debris found, and proceed with MC sampling as described in the following sections.

## 4.6 Sampling

This SSWP details sampling by media planned at the former Ft. Flagler FUDS, as discussed at July 24, 2006 TPP Meeting as documented in the *Final Technical Project Planning Memorandum, Fort, Flagler Military Reservation* (Shaw 2006b). Soil and sediment samples will be collected based upon the rationale in Table 3. The proposed sampling for the Ft. Flagler is summarized in Table 4. Sample designations and quality assurance/quality control (QA/QC) sample requirements are summarized in Table 5.

A MEC and anomaly avoidance survey, aided by use of a magnetometer, will be conducted at sampling locations prior to any sampling. Although MEC is not expected to be present on the land surface, a magnetometer-assisted, visual inspection will be conducted by a qualified UXO technician at sampling locations within the AOC. A GPS receiver will be used to record discovered MEC, munitions debris, and sample point locations. Digital photographs will be taken to document significant features. Note that sample locations shown of the figures are approximate. The site has not been previously walked and locations of features such as firing lines, target berms, grenade court, etc. are not known accurately.

The following conditions at each planned sampling location will be documented in the field log book and recorded by digital photographs as necessary:

- Presence or absence of MEC and munitions debris,
- Coordinates of sampling locations (using a hand-held GPS unit),
- Access limitations,
- Vegetative cover,
- Soil conditions, and
- Other conditions encountered that impact sample collection.

In all instances, samples will be collected using clean, new, disposable sampling equipment, i.e., a spoon or scoop and bowl. Non-disposable tools, such as a spade, shovel, or trowel, may be used to remove vegetation and roots prior to collection of the soil or sediment sample.

All soil and sediment samples will be collected in accordance with Sections 6.1 and Shaw Standard Operating Procedures (SOPs) T-FS-101 of Appendix E of the *Final Type I Work Plan* (Shaw, 2006a).

Based on the TPP Memo (Shaw, 2006b) the constituents of concern include explosive compounds and metals. Analysis of explosive compounds includes the list of explosives identified in Appendix E of the *Type I Work Plan* (Shaw, 2006a). In some cases, as identified below, nitroglycerin and pentaerythritol tetranitrate (PETN) will also be included in the list for explosives analysis. Analysis for the components of black powder (potassium nitrate, charcoal, and sulfur) will not be performed because they are not hazardous substances. Similarly, analysis for the explosive nitrocellulose, which is formed by the combining of nitric acid and cellulose, will not be performed because it is not a hazardous substance when not used as an explosive.

The select metal list was developed from metals that are related to either munitions firing or components of bullets, projectiles, or metal casing. No metals have been identified as being present during firing, or if present they would not be in sufficient concentrations to be detectable.

The sheet metal and cast iron munitions bodies consisted primarily of iron. Other metals that may be present include hazardous substances chromium, copper, and nickel, and non-hazardous substances aluminum and molybdenum. Lead a potential contaminant for small arms ranges. Based on the above discussion the select metals list for the former Fort Flagler includes aluminum, chromium, copper, iron, lead, molybdenum, and nickel. In addition, the manganese will also be included as it is useful in evaluating naturally occurring concentrations of lead in soil, if required, If the this is required, the method of Myers and Thorbjornsen (2004) will be used.

Analysis for diphenylamine will not be completed. Diphenylamine is a stabilizer that is added to Ballistite. Ballistite also contains nitrocellulose and nitroglycerin. If remnants of diphenylamine remain in the soil it will be indicated by the presence of nitroglycerin which is being analyzed for.

Sampling for perchlorate in soil and sediment will not be done. Perchlorate containing munitions (M28 and M29 3.5-inch Rockets and in some munitions fuzes) have been identified as used at former Ft. Flagler. Perchlorate is very soluble in water, and in the over 50 years since the former Ft. Flagler was active any residual perchlorate would have been solublized by precipitation and would not be present in detectable concentrations.

If during sampling activities sensitive cultural resources, biological hazards (poison ivy, etc), sensitive habitat, or other sampling restriction are identified at a sampling location, the location shall be moved. The sampling location will be moved in 10 ft increments until a suitable location is identified. The direction of movement will be at the discretion for the Field Team Leader and the new location will honor the purpose of the sample. For example, if the sample is to be collected from a target berm the sample should be moved laterally along the berm so as to be representative of the berm.

#### **4.6.1 Soil**

Surface soil sampling is proposed at the Transition Range 1, Transition Range 2, Rifle Grenade/Anti-Tank Rocket Range, Live Grenade Range, Rifle Range, and Quartermaster Wharf AOCs. Additionally, a contingency surface soil sample is allotted for the Ammunition Bunker, if needed. No soil samples will be collected from the Range Complex, Demolition Area, or the Gas Chamber AOCs. The conceptual models for these AOCs do not indicate the likely presence of MC in the surface soils (see Appendix A).

Surface soil samples will be collected at a depth of approximately 0 to 6 inches below ground surface (bgs). Surface soil samples will be composite samples (7-point, wheel pattern with 2-foot radius). The surface soil sampling proposed for the AOCs at Ft. Flagler is discussed below and summarized in Table 4.

#### **Ammunition Bunker AOC**

One surface soil sample will be collected from the Ammunition Bunker AOC (Figure 3) if evidence of MEC or munitions debris is located during the visual reconnaissance. If a surface soil sample is collected at the Ammunition Bunker AOC, the sample will be located adjacent to the MEC munitions debris (only when safe) and analyzed for select metals (aluminum, chromium, copper, iron, lead, molybdenum, manganese, and nickel) and explosives, including nitroglycerin and PETN, according to the methods specified in Section 4.6.4.

### **Transition Ranges 1 and 2 AOCs**

Two surface soil samples each will be collected from the Transition Range 1 AOC and the Transition Range 2 AOC. These samples will be collected from locations near the range's target berms (Figures 7 and 8, respectively). The target berms may be readily recognizable as raised soil mounds or linear features or target remnants may be present. However, in some cases these features may have been eroded or removed and indications may be subtle. In addition, bullets may be visible on the surface, which would indicate the target area. Surface soil samples collected from the Transition Ranges will be analyzed for lead according to the method specified in Section 4.6.4.

### **Rifle Grenade/Anti-Tank Rocket Range AOC**

Three surface soil samples will be collected from the Rifle Grenade/Anti-Tank Rocket Range AOC (Figure 5). Two of the three surface soil samples will be collected from locations where MEC or debris were observed during the 1992 TCRA based on survey coordinates available in the closure report. The third surface soil sample will be collected from a location in the eastern part of the clearance area where the visual reconnaissance will be performed and where munitions debris is identified. If not munitions debris is identified, the sample location will be at a location along one of the reconnaissance transects. These samples will be analyzed for select metals (aluminum, chromium, copper, iron, lead, molybdenum, manganese, and nickel) and explosives, including nitroglycerin and PETN, according to the methods specified in Section 4.6.4.

### **Live Grenade Court AOC**

One surface soil sample will be collected from the Live Grenade Court AOC following completion of the visual reconnaissance (Figure 6). The sample location will be at a location where munitions debris is located. If no munitions debris is located the sample will be collected from within the approximate center of the AOC. The sample will be analyzed for select metals (aluminum, chromium, copper, iron, lead, molybdenum, manganese, and nickel) and explosives, including nitroglycerin and PETN, according to the methods specified in Section 4.6.4.

### **Rifle Range AOC**

Two surface soil samples will be collected from the Rifle Range AOC from locations near or at the target berm (Figure 9). These samples will be analyzed for lead according to the method specified in Section 4.6.4.

### **Quartermaster Wharf Disposal Area AOC**

One surface soil sample (beach) will be collected from the Quartermaster Wharf Disposal Area AOC (Figure 10). The location will be selected based on direct observation of accumulations of military debris or refuse or munitions debris. If none are found, the sample location will be at the location shown on Figure 10. The sample will be analyzed for explosives (including nitroglycerin and PETN) according to the methods specified in Section 4.6.4. Analysis of metals will not be completed at the Quartermaster Wharf Disposal Area AOC. The area has been used as a disposal area of items other than those related to munitions (i.e. refuse) and any metals detections or exceedances of screening levels would not be related to munitions use at former Ft. Flagler.

#### **4.6.2 Sediment**

Sediment sampling is proposed at the Transition Range 1, Transition Range 2, Rifle Grenade/Anti-Tank Rocket Range, and Rifle Range AOCs. Additionally, a contingency sediment sample is allotted for the Ammunition Bunker AOC, if needed. No sediment samples will be collected from the Range Complex, Demolition Area, or the Gas Chamber AOCs as the CSMs for these AOCs do not indicate the likely presence of MC in the surface soils (see Appendix A). No sediment sample will be collected from the Live Grenade Court as the AOC is relatively flat and overland flow is not expected. No sediment sample will be collected from the Quartermaster Wharf Disposal Area as the AOC is located within the inter-tidal zone and the soil sample identified above addresses this data gap.

Sediment samples will be collected from 0 to 2 inches bgs in area of surface water accumulation. These samples will be collected as discrete samples in order to be representative of material deposited in specific, localized areas of surface water accumulation. The sediment sampling proposed for the AOCs at Ft. Flagler is discussed below and summarized in Table 4.

##### **Ammunition Bunker AOC**

One sediment sample will be collected from the Ammunition Bunker AOC (Figure 3) if evidence of MEC or MEC debris is located during the visual reconnaissance. The sample will be collected from an area of surface water accumulation. If no water accumulation areas are identified, the sample team will move down slope of the Ammunition Bunker until a suitable location is found. The sample will be analyzed for select metals (aluminum, chromium, copper, iron, lead, molybdenum, manganese, and nickel) and explosives, including nitroglycerin and PETN, according to the methods specified in Section 4.6.4.

##### **Transition Range's 1 and 2 AOCs**

One sediment sample each will be collected from the Transition Range 1 AOC and the Transition Range 2 AOCs (Figures 7 and 8, respectively). The sample will be collected from an area of surface water accumulation down slope of target berms. If no water accumulation areas are identified, the sample team will move down slope of the target berms until a suitable location is found. These sediment samples will be analyzed for lead according to the method specified in Section 4.6.4.

##### **Rifle Grenade/Anti-Tank Rocket Range AOC**

One sediment sample will be collected from the Rifle Grenade/ Anti-Tank Rocket Range AOC (Figure 5). The sample will be collected from an area of surface water accumulation down slope of locations where munitions debris was identified during the 1992 TCRA (reference). If no water accumulation areas are identified, the sample team will move further down slope of the location until a suitable location is found. The sample will be analyzed for select metals (aluminum, chromium, copper, iron, lead, molybdenum, manganese, and nickel) and explosives, including nitroglycerin and PETN, according to the methods specified in Section 4.6.4.

##### **Rifle Range AOC**

One sediment sample will be collected in front of the target berm at the Rifle Range AOC where runoff would be expected (Figure 9). The sample will be analyzed for lead according to the method specified in Section 4.6.4.

### 4.6.3 Background

Ten soil samples, one sediment sample, and one beach sample will be collected from background locations (Figure 11). Proposed background composite soil sample locations are shown on Figure 11. Prior to collecting each background sample, the location will be assessed to evaluate if the location has been impacted by past site operations (i.e. firing points, roads, storage areas). If potential impacts are identified the location will be moved, at the discretion of the Field Team Lead, to a nearby location that does not show impacts from past site operations. Approval for moving these locations does not require approval by the USACE. Indicators of past site activities would include disturbed soil, soil staining, adjacent buildings. Background sample locations will be a minimum 50 ft distant from roads, trails, or buildings.

The background samples will be analyzed for Target Analyte List metals and molybdenum according to the methods specified in Section 4.6.4. The ten background soil sample analytical results will be used to calculate background metal soil concentrations using published USEPA Guidance (1989, 1992, 1994, 1995, and 2006). A 95<sup>th</sup> upper tolerance limit (UTL) for normally and lognormally distributed analytes or the 95<sup>th</sup> percentile for nonparametric distributed analytes will be calculated for background concentrations.

The method for comparing source area sediment analytical results to the single background analysis will be consistent with the USEPA HRS (40 CFR Part 300: Appendix A). The HRS uses three times the background concentration as the criteria for evidence of a release to the environment. These criteria are not applied for soils because a statistically based determination of background has been established, and an exceedance of the 95<sup>th</sup> UTL or 95<sup>th</sup> percentile is used to establish a release of MC.

### 4.6.4 Analytical Program

Definitive target analyses for samples collected from Ft. Flagler consist of the following:

- Select metals (aluminum, chromium, copper, iron, lead, molybdenum, manganese, and nickel) and lead by USEPA SW-846 Method 6020A,
- TAL metals and molybdenum by USEPA SW-846 Method 6020/7471A,
- Explosives by USEPA SW-846 Method 8330A, and
- Nitroglycerin and PETN by USEPA SW-846 Method 8330A (Modified).

Soil and sediment samples will be analyzed using USEPA SW-846 methodology as presented in Section 5.0 of the USACE QAPP. Soil and sediment samples may have been impacted by small arms fire will be passed through an ASTM No. 10 (2-mm) wire mesh sieve at the laboratory prior to analysis for metals in order to remove coarser particles and foreign objects, including large metallic fragments from bullets, which have a low degree of bio-availability (ITRC, 2003).

Tables 6 through 8 present human health and ecological risk based screening concentrations. If the Practical Quantitation Limit (PQL) exceeds a screening value, the compound will be carried forward in the evaluation process. Chemical data will be reported via a hard-copy data package and electronic format following the requirements referenced in Section 7.1 and 7.2 of the USCAE QAPP. These data deliverables will be validated in accordance to the requirements referenced in Section 8.2 of the USACE QAPP.

#### **4.6.5 Quality Assurance/Quality Control Samples**

In accordance with the USACE Programmatic SAP, quality control (QC) samples will be collected. The locations planned for the collection of QC samples are noted on Table 5. The QC samples to be collected include field duplicates matrix spike/matrix spike duplicate (MS/MSD) samples. The Omaha Design Center has directed that no QA field split samples will be collected for this site.

#### **4.6.6 Sample Preservation, Packaging, and Shipping**

Sample preservation and packaging are provided in Table 4-1 and Table 4-2 of the NWO FUDS QAPP. Sample shipment will follow the procedures specified in Section 4.0 of the NWO FUDS QAPP. Completed analysis request/chain of custody records per Section 7.1.3 of the NWO FUDS SAP will be secured and included with each shipment of coolers to GPL Laboratories, LLC. All samples will be shipped to the following:

##### **GPL Laboratories, LLC**

7210A Corporate Court

Attention: Sample Receiving/Virginia Zusman

Frederick, MD 21703

Phone: 301.694.5310; Fax: 301.620.0731

### **5.0 INVESTIGATION DERIVED WASTE**

Investigation-derived waste (IDW) will be managed in accordance with the *Final Type I Work Plan* (Shaw, 2006a) (Section 3.7, and Appendix E, Shaw's SAP Section 9.0). All IDW is presumed non-hazardous unless field observations indicate otherwise. The following types of IDW will be managed as specified in the *Final Type I Work Plan* (Shaw, 2006a), Appendix E, and the USACE Field Sampling Plan:

- Personal protective equipment and disposable equipment (i.e., disposable sampling scoop): bagged and routed to a municipal landfill;
- Excess surface soil, surface water, and sediment material: returned to source (i.e., ground surface).

### **6.0 PROPOSED SCHEDULE**

The proposed schedule for field activities and reporting is provided below. The timing of the field activities assumes there will be no delays because of inclement weather or ROE issues.

December 2006 – Review of Draft SSWP;

January 2007 – Submit Final SSWP;

February 2007 – Conduct SI field activities;

April 2007 – Submit Draft SI Report;

May 2007 – Review Draft SI Report;

May 2007 – Submit Draft Final SI Report;

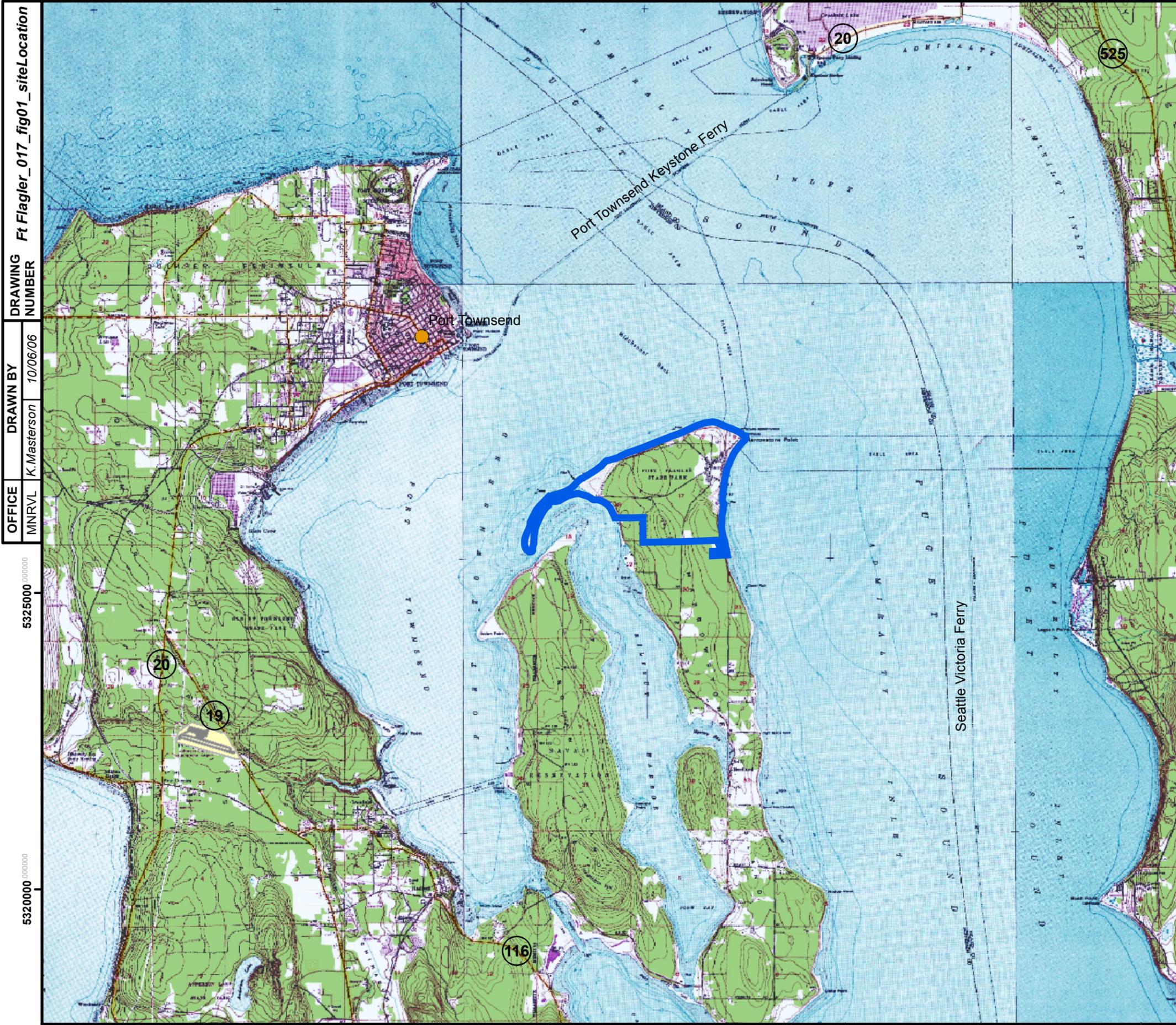
May 2007 – Review Draft Final SI Report; and

June 2007 – Submit of Final SI Report.

## 7.0 REFERENCES

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# FIGURES



DRAWING NUMBER: Ft Flagler\_017\_fig01\_siteLocation  
 DRAWN BY: K.Masterson  
 DATE: 10/06/06  
 OFFICE: MNRVL

5325000 000000  
 5320000 000000

515000 000000      520000 000000      525000 000000      530000 000000

515000 000000      520000 000000      525000 000000      530000 000000

**Legend**

- Fort Flagler Military Reservation Property Boundary



REFERENCE/PROJECTION: NAD 83 UTM Zone 10N



U.S. ARMY CORPS OF ENGINEERS  
 OMAHA DESIGN CENTER

**FIGURE 1**  
**SITE LOCATION**  
 FORT FLAGLER MILITARY RESERVATION





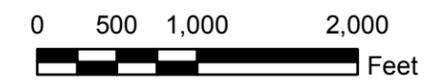
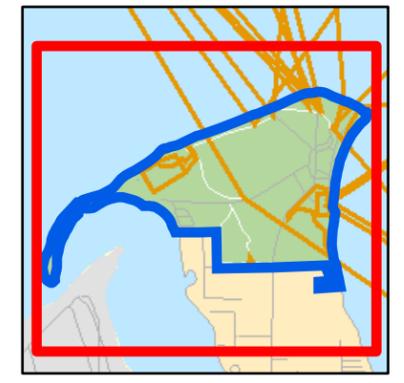
DRAWING NUMBER: FtFlagler\_034\_fig02\_SiteLayout\_SSWP  
 DRAWN BY: K. Black  
 DATE: 12/15/06  
 OFFICE: SJ

**Legend**

- Fort Flagler Military Reservation Property Boundary
- Fort Flagler Area of Concern
- 1992 UXO Clearance Area

**NOTES:**

- 1) AOC boundaries were derived from the Fort Flagler Military Reservation ASR, INPR Supplement and State Park historic map.
- 2) Fort Flagler Military Reservation property is located entirely within the Ft. Flagler State Park.
- 3) The aerial photo was obtained from TerraServer (1-meter resolution); the photo is dated June 21, 1990.



REFERENCE/PROJECTION: NAD 83 UTM Zone 10N



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**FIGURE 2**  
**FT. FLAGLER MILITARY RESERVATION**  
**AOC LOCATION MAP**

FORT FLAGLER MILITARY RESERVE

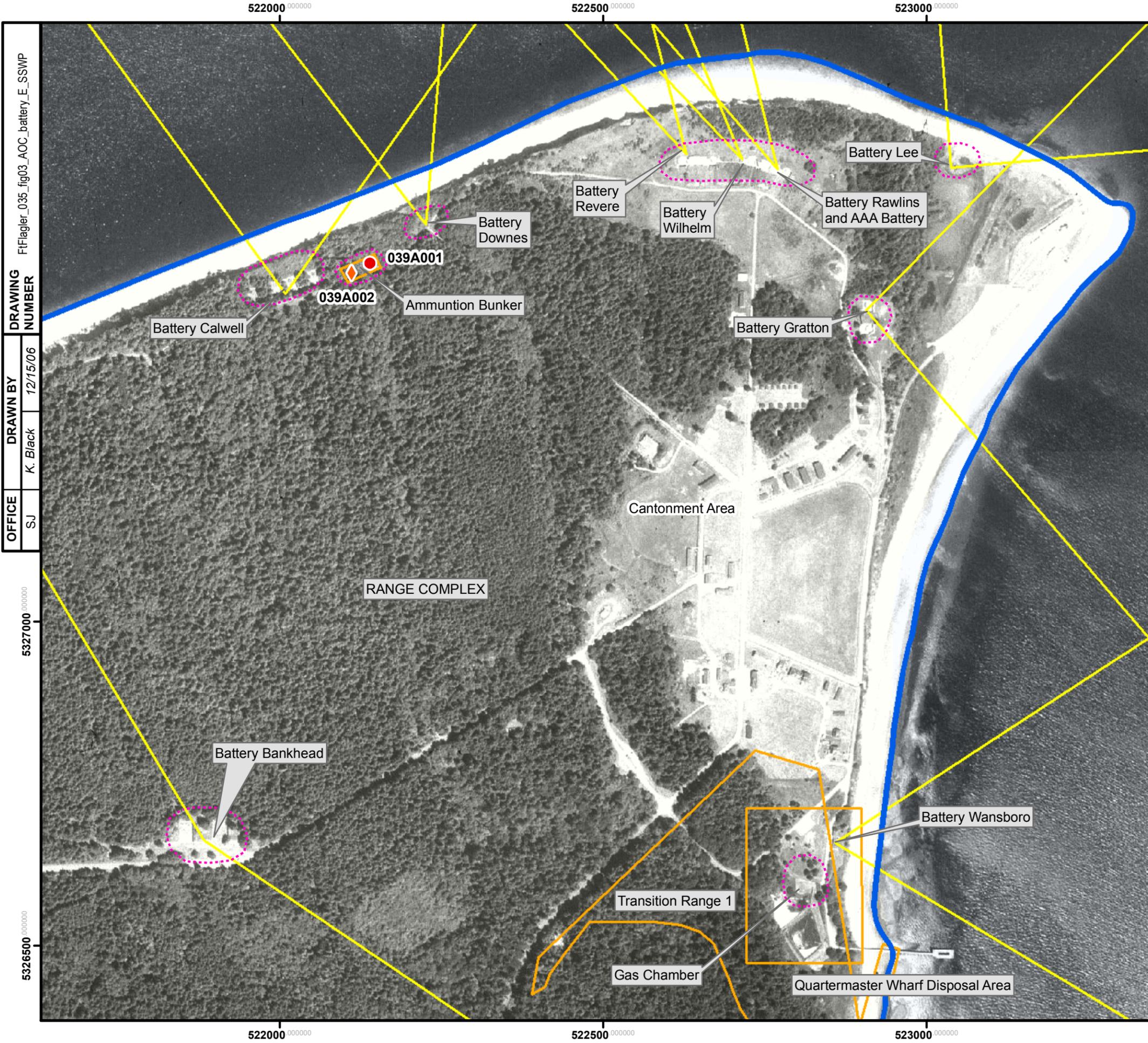


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 5327000  
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DRAWING NUMBER: FFlagler\_035\_fig03\_AOC\_battery\_E\_SSWP  
 DRAWN BY: K. Black  
 DATE: 12/15/06  
 OFFICE: SJ



**Legend**

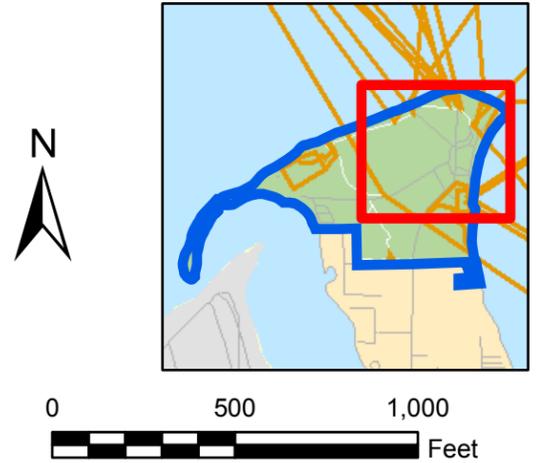
- Fort Flagler Military Reservation Property Boundary
- Fort Flagler Area of Concern
- Range Fan
- Visual Only Reconnaissance Survey Path (Approximate)

**Proposed Sampling Locations (approximate)**

- Sediment
- Soil

**NOTES:**

- AOC boundaries were derived from the Fort Flagler Military Reservation ASR, INPR Supplement and State Park historic map.
- The aerial photo was obtained from TerraServer (1-meter resolution); the photo is dated June 21, 1990.



REFERENCE/PROJECTION: NAD 83 UTM Zone 10N

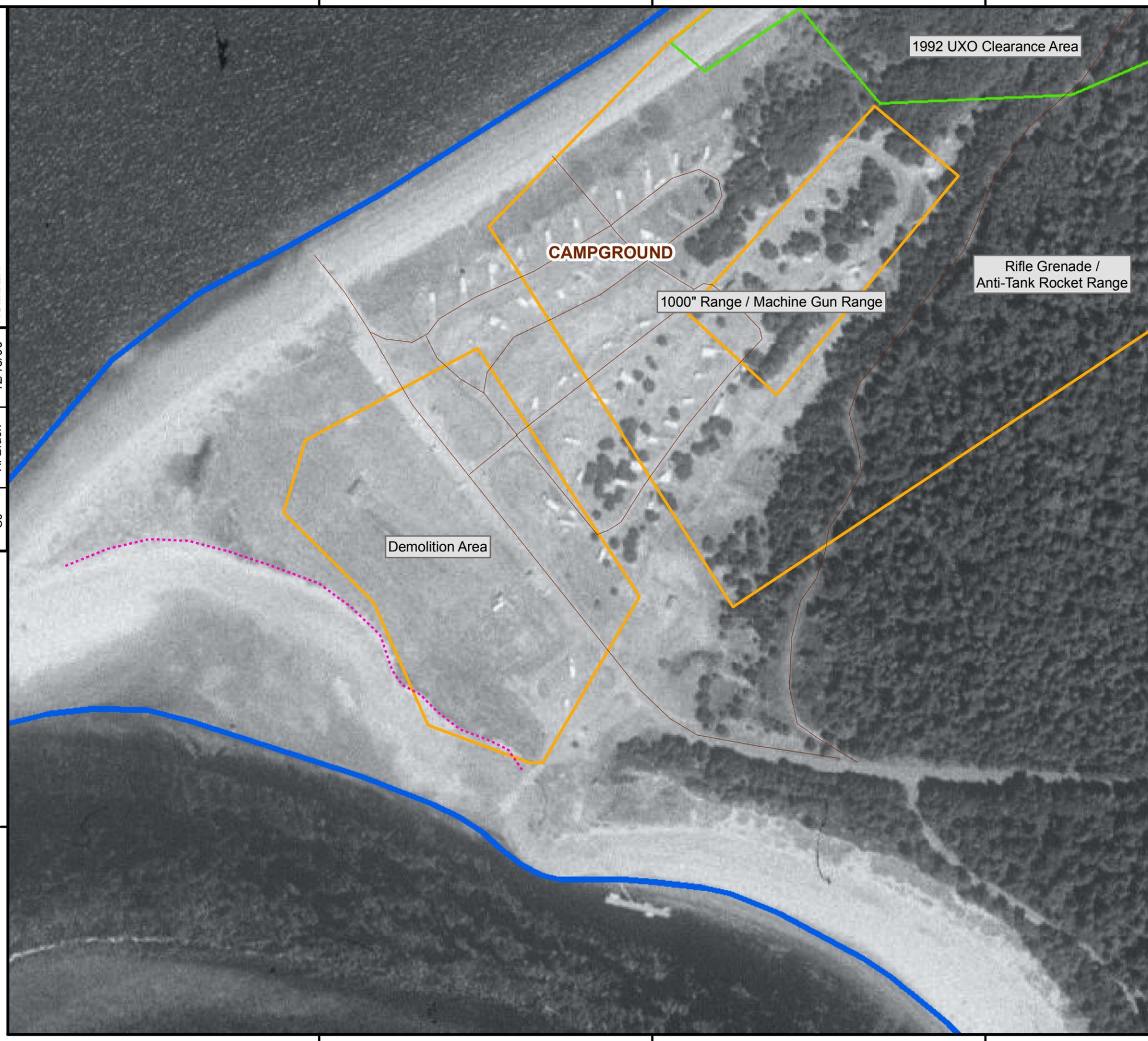

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 OMAHA DESIGN CENTER

**FIGURE 3**  
**RANGE COMPLEX AREA OF CONCERN**

FORT FLAGLER MILITARY RESERVATION


 Shaw Environmental, Inc.

DRAWING NUMBER: Ft Flagler\_036\_fig04\_AOC\_demolition\_SSWP  
 DRAWN BY: K. Black  
 DATE: 12/13/06  
 OFFICE: SJ

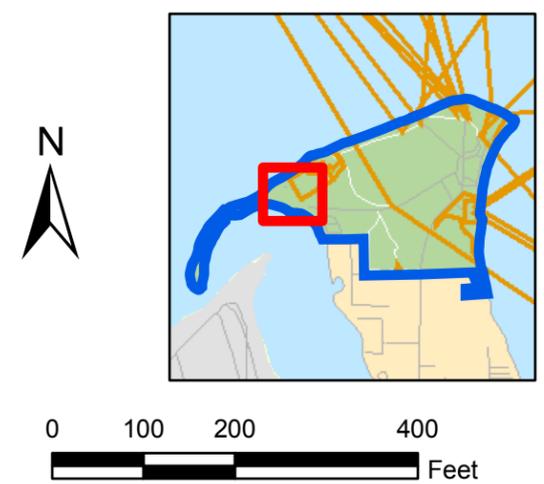


**Legend**

- Fort Flagler Military Reservation Property Boundary
- 1992 UXO Clearance Area
- Fort Flagler Area of Concern Adjusted Location
- Campground Road/Trail
- Visual Only Reconnaissance Survey Path (Approximate)

**NOTES:**

- 1) AOC boundaries were derived from the Fort Flagler Military Reservation ASR, INPR Supplement and State Park historic map.
- 2) The aerial photo was obtained from TerraServer (1-meter resolution); the photo is dated June 21, 1990.

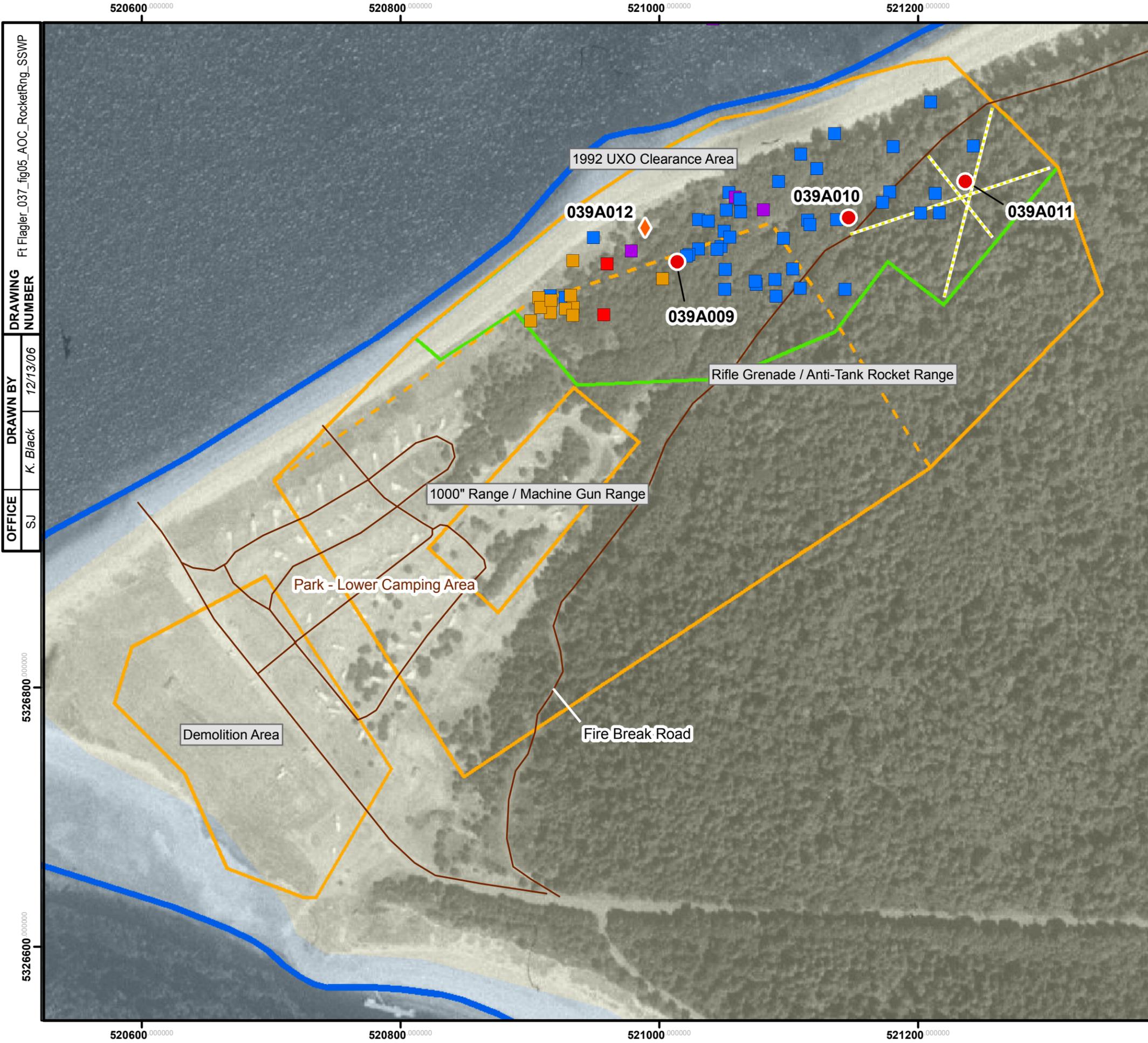


REFERENCE/PROJECTION: NAD 83 UTM Zone 10N

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 OMAHA DESIGN CENTER

**FIGURE 4**  
**AREA OF CONCERN**  
**DEMOLITION AREA**  
 FORT FLAGLER MILITARY RESERVATION

Shaw Environmental, Inc.



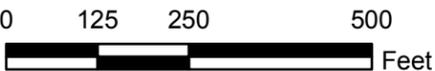
DRAWING NUMBER: Ft Flagler\_037\_fig05\_AOC\_RocketRng\_SSWP  
 DRAWN BY: K. Black  
 DATE: 12/13/06  
 OFFICE: SJ

**Legend**

- Fort Flagler Military Reservation Property Boundary
- 1992 UXO Clearance Area
- Fort Flagler Area of Concern Adjusted Location
- Fort Flagler Area of Concern as Identified in the ASR Supplement
- Campground Road/Trail
- 2.36" HEAT Rocket Motor
- 3.5" HEAT Rocket Motor
- Bunker Corner
- Mine Anti-Tank/Anti-Vehicle
- Visual Reconnaissance with Magnetometer Path (Approximate)
- Proposed Sampling Locations (approximate)
- Sediment
- Soil

**NOTES:**

- 1) AOC boundaries were derived from the Fort Flagler Military Reservation ASR, INPR Supplement and State Park historic map.
- 2) The aerial photo was obtained from TerraServer (1-meter resolution); the photo is dated June 21, 1990.

0 125 250 500 Feet

REFERENCE/PROJECTION: NAD 83 UTM Zone 10N




 U.S. ARMY CORPS OF ENGINEERS  
 OMAHA DESIGN CENTER

**FIGURE 5**  
**AREA OF CONCERN**  
**RIFLE GRENADE / ANTI-TANK ROCKET RANGE**  
 FORT FLAGLER MILITARY RESERVATION


 Shaw Environmental, Inc.

522400 000000 522600 000000 522800 000000 523000 000000

DRAWING NUMBER Ft Flagler\_038\_fig06\_AOC\_PracticeGrenade\_SSWP

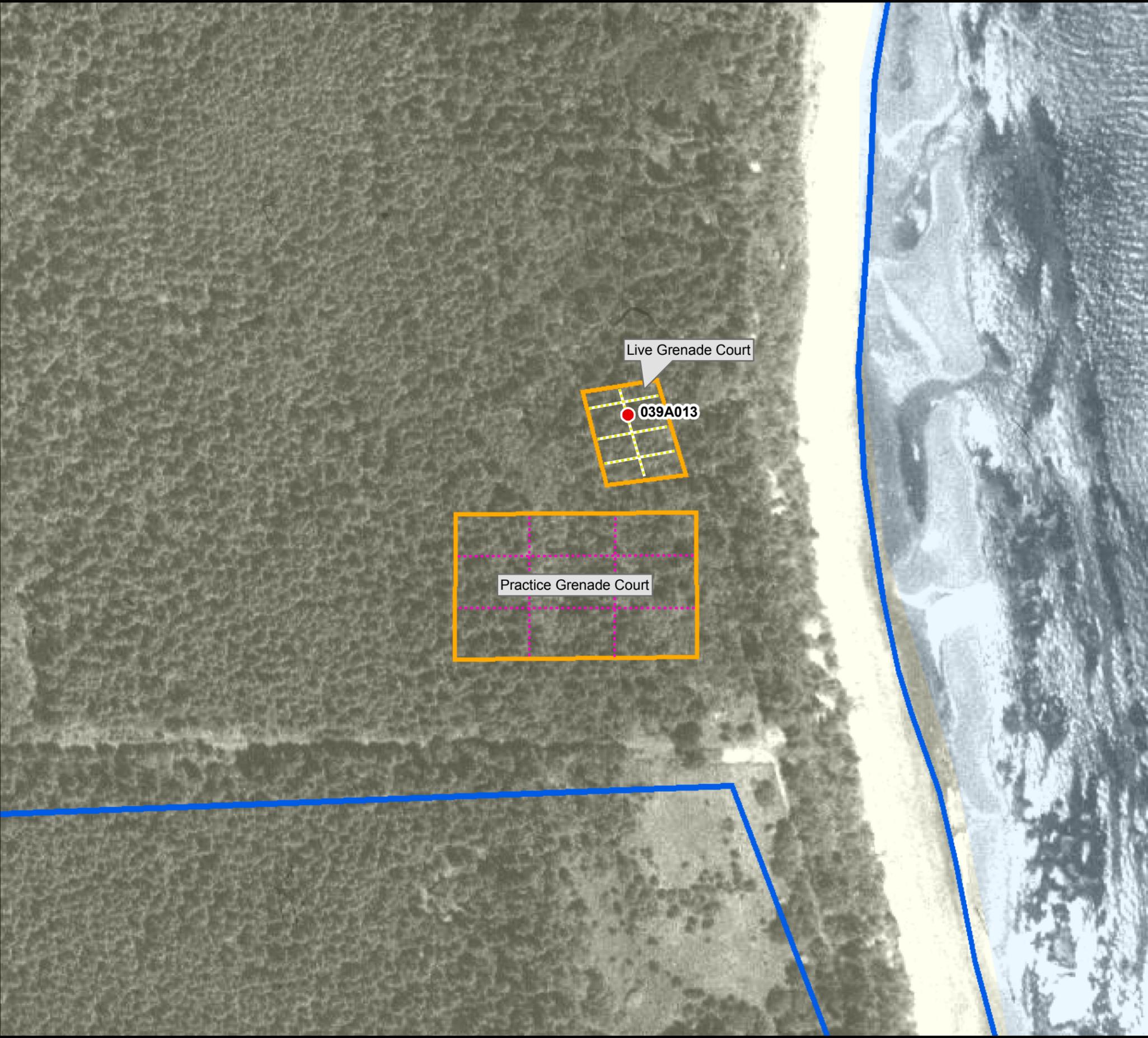
DRAWN BY K. Black 12/11/06

OFFICE SJ

532600 000000

5325800 000000

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**Legend**

**Proposed Sampling Location (approximate)**

- Soil
- Visual Only Reconnaissance Path (Approximate)
- Visual Reconnaissance with Magnetometer Path (Approximate)
- Fort Flagler Area of Concern
- Fort Flagler Military Reservation Property Boundary

NOTES:

- 1) AOC boundaries were derived from the Fort Flagler Military Reservation ASR, INPR Supplement and State Park historic map.
- 2) The aerial photo was obtained from TerraServer (1-meter resolution); the photo is dated June 21, 1990.



REFERENCE/PROJECTION: NAD 83 UTM Zone 10N

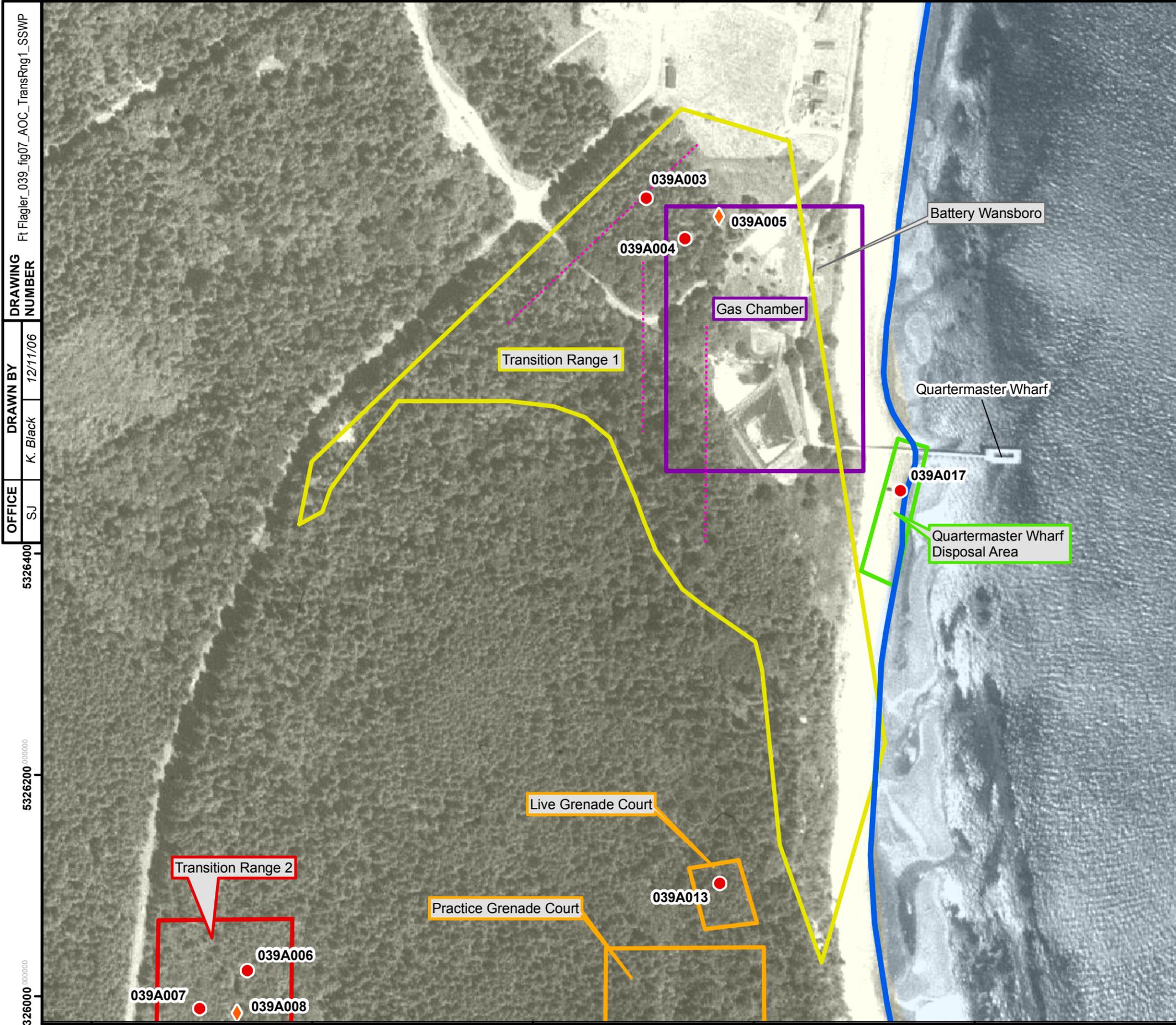


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**FIGURE 6**  
**AREA OF CONCERN**  
**LIVE AND PRACTICE GRENADE COURTS**  
FORT FLAGLER MILITARY RESERVATION



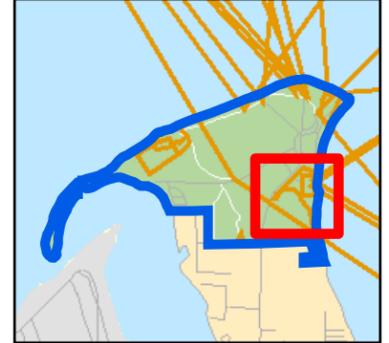
522200 000000 522400 000000 522600 000000 522800 000000 523000 000000



**Legend**

- Fort Flagler Military Reservation Property Boundary
- Fort Flagler Areas of Concern**
- Gas Chamber
- Quatermaster Wharf Disposal Area
- Transition Range 1
- Live Grenade Court
- Practice Grenade Court
- Transition Range 2
- Visual Only Reconnaissance Path (Approximate)
- Proposed Sampling Location (approximate)**
- Sediment
- Soil

NOTES:  
 1) AOC boundaries were derived from the Fort Flagler Military Reservation ASR, INPR Supplement and State Park historic map.  
 2) The aerial photo was obtained from TerraServer (1-meter resolution); the photo is dated June 21, 1990.



REFERENCE/PROJECTION: NAD 83 UTM Zone 10N

DRAWING NUMBER: Ft Flagler\_039\_fig07\_AOC\_TransRng1\_SSWP  
 DRAWN BY: K. Black  
 DATE: 12/11/06  
 OFFICE: SJ

5326400  
 5326200  
 5326000

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**FIGURE 7**  
**AREA OF CONCERN**  
**TRANSITION RANGE 1**  
 FORT FLAGLER MILITARY RESERVATION

Shaw Environmental, Inc.

522000 000000 522200 000000 522400 000000 522600 000000



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 OFFICE SJ  
 DRAWN BY K. Black  
 DRAWING NUMBER 12/11/06  
 Ft Flagler\_040\_fig08\_AOC\_TransRng2\_SSWP

**Legend**

-  Fort Flagler Military Reservation Property Boundary
-  Fort Flagler Area of Concern

**Proposed Sampling Location (approximate)**

-  Sediment
-  Soil
-  Visual Only Reconnaissance Path (Approximate)

NOTES:  
 1) AOC boundaries were derived from the Fort Flagler Military Reservation ASR, INPR Supplement and State Park historic map.  
 2) The aerial photo was obtained from TerraServer (1-meter resolution); the photo is dated June 21, 1990.



REFERENCE/PROJECTION: NAD 83 UTM Zone 10N



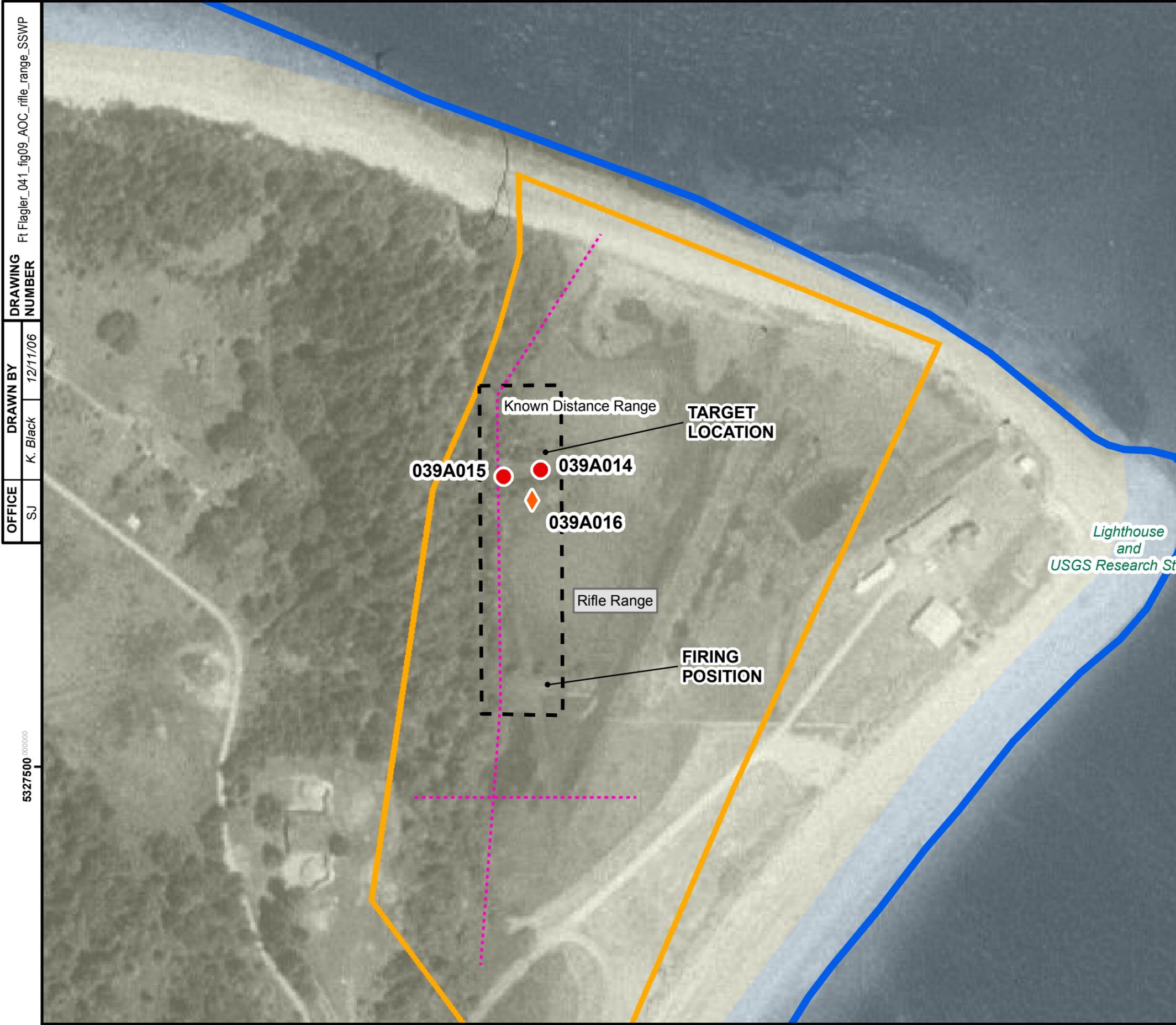
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 OMAHA DESIGN CENTER

**FIGURE 8**  
**AREA OF CONCERN**  
**TRANSITION RANGE 2**

FORT FLAGLER MILITARY RESERVATION



522000 000000 522200 000000 522400 000000 522600 000000



OFFICE: SJ  
 DRAWN BY: K. Black  
 DRAWING NUMBER: 12/11/06  
 Ft Flagler\_041\_fig09\_AOC\_rifle\_range\_SSWP

**Legend**

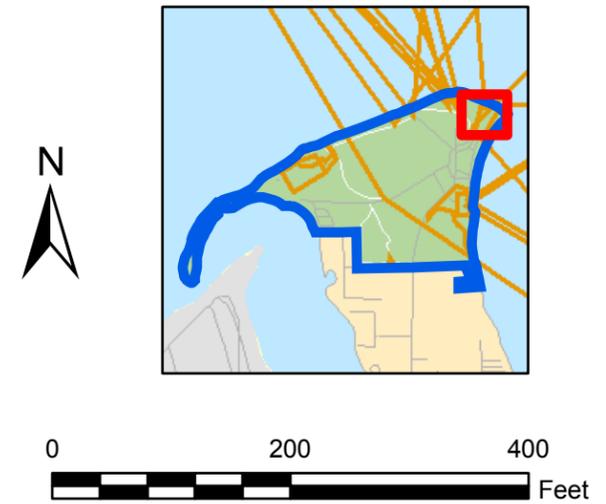
- Fort Flagler Military Reservation Property Boundary
- Fort Flagler Area of Concern
- Visual Only Reconnaissance Path (Approximate)

**Proposed Sampling Location (approximate)**

- ◆ Sediment
- Soil

**NOTES:**

- 1) AOC boundaries were derived from the Fort Flagler Military Reservation ASR, INPR Supplement and State Park historic map.
- 2) The aerial photo was obtained from TerraServer (1-meter resolution); the photo is dated June 21, 1990.

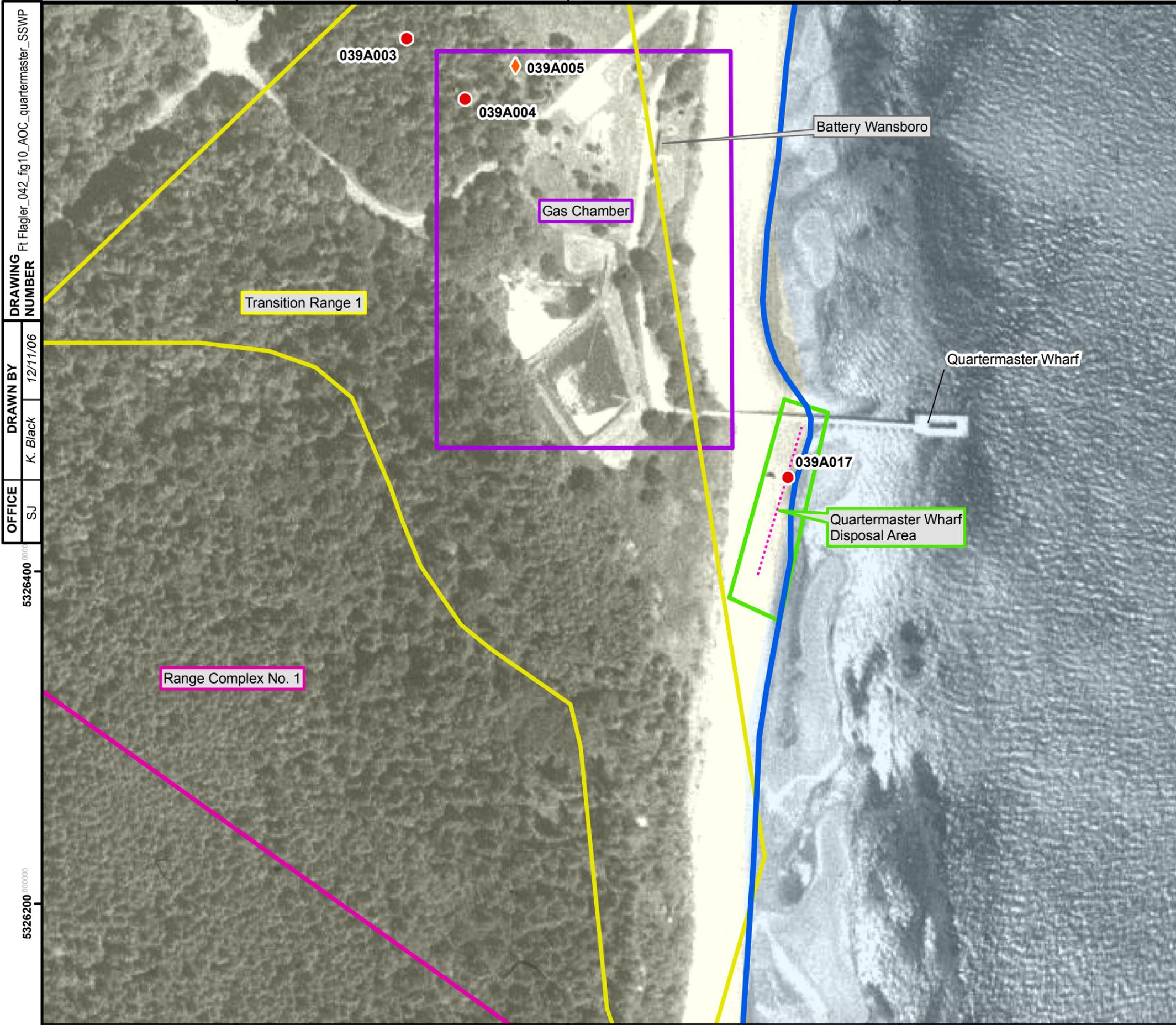


REFERENCE/PROJECTION: NAD 83 UTM Zone 10N

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**FIGURE 9**  
**AREA OF CONCERN**  
**RIFLE RANGE**  
 FORT FLAGLER MILITARY RESERVATION

Shaw Environmental, Inc.

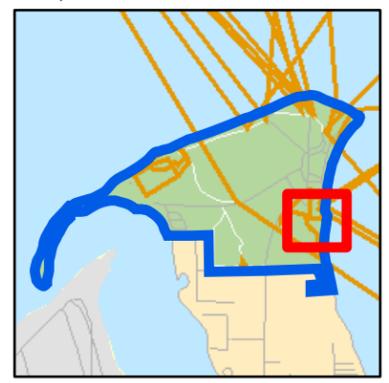


DRAWING NUMBER: Ft Flagler\_042\_fig10\_AOC\_quartermaster\_SSWP  
 DRAWN BY: K. Black  
 DATE: 12/11/06  
 OFFICE: SJ

**Legend**

- Fort Flagler Military Reservation Property Boundary
- Fort Flagler Areas of Concern
- Range Complex No. 1
- Gas Chamber
- Quatermaster Wharf Disposal Area
- Transition Range 1
- - - - - Visual Only Reconnaissance Path (Approximate)
- Proposed Sampling Location (approximate)
- ◆ Sediment
- Soil

NOTES:  
 1) AOC boundaries were derived from the Fort Flagler Military Reservation ASR, INPR Supplement and State Park historic map.  
 2) The aerial photo was obtained from TerraServer (1-meter resolution); the photo is dated June 21, 1990.



REFERENCE/PROJECTION: NAD 83 UTM Zone 10N



U.S. ARMY CORPS OF ENGINEERS  
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**FIGURE 10**  
**AREA OF CONCERN**  
**QUARTEMASTER WHARF DISPOSAL AREA**  
 FORT FLAGLER MILITARY RESERVATION



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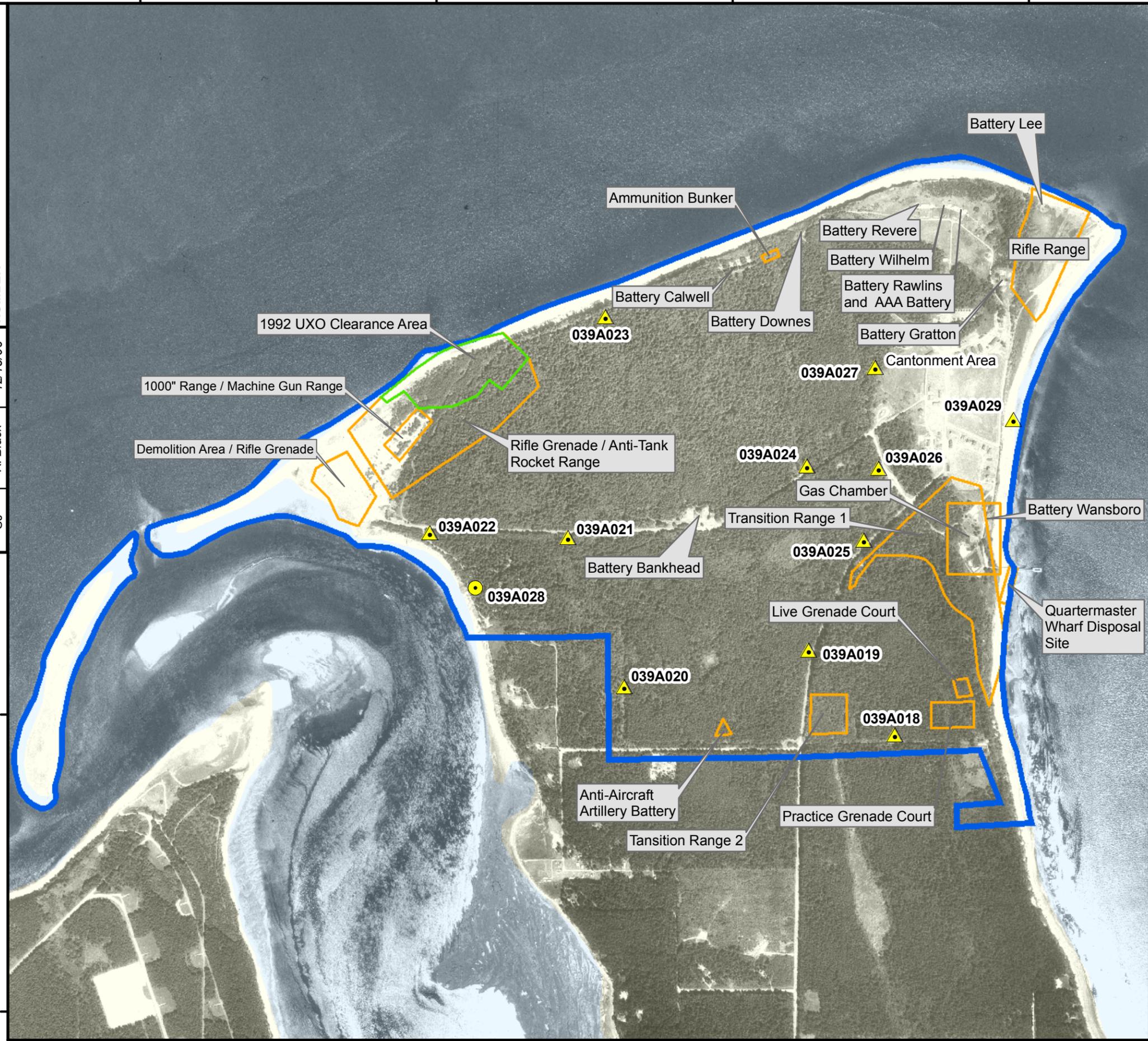
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 5326400

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DRAWING NUMBER: FtFlagler\_043\_fig11\_Bckgrnd\_Samp\_SSWP  
DRAWN BY: K. Black  
DATE: 12/15/06  
OFFICE: SJ



**Legend**

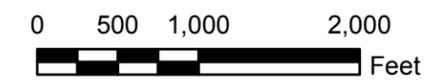
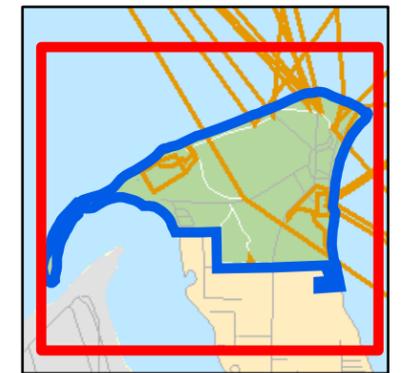
- Fort Flagler Military Reservation Property Boundary
- Fort Flagler Area of Concern
- 1992 UXO Clearance Area

**Proposed Sampling Location (approximate)**

- Background Sediment
- Background Soil

**NOTES:**

- 1) AOC boundaries were derived from the Fort Flagler Military Reservation ASR, INPR Supplement and State Park historic map.
- 2) Fort Flagler Military Reservation property is located entirely within the Ft. Flagler State Park.
- 3) The aerial photo was obtained from TerraServer (1-meter resolution); the photo is dated June 21, 1990.



REFERENCE/PROJECTION: NAD 83 UTM Zone 10N

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OMAHA DESIGN CENTER

**FIGURE 11**  
**FT. FLAGLER MILITARY RESERVATION**  
**BACKGROUND SAMPLE LOCATIONS**

FORT FLAGLER MILITARY RESERVE



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# **TABLES**

**Table 1**  
**Potential MEC and MC at Ft. Flagler Military Reservation**

<b>AOC</b>	<b>Subrange /Battery</b>	<b>Munitions</b>	<b>Munitions Constituents</b>	<b>Land Use Controls</b>
Range Complex	Battery Bankhead	12-inch Mortar, M1889 MI	Propellant – single-base (nitrocellulose) or triple-base (nitrocellulose, NG, and nitroguanidine); HE Projectile – Explosive D (ammonium picrate). Projectile cast iron or steel	No
	Battery Calwell	6-inch Rapid Fire, M1903	Propellant – single-base (nitrocellulose) double-base (nitrocellulose and NG, or triple base (nitrocellulose, NG, and nitroguanidine); Practice Projectile – spotting charge; HE Projectile – TNT. Projectile cast iron or steel	
	Battery Downes	3-inch Rapid Fire, M1903	Propellant – single-base (nitrocellulose) or triple base (nitrocellulose, NG, and nitroguanidine); HE Projectile – TNT. Projectile cast iron or steel	
	Battery Gratton	6-inch Rapid Fire, M1903	Propellant – single-base (nitrocellulose) or triple base (nitrocellulose, NG, and nitroguanidine); Practice Projectile – spotting charge; HE Projectile – Explosive D (ammonium picrate). Projectile cast iron or steel	
	Battery Lee	5-inch Rapid Fire, M1897	Propellant – single-base (nitrocellulose) or triple base (nitrocellulose, NG, and nitroguanidine); Projectile explosive– unknown. Projectile cast iron or steel	
	Battery Rawlins	10-inch Rifle, MII	Propellant – single-base (nitrocellulose) or triple base (nitrocellulose, NG, and nitroguanidine); Projectile explosive – unknown. Projectile cast iron or steel	
	Battery Revere	10-inch Rifle, MII	Propellant – single-base (nitrocellulose) or triple base (nitrocellulose, NG, and nitroguanidine); Projectile explosive– unknown. Projectile cast iron or steel	
	Battery Wansboro	3-inch Rapid Fire, M1903	Propellant – single-base (nitrocellulose) or triple base (nitrocellulose, NG, and nitroguanidine); Practice Projectile – spotting charge; HE Projectile – TNT. Projectile cast iron or steel	
	Battery Wilhelm	12-inch Rifle, M1888 MII	Propellant – single-base (nitrocellulose) or triple base (nitrocellulose, NG, and nitroguanidine); HE Projectile – Explosive D (ammonium picrate). Projectile cast iron or steel	
	Anti-Torpedo Boat Battery	90-mm M1	Propellant – single-base (nitrocellulose), double-base (nitrocellulose and NG, or triple base (nitrocellulose, NG, and nitroguanidine) Projectile explosive - unknown Projectile cast iron or steel	
	Anti-Aircraft Artillery Battery	3-inch, M1917M1A2	Propellant – single-base (nitrocellulose) or triple base (nitrocellulose, NG, and nitroguanidine); Practice Projectile – spotting charge; HE Projectile – Explosive D (Ammonium picrate). Projectile cast iron or steel	

**Table 1 (Continued)**  
**Potential MEC and MC at Ft. Flagler Military Reservation**

AOC	Munitions	Munitions Constituents	Land Use Controls
Ammunition Bunker	Small Arms	Lead; Propellant – single-base (nitrocellulose) or double-base (nitrocellulose and NG).	No
	Riot Hand Grenade, ABC-M25A1	CN, steel	
	Candle	CN	
	Rocket, M28, 3.5-inch	NG, nitrocellulose, potassium perchlorate, RDX, TNT, steel	
	Practice Rocket, M29, 3.5-inch	NG, nitrocellulose, potassium perchlorate, steel	
	Rocket, M6A1, 2.36-inch, Anti-Tank	Ballistite (nitrocellulose, NG, diphenylamine); Pentolite (TNT & PETN), steel	
	Practice Rocket, M7A1, 2.36-inch, Anti-Tank	Ballistite (nitrocellulose, NG, diphenylamine), steel	
	Mk II Fragment Hand Grenade	TNT, flaked or granular, older models used E.C. blank fire smokeless powder, perchlorate in fuze, cast iron	
	M21 Practice Hand Grenade	Black powder (potassium nitrate, sulfur, charcoal), perchlorate in fuze.	
	Mk 1A1 Practice Hand Grenade	Spotting charge, steel	
	Anti-Tank, Anti-Vehicle Mine	Inert, steel	
Transition Range 1	Small Arms	Lead; Propellant – single-base (nitrocellulose) or double-base (nitrocellulose and NG).	No
Transition Range 2	Small Arms	Lead; Propellant – single-base (nitrocellulose) or double-base (nitrocellulose and NG).	No
Gas Chamber	Riot Hand Grenade, ABC-M25A1	CN, steel	No
	Candle	CN	
Rifle Grenade/ Anti-Tank Rocket Range	Rocket, M28, 3.5-inch	NG, nitrocellulose, potassium perchlorate, RDX, TNT, steel.	No
	Practice Rocket, M29, 3.5-inch	NG, nitrocellulose, potassium perchlorate, steel.	
	Rocket, M6A1, 2.36-inch, Anti-Tank	Ballistite (nitrocellulose, NG, diphenylamine); Pentolite (TNT & PETN), steel	
	Practice Rocket, M7A1, 2.36-inch, Anti-Tank	Ballistite (nitrocellulose, NG, diphenylamine), steel	
	Anti-Tank/Anti-Vehicle Mine.	Inert, steel	

**Table 1 (Continued)**  
**Potential MEC and MC at Ft. Flagler Military Reservation**

<b>AOC</b>	<b>Munitions</b>	<b>Munitions Constituents</b>	<b>Land Use Controls</b>
Live Grenade Court	Mk II Fragment Hand Grenade	TNT, flaked or granular, older models used E.C. blank fire smokeless powder, perchlorate in fuze, cast iron	No
	M21 Practice Hand Grenade	Black powder (potassium nitrate, sulfur, charcoal), perchlorate in fuze, steel	
Practice Grenade Court	M21 Practice Hand Grenade	Black powder (potassium nitrate, sulfur, charcoal), perchlorate in fuze, steel	No
	Mk 1A1 Practice Hand Grenade	Spotting charge, steel	
Rifle Range	Small Arms	Lead; Propellant – single-base (nitrocellulose) or double-base (nitrocellulose and NG).	No
Demolition Area	Small Arms	Lead; Propellant – single-base (nitrocellulose) or double-base (nitrocellulose and NG).	No
	Riot Hand Grenade, ABC-M25A1	CN, steel	
	Rocket, M28, 3.5-inch	NG, nitrocellulose, potassium perchlorate, RDX, TNT, steel	
	Practice Rocket, M29, 3.5-inch	NG, nitrocellulose, potassium perchlorate, steel	
	Rocket, M6A1, 2.36-inch, Anti-Tank	Ballistite (nitrocellulose, NG, diphenylamine); Pentolite (TNT & PETN), steel	
	Practice Rocket, M7A1, 2.36-inch, Anti-Tank	Ballistite (nitrocellulose, NG, diphenylamine), steel	
	Mk II Fragment Hand Grenade	TNT, flaked or granular, older models used E.C. blank fire smokeless powder, perchlorate in fuze, cast iron.	
	M21 Practice Hand grenade	Black powder (potassium nitrate, sulfur, charcoal), perchlorate in fuze, steel	
	Mk 1A1 Practice Hand Grenade	Spotting charge, steel	

**Table 1 (Continued)**  
**Potential MEC and MC at Ft. Flagler Military Reservation**

AOC	Munitions	Munitions Constituents	Land Use Controls
Quarter Master Wharf	Small Arms	Lead; Propellant – single-base (nitrocellulose) or double-base (nitrocellulose and NG)	No
	Riot Hand Grenade, ABC-M25A1	CN, steel	
	Rocket, M28, 3.5-inch	NG, nitrocellulose, potassium perchlorate, RDX, TNT, steel	
	Practice Rocket, M29, 3.5-inch	NG, nitrocellulose, potassium perchlorate, steel	
	Rocket M6A1, 2.36-inch, Anti-Tank	Ballistite (nitrocellulose, NG, diphenylamine); Pentolite (TNT & PETN), steel	
	Rocket Practice M7A1, 2.36-inch Anti-Tank	Ballistite (nitrocellulose, NG, diphenylamine), steel	
	Mk II Fragment Hand Grenade	TNT, flaked or granular, older models used E.C. blank fire smokeless powder, perchlorate in fuze, cast iron	
	M21 Practice Hand Grenade	Black powder (potassium nitrate, sulfur, charcoal), perchlorate in fuze, steel	
	Mk 1A1 Practice Hand Grenade	Spotting charge, steel	

AOC - area of concern

CN – chloroacetophenone

HE – high explosive

mm – millimeter

NG - nitroglycerin

PETN - pentaerythritol tetranitrate

RDX - Hexahydro-1,3,5-trinitro-1,3,5-triazine

TNT - 2,4,6-Trinitrotoluene

**Table 2  
Rights of Entry Status  
Ft. Flagler Military Reservation**

Area of Concern	Land Owner	Date Signed by Land Owner	Land Owner Concerns	Estimated Date to Contact Prior to Field Work
Rifle Range	U.S Geological Survey Western Fisheries Research Center ROE No. DACA67-9-06-899	18 Sep 06	Notify Mr. W David Woodson at 206-526-6282 x239 prior to starting work. Complete work prior to 1 March 07.	2 weeks
All other	Washington State Parks and Recreation, ROE No. DACA67-9-06-865	4 Oct 06	Notify Mr. Mike Zimmerman 360-385-1259 prior to starting work. Complete work prior to 1 March 07.	2 weeks

**Table 3  
Sample Location Rationale  
Ft. Flagler Military Reservation**

<b>AOC</b>	<b>Sample Location</b>	<b>Sample Media</b>	<b>Sample Location Rationale</b>
Ammunition Bunker	039A001	Surface Soil	One contingency soil sample and one contingency sediment sample will be collected from the Ammunition Bunker AOC if evidence of MEC or munitions debris discovered during the visual reconnaissance. The samples will be analyzed for select metals (aluminum, chromium, copper, iron, lead, manganese, molybdenum, and nickel) and explosives (including PETN and NG).
	039A002	Sediment	
Transition Range 1	039A003	Surface Soil	Two soil samples will be collected from the Transition Range 1 AOC near the location of the target berm. The samples will be analyzed for lead.
	039A004	Surface Soil	
	039A005	Sediment	One sediment sample will be collected from the Transition Range 1 AOC from the water collection area. The sample will be analyzed for lead.
Transition Range 2	039A006	Surface Soil	Two soil samples will be collected from the Transition Range 2 AOC near the location of the target berm. The samples will be analyzed for lead.
	39A007	Surface Soil	
	039A008	Sediment	One sediment sample will be collected from the Transition Range 2 AOC from a water collection area. The sample will be analyzed for lead.
Rifle Grenade/Anti-Tank Rocket Range	039A009	Surface Soil	Three soil samples will be collected from the Rifle Grenade/Anti-Tank Rocket Range AOC. Two soil samples will be collected from locations where MEC or debris was located during the 1992 TCRA and one sample will be collected from a location in the eastern part of the clearance area where the visual reconnaissance will be performed. Samples will be analyzed for select metals (aluminum, chromium, copper, iron, lead, manganese, molybdenum, and nickel) and explosives (including PETN and NG).
	039A010	Surface Soil	
	039A011	Surface Soil	
	039A012	Sediment	One sediment sample will be collected from a water collection area within the Rifle Grenade/Anti-Tank Rocket Range AOC. Samples will be analyzed for select metals (aluminum, chromium, copper, iron, lead, manganese, molybdenum, and nickel) and explosives (including PETN and NG).
Live Grenade Range	039A013	Surface Soil	One soil sample will be collected from the Live Grenade Range AOC near evidence of MEC or munitions debris discovered during the visual reconnaissance. The sample will be analyzed for select metals (aluminum, chromium, copper, iron, lead, manganese, molybdenum, and nickel) and explosives (including nitroglycerin and PETN).

**Table 3 (Continued)  
Sample Location Rationale  
Fort Flagler Military Reservation**

<b>AOC</b>	<b>Sample Location</b>	<b>Sample Media</b>	<b>Sample Location Rationale</b>
Rifle Range	039A014	Surface Soil	Two soil samples will be collected from the Rifle Range AOC near the location of the target berm. The samples will be analyzed only for lead.
	039A015	Surface Soil	
	039A016	Sediment	One sediment sample will be collected from the Rifle Range AOC at a water collection area in front of the target berm. The sample will be analyzed only for lead.
Quartermaster Wharf	039A017	Surface Soil	One soil sample will be collected from the beach south of the Quartermaster Wharf AOC. The sample will be analyzed for explosives (including nitroglycerin and PETN).
Background	039A018	Surface Soil	Ten background soil samples will be collected in areas that do not appear to be impacted by past site operations. Samples will be analyzed for the Target Analyte List metals and molybdenum.
	039A019	Surface Soil	
	039A020	Surface Soil	
	039A021	Surface Soil	
	039A022	Surface Soil	
	039A023	Surface Soil	
	039A024	Surface Soil	
	039A025	Surface Soil	
	039A026	Surface Soil	
	039A027	Surface Soil	
	039A028	Sediment	One background sediment sample will be collected in an area that does not appear to be impacted by past site operations. The sample will be analyzed for the Target Analyte List metals and molybdenum.
039A029	Beach Sediment	One background beach sediment sample will be collected in an area on the beach that does not appear to be impacted by past site operations. The sample will be analyzed for the Target Analyte List metals and molybdenum.	

AOC – area of concern

MEC – munitions and explosives of concern

NG – nitroglycerin

PETN - pentaerythritol tetranitrate

TCRA - time-critical removal action

**Table 4  
Proposed Sampling Approach  
Ft. Flagler Military Reservation**

Area of Concern	Media	Samples	Contaminants of Concern <sup>a</sup>						
			Lead	Select Metals <sup>b</sup>	TAL Metals and Molybdenum	Explosives	PETN	NG	Sieving (No. 10)
Ammunition Bunker (contingency sample)	Soil	1	0	1	0	1	1	1	0
	Sediment	1	0	1	0	1	1	1	0
	Surface Water	0	0	0	0	0	0	0	0
	Groundwater	0	0	0	0	0	0	0	0
Transition Range 1	Soil	2	2	0	0	0	0	0	2
	Sediment	1	1	0	0	0	0	0	1
	Surface Water	0	0	0	0	0	0	0	0
	Groundwater	0	0	0	0	0	0	0	0
Transition Range 2	Soil	2	2	0	0	0	0	0	2
	Sediment	1	1	0	0	0	0	0	1
	Surface Water	0	0	0	0	0	0	0	0
	Groundwater	0	0	0	0	0	0	0	0
Rifle Grenade/Anti-Tank Rocket Range	Soil	3	0	3	0	3	3	3	0
	Sediment	1	0	1	0	1	1	1	0
	Surface Water	0	0	0	0	0	0	0	0
	Groundwater	0	0	0	0	0	0	0	0
Live Grenade Range	Soil	1	0	1	0	1	1	1	0
	Sediment	0	0	0	0	0	0	0	0
	Surface Water	0	0	0	0	0	0	0	0
	Groundwater	0	0	0	0	0	0	0	0
Rifle Range	Soil	2	2	0	0	0	0	0	2
	Sediment	1	1	0	0	0	0	0	1
	Surface Water	0	0	0	0	0	0	0	0
	Groundwater	0	0	0	0	0	0	0	0
Quartermaster Wharf	Soil	1	0	0	0	1	1	1	0
	Sediment	0	0	0	0	0	0	0	0
	Surface Water	0	0	0	0	0	0	0	0
	Groundwater	0	0	0	0	0	0	0	0

**Table 4  
Proposed Sampling Approach  
Ft. Flagler Military Reservation**

Area of Concern	Media	Samples	Contaminants of Concern <sup>a</sup>						
			Lead	Select Metals <sup>b</sup>	TAL Metals and Molybdenum	Explosives	PETN	NG	Sieving (No. 10)
Background	Soil	10	0	0	10	0	0	0	0
	Sediment	1	0	0	1	0	0	0	0
	Beach	1	0	0	1	0	0	0	0
	Surface Water	0	0	0	0	0	0	0	0
	Groundwater	0	0	0	0	0	0	0	0
Totals			9	7	12	8	8	8	9

QC Required Samples <sup>c</sup>	Media	Samples	Contaminants of Concern <sup>a</sup>						
			Lead	Select Metals <sup>b</sup>	TAL Metals and Molybdenum	Explosives	PETN	NG	Sieving (No. 10)
Duplicate	Soil	2	0	1	1	1	1	1	0
	Sediment	1	1	0	0	0	0	0	1
	Surface Water	0	0	0	0	0	0	0	0
	Groundwater	0	0	0	0	0	0	0	0
Totals			1	1	1	1	1	1	1

MS/MSD	Soil	2	0	1	1	1	1	1	0
	Sediment	0	0	0	0	0	0	0	0
	Surface Water	0	0	0	0	0	0	0	0
	Groundwater	0	0	0	0	0	0	0	0
Totals			0	1	1	1	1	1	0

Notes:

<sup>a</sup> By USEPA Methods: lead and select metals by SW-846 6020A; TAL metals and molybdenum by SW-846 6020/7471A; explosives by SW-846 8330A. PETN and NG by SW-845 8330A (Modified).

<sup>b</sup> Select metals are aluminum, chromium, copper, iron, lead, manganese, molybdenum, and nickel.

<sup>c</sup> In addition to the QC samples shown temperature blanks will be submitted with samples, one blank per cooler.

MS/MSD = matrix spike/matrix spike duplicate

NG = nitroglycerin

PETN = pentaerythritol tetranitrate

QC = quality control

TAL = Target Analyte List

**Table 5  
Sample Designations and Analyses  
Ft. Flagler Military Reservation**

AOC	Sample Location	Sample Type	Sample Number	Sample Media	QA/QC Samples		USEPA Method
					Field Duplicate	MS/MSD	
Ammunition Bunker	039A001	Composite	NWO-039-0001	Soil		NWO-039-0001-MS/MSD	Select metals (aluminum, chromium, copper, iron, lead, manganese, molybdenum, and nickel) by SW846 6020A Explosives by SW846 8330A PETN and NG by SW846 8330A (Modified)
	039A002	Discrete	NWO-039-1001	Sediment			
Transition Range 1	039A003	Composite	NWO-039-0002	Soil			* Lead by SW846 6020A
	039A004	Composite	NWO-039-0003	Soil			
	039A005	Discrete	NWO-039-1002	Sediment			
Transition Range 2	039A006	Composite	NWO-039-0004	Soil			* Lead by SW846 6020A
	039A007	Composite	NWO-039-0005	Soil			
	039A008	Discrete	NWO-039-1003	Sediment	NWO-039-1004		
Rifle Grenade / Anti-Tank Rocket Range	039A009	Composite	NWO-039-0006	Soil			Select metals (aluminum, chromium, copper, iron, lead, manganese, molybdenum, and nickel) by SW846 6020A Explosives by SW846 8330A PETN and NG by SW846 8330A (Modified)
	039A010	Composite	NWO-039-0007	Soil			
	039A011	Composite	NWO-039-0008	Soil	NWO-039-0009		
	039A012	Discrete	NWO-039-1005	Sediment			
Live Grenade Range	039A013	Composite	NWO-039-0010	Soil			Select metals (aluminum, chromium, copper, iron, lead, manganese, molybdenum, and nickel) by SW846 6020A Explosives by SW846 8330A PETN and NG by SW846 8330A (Modified)
Rifle Range	039A014	Composite	NWO-039-0011	Soil			* Lead by SW846 6020A
	039A015	Composite	NWO-039-0012	Soil			
	039A016	Discrete	NWO-039-1006	Sediment			

**Table 5 (Continued)  
Sample Designations and Analyses  
Fort Flagler Military Reservation**

AOC	Sample Location	Sample Type	Sample Number	Sample Media	QA/QC Samples		USEPA Method
					Field Duplicate	MS/MSD	
Quartermaster's Wharf	039A017	Composite	NWO-039-0013	Soil			Explosives by SW846 8330A PETN and NG by SW846 8330A (Modified)
Background	039A018	Composite	NWO-039-5001	Soil		NWO-039-5001-MS/MSD	* TAL metals plus molybdenum by SW846 6020/7471A
	039A019	Composite	NWO-039-5002	Soil			
	039A020	Composite	NWO-039-5003	Soil			
	039A021	Composite	NWO-039-5004	Soil			
	039A022	Composite	NWO-039-5005	Soil			
	039A023	Composite	NWO-039-5006	Soil			
	039A024	Composite	NWO-039-5007	Soil			
	039A025	Composite	NWO-039-5008	Soil			
	039A026	Composite	NWO-039-5009	Soil			
	039A027	Composite	NWO-039-5010	Soil	NWO-039-5011		
	039A028	Discrete	NWO-039-5012	Sediment			
039A029	Discrete	NWO-039-5013	Sediment (Beach)				

Notes:

AOC = area of concern

MS/MSD = matrix spike/matrix spike duplicate

EPA = Environmental Protection Agency

NG = nitroglycerin

PETN = pentaerythritol tetranitrate

QA/QC = quality assurance/quality control

TAL = Target Analyte List

\* Analyses for will be performed on soil or sediment that has been passed through an ASTM No. 10 (2-mm) wire mesh sieve at the laboratory.

**Table 6**  
**Human Health Soil and Sediment Screening Criteria**  
**Former Fort Flagler Military Reservation**

Analyte	USEPA Region 9 <sup>a</sup>		Washington Department of Ecology - Soil Cleanup Levels <sup>b</sup>					Final Screening Value <sup>b</sup> (mg/kg)
	Residential PRGs (mg/kg)	Industrial PRGs (mg/kg)	Method B Level - Unrestricted <sup>c</sup> (mg/kg)	Leaching - Phase 3 Model - Unrestricted <sup>d</sup> (mg/kg)	Method B Level - Industrial <sup>e</sup> (mg/kg)	Leaching - Phase 3 Model - Industrial <sup>f</sup> (mg/kg)	Natural Background Level <sup>g</sup> (mg/kg)	
<b>Explosives</b>								
Hexahydro-1,3,5-trinitro-1,3,5-triazine	4.4	16	NVA	NVA	NVA	NVA	NA	4.4
Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine	3,100	31,000	NVA	NVA	NVA	NVA	NA	3,100
2,4,6-Trinitrotoluene	16	57	NVA	NVA	NVA	NVA	NA	16
1,3,5-Trinitrobenzene	1,800	18,000	NVA	NVA	NVA	NVA	NA	1,800
1,3-Dinitrobenzene	6.1	62	NVA	NVA	NVA	NVA	NA	6.1
2,4-Dinitrotoluene <sup>1</sup>	0.72	2.5	NVA	NVA	NVA	NVA	NA	0.72
2,6-Dinitrotoluene <sup>1</sup>	0.72	2.5	NVA	NVA	NVA	NVA	NA	0.72
2-Amino-4,6-dinitrotoluene	12	120	NVA	NVA	NVA	NVA	NA	12
2-Nitrotoluene	0.88	2.2	NVA	NVA	NVA	NVA	NA	0.88
3-Nitrotoluene	730	1,000	NVA	NVA	NVA	NVA	NA	730
4-Amino-2,6-dinitrotoluene	12	120	NVA	NVA	NVA	NVA	NA	12
4-Nitrotoluene	12	30	NVA	NVA	NVA	NVA	NA	12
Nitrobenzene	20	100	NVA	NVA	NVA	NVA	NA	20
Nitroglycerin	35	120	NVA	NVA	NVA	NVA	NA	35
Methyl-2,4,6-trinitrophenylnitramine	610	6,200	NVA	NVA	NVA	NVA	NA	610
Pentaerythritol tetranitrate	NVA	NVA	NVA	NVA	NVA	NVA	NA	0.5 <sup>1</sup>
<b>Metals</b>								
Aluminum	76,000	100,000	NVA	NVA	NVA	NVA	32,600	76,000
Chromium (Total)	210	450	NVA	NVA	NVA	NVA	48	210
Copper	3,100	41,000	NVA	NVA	NVA	NVA	36	3,100
Iron	23,000	100,000	NVA	NVA	NVA	NVA	58,700	23,000
Lead	400	800	NVA	3,000	NVA	3,000	24	400
Manganese	1,800	19,000	NVA	NVA	NVA	NVA	1,200	1,800
Molybdenum	390	5,100	NVA	NVA	NVA	NVA	NVA	390
Nickel	1,600	20,000	NVA	NVA	NVA	NVA	48	1,600

CLARC = Cleanup Level and Risk Calculation  
WAC = Washinton Administrative Code  
NVA = no value available  
mg/kg = milligrams per kilogram.

C = Value for carcinogen  
N = Value for noncarcinogen  
NA = not applicable, compound considered not present in natural soils  
USEPA = U.S. Environmental Protection Agency

**Table 6**  
**Human Health Soil and Sediment Screening Criteria**  
**Former Fort Flagler Military Reservation**

<sup>a</sup> Region 9 Preliminary Remediation Goals (PRG) table; October 2004. Values are based on residential and industrial exposure to single chemicals.

<sup>b</sup> Cleanup levels are established under the Model Toxics Control Act (MCTA) Cleanup Regulation. Chapter 173-340 WAC.

<sup>c</sup> Values from Notes on Method A Cleanup Levels WAC 173-340-720, 740, and 745, Table 740-1, Table 5: Method B Calculations for Carcinogens for Soil Ingestion Plus Dermal Contact and Table 6: Method B Calculation for Soil Injection Plus Dermal Contact. Based on Unrestricted land use. From CLARC Notes undated on November 23, 2004.

<sup>d</sup> Values from Notes on Method A Cleanup Levels WAC 173-340-720, 740, and 745, Table 740-1, Table 7: 3-Phase Model Assumptions and Results. Based on protection of groundwater. From CLARC Notes updated on November 23, 2004.

<sup>e</sup> Values from Notes on Method A Cleanup Levels WAC 173-340-720, 740, and 745, Table 745-1, Table 5: Method C Industrial Calculations for Carcinogens for Soil Injection Plus Dermal Contact and Table 6: Method C Industrial Calculations for Carcinogens for Soil Injection Plus Dermal Contact. Based on industrial land use. From CLARC Notes updated on November 23, 2004.

<sup>f</sup> Values from Notes on Method A Cleanup Levels WAC 173-340-720, 740, and 745, Table 745-1, Table 7: 3-Phase Model Assumptions and Results. Based on protection of groundwater. From CLARC Notes updated on November 23, 2004.

<sup>g</sup> Values from "Natural Background Soil Metals Concentrations in Washington State", Publication #94-115, October 1994. Based on data for Puget Sound.

<sup>h</sup> Final Screening Value selected based on the lowest value listed for chemical between USEPA Region 9 PRG and Washington Department of Ecology – Soil Cleanup Levels.

<sup>i</sup> Carcinogenic DNT mixture values used if more conservative than noncarcinogenic isomer-specific values.

<sup>j</sup> Value is laboratory practical quantitation limit.

**Table 7**  
**Ecological Soil Screening Criteria and Selected Values for Potential Contaminants of Concern**  
**Ft. Flagler Military Reservation**

Analyte	Proposed Benchmarks										Potential Bioaccumulative Constituent? <sup>h</sup>	Final Proposed Ecological Screening Value Soil <sup>i</sup> (mg/kg)
	Washington Department of Ecology Lowest Value for Plants/ Soil Biota/Wildlife <sup>a</sup> (mg/kg)	USEPA Region 5 ESLs <sup>b</sup> (2003) (mg/kg)	USEPA Region 7 <sup>c</sup> (mg/kg)	USEPA Region 8 <sup>d</sup> (mg/kg)	USEPA Region 10 <sup>e</sup> (mg/kg)	Other Values: Talmage et al. (1999) <sup>f</sup> or LANL (2005) <sup>g</sup> (mg/kg)						
<b>Explosives</b>												
1,3,5-Trinitrobenzene	NVA	0.376	0.376	EPA-R4	NVA		0.376	EPA-R4	6.6	LANL		0.376
1,3-Dinitrobenzene	NVA	0.655	0.655	EPA-R4	NVA		0.655	EPA-R4	0.073	LANL		0.655
2,4,6-Trinitrotoluene	NVA	NVA	NVA		NVA		NVA		6.4	LANL		6.4
2,4-Dinitrotoluene	NVA	1.28	1.28	EPA-R4	NVA		1.28	EPA-R4	0.52	LANL		1.28
2,6-Dinitrotoluene	NVA	0.0328	0.0328	EPA-R4	NVA		0.0328	EPA-R4	0.37	LANL		0.0328
2-Amino-4,6-Dinitrotoluene	NVA	NVA	NVA		NVA		NVA		2.1	LANL		2.1
2-Nitrotoluene	NVA	NVA	NVA		NVA		NVA		2.0	LANL		2.0
3-Nitrotoluene	NVA	NVA	NVA		NVA		NVA		2.4	LANL		2.4
4-Amino-2,6-Dinitrotoluene	NVA	NVA	NVA		NVA		NVA		0.73	LANL		0.73
4-Nitrotoluene	NVA	NVA	NVA		NVA		NVA		4.4	LANL		4.4
HMX	NVA	NVA	NVA		NVA		NVA		27	LANL		27
Nitrobenzene	40	1.31	1.31	EPA-R4	NVA		1.31	EPA-R4	2.2	LANL		40
Nitroglycerin	NVA	NVA	NVA		NVA		NVA		71	LANL		71
PETN	NVA	NVA	NVA		NVA		NVA		8600	LANL		8600
RDX	NVA	NVA	NVA		NVA		NVA		7.5	LANL		7.5
Tetryl	NVA	NVA	NVA		NVA		NVA		0.99	LANL		0.99
<b>Metals/Inorganics</b>												
Aluminum	50	NVA	50	EPA-R4	NVA		50	EPA-R4	5.5	LANL		50
Chromium (total)	42	0.4	26	SSL	26	SSL	26	SSL	2.3	LANL	Yes	42
Copper	50	5.4	60	ORNL	190	Dutch	60	ORNL	10	LANL	Yes	50
Iron	NVA	NVA	200	EPA-R4	NVA		200	EPA-R4	NVA			200
Lead	50	0.0537	11	SSL	11	SSL	11	SSL	14	LANL	Yes	50
Manganese	1100	NVA	100	EPA-R4	NVA		100	EPA-R4	50	LANL		1100
Molybdenum	2	NVA	2	ORNL	2	ORNL	2	ORNL	NVA			2
Nickel	30	13.6	30	ORNL	30	ORNL	30	ORNL	20	LANL	Yes	30

**Acronyms and Abbreviations:**

EPA-R4 = USEPA Region 4

Dutch = Dutch Intervention Values

HMX - Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine

LANL = Los Alamos National Laboratory

mg/kg = milligrams per kilogram

NVA: No value available

ORNL = Oak Ridge National Laboratory Ecological PRGs (Efroymsen et al.)

PETN - pentaerythritol tetranitrate

RDX - Hexahydro-1,3,5-trinitro-1,3,5-triazine

SSL = USEPA Eco Soil Screening Levels

USEPA = U. S. Environmental Protection Agency

**Notes:**

<sup>a</sup> Washington Department of Ecology, Toxics Cleanup Program, Table 749-3, Ecological Indicator Soil Concentrations for Protection of Terrestrial Plants and Animals. Developed under WAC 173-340-7493 (2)(a)(i).

<sup>b</sup> Ecological Screening Levels (ESLs), USEPA Region V, August 2003.

<sup>c</sup> USEPA Region 7: Catherine Wooster-Brown (Eco Risk Assessor) recommends the following hierarchy: USEPA EcoSSLs; ORNL Efroymsen values; USEPA Region 4 values; other published values.

<sup>d</sup> USEPA Region 8: Dale Hoff (Eco Risk Assessor) recommends the following hierarchy: USEPA SSLs; Dutch Intervention Values or ORNL Efroymsen values.

<sup>e</sup> USEPA Region 10: Joseph Goulet (Eco Risk Assessor) says Region 10 has no recommended hierarchy, therefore, values from the USEPA Region 7 Approach were used.

<sup>f</sup> Talmage, S.S., D.M. Opresko, C.J. Maxwell, C.J.E. Welsh, F.M. Cretella, P.H. Reno, and F.B. Daniel, 1999, Nitroaromatic Munition Compounds: Environmental Effects and Screening Values,

**Table 7**  
**Ecological Soil Screening Criteria and Selected Values for Potential Contaminants of Concern**  
**Ft. Flagler Military Reservation**

Rev. Environ. Contam. Toxicol.

<sup>g</sup> Los Alamos National Laboratory (LANL), Eco Risk Database, Release 2.2, September 2005.

<sup>h</sup> Potential bioaccumulative constituents will be evaluated in more detail, as some screening values do not take into account bioaccumulation.

Potential bioaccumulative potential from: *Bioaccumulation and Interpretation for the Purposes of Sediment Quality Assessment: Status and Needs* (USEPA, 2000) and ODEQ EQSLVs (ODEQ, 2001).

<sup>i</sup> Final Screening Value selected using the following hierarchy:

1. State Value (Washington)
2. USEPA Region State Located In (USEPA Region 10)
3. Lower of Talmage et al. (1999) or LANL (2005) values.

**Other References:**

U.S. Environmental Protection Agency, 2005, *Guidance for Developing Ecological Soil Screening Levels (Eco-SSLs)* , Office of Solid Waste and Emergency Response, Website version last updated March 15, 2005: <http://www.epa.gov/ecotox/ecossl>.

U.S. Environmental Protection Agency, 2001, *Supplemental Guidance to RAGS: Region 4 Bulletins, Ecological Risk Assessment* . Originally published November 1995. Website version last updated November 30, 2001: <http://www.epa.gov/region4/waste/ots/ecolbul.htm>.

Efroymson, R.A., Suter II, G.W., Sample, B.E. and Jones, D.S., 1997. Preliminary Remediation Goals for Ecological Endpoints. Lockheed Martin Energy Systems, Inc. (ORNL) ES/ER/TM-162/R2.

**Dutch Intervention Values:**

Swartjes, F.A. 1999. *Risk-based Assessment of Soil and Groundwater Quality in the Netherlands: Standards and Remediation Urgency* . Risk Analysis 19(6): 1235-1249

The Netherlands Ministry of Housing, Spatial Planning and Environment's Circular on target values and intervention values for soil remediation [http://www2.minvrom.nl/Docs/internationaal/S\\_I2000.pdf](http://www2.minvrom.nl/Docs/internationaal/S_I2000.pdf) and Annex A:

Target Values, Soil Remediation Intervention Values and Indicative Levels for Serious Contamination [http://www2.minvrom.nl/Docs/internationaal/annexS\\_I2000.pdf](http://www2.minvrom.nl/Docs/internationaal/annexS_I2000.pdf) were also consulted.

**Table 8  
Ecological Sediment Screening Criteria and Selected Values for Potential Contaminants of Concern  
Ft. Flagler Military Reservation**

Analyte	Proposed Benchmarks									Potential Bioaccumulative Constituent? <sup>g</sup>	Final Ecological Screening Value Sediment <sup>h</sup> (mg/kg)	
	Washington Department of Ecology Screening Level Values Freshwater <sup>a</sup> (mg/kg)	USEPA Region 5 Ecological Screening Levels <sup>b</sup> (mg/kg)	USEPA Region 7 <sup>c</sup> (mg/kg)	USEPA Region 8 <sup>d</sup> (mg/kg)	USEPA Region 10 <sup>e</sup> (mg/kg)	Other Ecological Screening Levels <sup>f</sup> (mg/kg)						
<b>Explosives</b>												
1,3,5-Trinitrobenzene	NVA	NVA	NVA		NVA		NVA		2.40E-02	TAL		2.40E-02
1,3-Dinitrobenzene	NVA	8.61E-03	NVA		NVA		NVA		6.70E-02	TAL		6.70E-02
2,4,6-Trinitrotoluene	NVA	NVA	NVA		NVA		NVA		9.20E-01	TAL		9.20E-01
2,4-Dinitrotoluene	NVA	1.44E-03	NVA		NVA		NVA		2.90E-01	LANL		2.90E-01
2,6-Dinitrotoluene	NVA	3.98E-03	NVA		NVA		NVA		1.90E+00	LANL		1.90E+00
2-Amino-4,6,-Dintrotoluene	NVA	NVA	NVA		NVA		NVA		7.00E+00	LANL		7.00E+00
2-Nitrotoluene	NVA	NVA	NVA		NVA		NVA		5.60E+00	LANL		5.60E+00
3-Nitrotoluene	NVA	NVA	NVA		NVA		NVA		4.90E+00	LANL		4.90E+00
4-Amino-2,6,-Dintrotoluene	NVA	NVA	NVA		NVA		NVA		1.90E+00	LANL		1.90E+00
4-Nitrotoluene	NVA	NVA	NVA		NVA		NVA		1.00E+01	LANL		1.00E+01
HMX	NVA	NVA	NVA		NVA		NVA		4.70E-02	TAL		4.70E-02
Nitrobenzene	NVA	1.45E-01	NVA		NVA		NVA		3.20E+01	LANL		3.20E+01
Nitroglycerin	NVA	NVA	NVA		NVA		NVA		1.70E+03	LANL		1.70E+03
PETN	NVA	NVA	NVA		NVA		NVA		1.20E+05	LANL		1.20E+05
RDX	NVA	NVA	NVA		NVA		NVA		1.30E-01	TAL		1.30E-01
Tetryl	NVA	NVA	NVA		NVA		NVA		1.00E+02	LANL		1.00E+02
<b>Metals/Inorganics</b>												
Aluminum	NVA	NVA	NVA		NVA		NVA		2.80E+02	LANL		2.80E+02
Chromium	2.60E+02	4.34E+01	4.34E+01	MAC	4.34E+01	MAC	4.34E+01	MAC	5.60E+01	LANL	Yes	2.60E+02
Copper	3.90E+02	3.16E+01	3.16E+01	MAC	3.16E+01	MAC	3.16E+01	MAC	1.70E+01	LANL	Yes	3.90E+02
Iron	NVA	NVA	NVA		NVA		NVA		2.00E+01	LANL		2.00E+01
Lead	2.60E+02	3.58E+01	3.58E+01	MAC	3.58E+01	MAC	3.58E+01	MAC	2.70E+01	LANL	Yes	2.60E+02
Manganese	1.80E+03	NVA	NVA		NVA		NVA		7.20E+02	LANL		1.80E+03
Molybdenum	NVA	NVA	NVA		NVA		NVA		NVA			NVA
Nickel	4.60E+02	2.27E+01	2.27E+01	MAC	2.27E+01	MAC	2.27E+01	MAC	3.90E+01	LANL	Yes	4.60E+02

**Acronyms and Abbreviations:**

EPRGs = Oak Ridge National Laboratory Ecological PRGs

HMX - Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine

ISQGs = Canadian Interim Sediment Quality Guidelines

LANL = Los Alamos National Laboratory

MAC = MacDonald Consensus Values

mg/kg = milligram per kilogram

NVA = No Value Available

PETN - pentaerythritol tetranitrate

RDX - Hexahydro-1,3,5-trinitro-1,3,5-triazine

TAL = Talmage et al (1999)

USEPA = U. S. Environmental Protection Agency

**Table 8**  
**Ecological Sediment Screening Criteria and Selected Values for Potential Contaminants of Concern**  
**Ft. Flagler Military Reservation**

**Notes:**

<sup>a</sup> Washington Department of Ecology, Creation and Analysis of Freshwater Sediment Quality Values in Washington State, July, 1997, Pub. No. 97-323a (Table 11).

<sup>b</sup> Ecological Screening Levels (ESLs), USEPA Region V, August 2003.

<sup>c</sup> USEPA Region 7: Catherine Wooster-Brown (Eco Risk Assessor) recommends the following hierarchy: MacDonald Consensus Values (MacDonald, 2000); ORNL Efromyson values (ORNL, 1977).

<sup>d</sup> USEPA Region 8: Dale Hoff (Eco Risk Assessor) recommends the following hierarchy: MacDonald Consensus Values (MacDonald, 2000); Canadian ISQG values (CCME, 2003) or ORNL Efromyson values (ORNL, 1977).

<sup>e</sup> USEPA Region 10: Joseph Goulet (Eco Risk Assessor) says Region 10 has no recommended hierarchy, therefore, values from the USEPA Region 7 Approach were used.

<sup>f</sup> Talmage, S.S., D.M. Opresko, C.J. Maxwell, C.J.E. Welsh, F.M. Cretella, P.H. Reno, and F.B. Daniel (TAL), 1999, *Nitroaromatic Munition Compounds: Environmental Effects and Screening Values*, Rev. Environ. Contam. Toxicol. or Los Alamos National Laboratory (LANL), Eco Risk Database, Release 2.2, September 2005; the Talmage [TAL] screening values assume 10% organic carbon in the sediment.

<sup>g</sup> Potential bioaccumulative constituents will be evaluated in more detail, as some screening values do not take into account bioaccumulation. Potential bioaccumulative potential from: Bioaccumulation and Interpretation for the Purposes of Sediment Quality Assessment: Status and Needs (USEPA, 2000) and ODEQ EQSLVs (ODEQ, 2001).

<sup>h</sup> Final Screening Value selected using the following hierarchy:

1. State Value (Washington)
2. USEPA Region State Located In (USEPA Region 10)
3. Lower of Talmage et al. [TAL] (1999) or LANL (2005) values.

**Other References:**

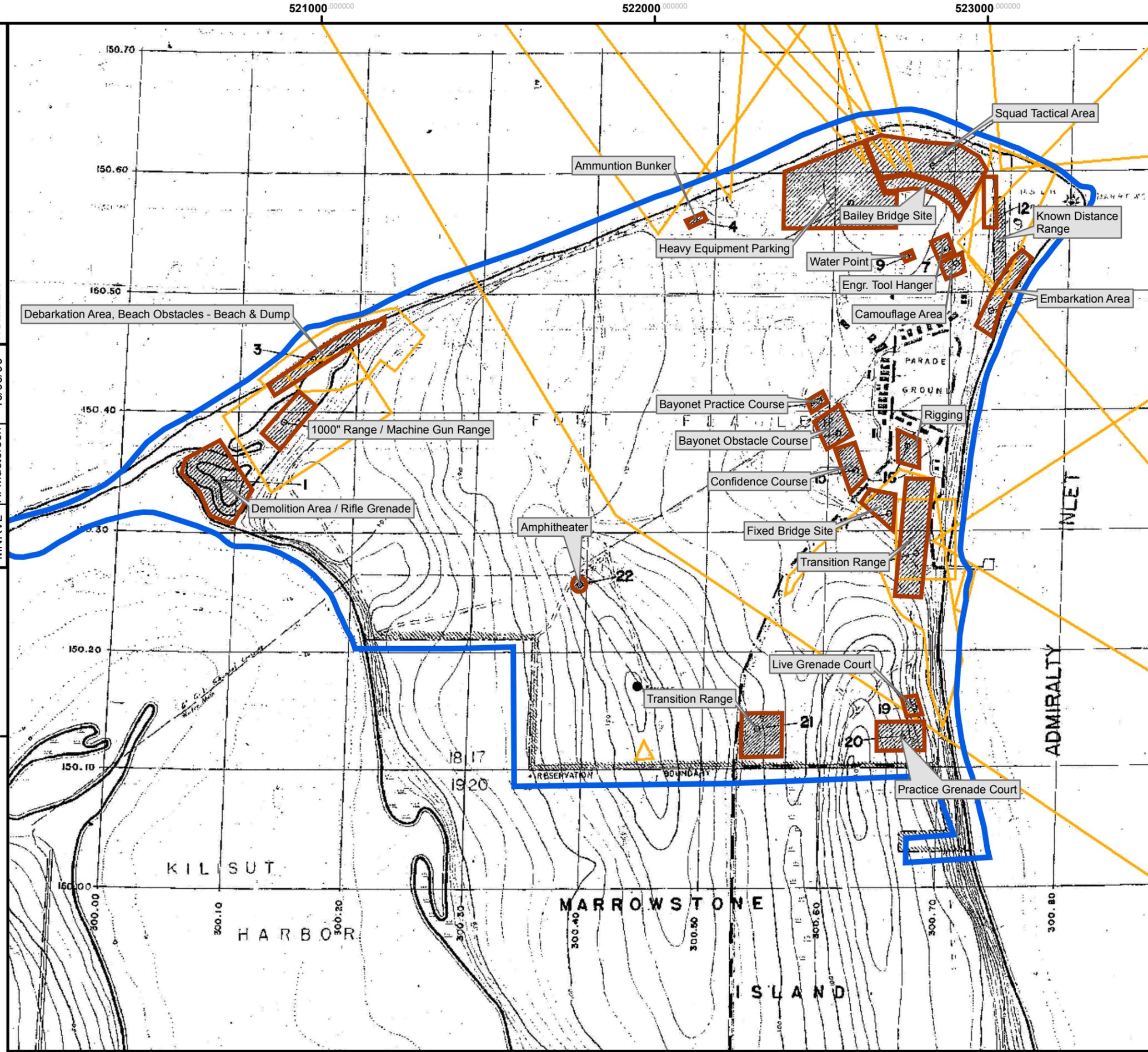
Efromyson, R.A., et al., 1997, *Preliminary Remediation Goals* (EPRGs), ORNL, ES/ER/TM-162/R2,

Canadian Interim Sediment Quality Guidelines (ISQGs) Summary Table, CCME, December 2003.

MacDonald, D.D, C.G. Ingersoll and T.A. Berger, 2000, *Development and Evaluation of Consensus-Based Sediment Quality Criteria for Freshwater Ecosystems*, Archives of Environmental Contamination and Toxicology 39:20-31.

**ATTACHMENT A**  
**WAR DEPARTMENT MAP**  
**(CIRCA 1945)**

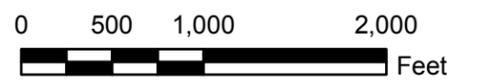
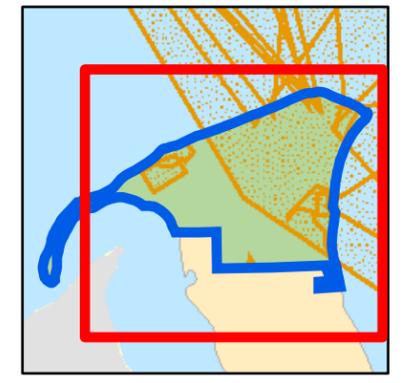
DRAWING NUMBER: Ft Flagler\_025\_attachmentsA\_TPP  
 DRAWN BY: K. Masterson  
 DATE: 10/06/06  
 OFFICE: MNRVL



**Legend**

- Fort Flagler Military Reservation Property Boundary
- Fort Flagler Area of Concern
- Features from State Park historic map (circa 1945)

NOTES:  
 1) Map was provided by Washington State Parks.



REFERENCE/PROJECTION: NAD 83 UTM Zone 10N



U.S. ARMY CORPS OF ENGINEERS  
 OMAHA DESIGN CENTER

**ATTACHMENT A**  
**STATE PARK HISTORIC MAP**  
**FT. FLAGLER MILITARY RESERVATION**

FORT FLAGLER MILITARY RESERVATION



521000 522000 523000

**APPENDIX A**  
**CONCEPTUAL SITE MODEL**

## Overview

Appendix A is taken from the *Final Technical Project Planning Project Memorandum, Fort Flagler Military Reservation* (Shaw, 2006c); therefore, tables and figures referenced in this appendix can be found in that document.

A site-specific CSM summarizes available site information and identifies relationships between exposure pathways and associated receptors. A CSM is used to determine the data types necessary to describe site conditions and quantify receptor exposure, and discusses the following information:

- Current site conditions and future land use;
- Potential contaminant sources (e.g., lead projectiles in an impact berm);
- Affected media;
- Governing fate and transport processes (e.g., surface water runoff and/or groundwater migration);
- Exposure media (i.e., media through which receptors could contact site-related contamination);
- Routes of exposure (e.g., inhalation, incidental ingestion, and dermal contact); and
- Potential human and/or representative ecological receptors at the exposure point. Receptors likely to be exposed to site contaminants are identified based on current and expected future land uses.

The CSM evaluates potential exposure pathways related to range operation and configuration relative to physical features and land use. Based on the CSM, sampling schemes are proposed for each area to evaluate potential human health and ecological impacts. Historical photos of the ranges (if available) are carefully examined for possible disturbances or other site features of interest in order to focus the efforts on areas where MC contamination is most likely to occur. The CSM is evaluated for completeness and further developed as needed through TPP meetings.

Based on a review of documents and the discussion during the TPP Meeting, the following AOCs have been identified within the Ft. Flagler FUDS:

- Range Complex (includes 10 subranges/batteries):
  - Battery Bankhead,
  - Battery Calwell,
  - Battery Downes,
  - Battery Gratton,
  - Battery Lee,
  - Battery Rawlins (includes Anti-torpedo Boat Battery),
  - Battery Revere,
  - Battery Wansboro,
  - Battery Wilhelm, and
  - Anti-Aircraft Artillery Battery.

- Ammunition Bunker
- Transition Range 1,
- Transition Range 2,
- Gas Chamber,
- Rifle Grenade/Anti-Tank Rocket Range,
- Live Grenade Court,
- Practice Grenade Court,
- Rifle Range,
- Demolition Area, and
- Quartermaster Wharf Disposal Area.

CSMs are provided for these AOCs. MEC and MC are analyzed individually within each of the CSMs.

The location of two potential AOCs could not be identified. The Pistol Range has not been located, but it is suspected that it was collocated with the Rifle Range. The locations of the 37-mm mobile artillery and .50-caliber machine guns are unknown. The ASR stated that the assessment team thought that the likely locations of the 37-mm artillery and machine guns were at gun batteries that were abandoned prior to World War II.

The Off Shore Ordnance Area consists of the impact areas used for test firing the artillery guns. The impact areas are within Puget Sound at least several hundred yards offshore. The offshore area is not discussed in this TPP Memorandum and is not addressed under FUDS.

## **Conceptual Site Model – Range Complex AOC**

The Range Complex is a single AOC that includes the ten coastal artillery batteries listed below:

- Battery Bankhead,
- Battery Calwell,
- Battery Downes,
- Battery Gratton,
- Battery Lee,
- Battery Rawlins,
- Battery Revere (Anti-Torpedo Boat Battery),
- Battery Wansboro,
- Battery Wilhelm, and
- Anti-Aircraft Artillery Battery.

The coastal artillery batteries were part of a coastal defense installation used to protect Puget Sound. The batteries consisted of artillery guns ranging in size from between 3-inch and 12-inch. The batteries were used from between 1899 and 1946.

Figures 2 and 3 show the location of the Range Complex AOC and batteries. Figure 4 is a graphic representation of the CSM for the artillery batteries.

### **Current and Future Land Use**

- Currently, the Range Complex AOC is part of the Ft. Flagler State Park which offers camping, boating, fishing, shoreline use, hiking, and historical interpretive information.
- For the foreseeable future, it is likely that the Range Complex AOC will continue to be part of the Ft. Flagler State Park.

### **Potential Contaminant Sources**

- According to the ASR the Range Complex AOC was used as a coastal defense battery. The range fans for the batteries extended beyond the FUDS boundary and over the waters of Puget Sound. No firing onto land occurred. The Anti-Torpedo Boat Battery was located at Battery Revere after the original 10-inch gun tubes were removed in 1941. It is unknown how often the artillery guns were fired or whether the firing included high explosive rounds in addition to spotting charges practice rounds. In a report dated 1933, it was stated that the two guns at Battery Revere were fired 111 and 94 times, respectively, as part of a testing program.

An analysis of the exposure media, pathways and receptors for MEC and MC are discussed below and summarized in Table 2.

## **MEC Evaluation**

### **Types of MEC**

- Potential MEC within the Range Complex are listed on Table 1 and include propellant charges, artillery shells, and projectiles. An explosive hazard could exist if artillery shells or propellant charges were improperly handled at the batteries and discarded nearby.
- The batteries are permanent structures in which the guns were emplaced in concrete structures and serviced by paved roads. It is unlikely that there was casual disposal of MEC in the vicinity of the battery.
- Based on over 50 years of park use surrounding the batteries, no evidence of MEC has been reported. MEC is not expected at the coastal batteries.

### **Surface Exposure Pathway**

- Because of the unlikely occurrence of MEC at the batteries, the surface exposure pathway is considered incomplete.

### **Subsurface Exposure Pathway**

- Because of the unlikely occurrence of MEC at the batteries, the subsurface exposure pathway is considered incomplete.

### **MEC Evaluation/Investigation Needed**

- Visual reconnaissance will be performed to verify current conditions at the site.

## **MC Evaluation**

### **Types of MC**

- The potential MC at the Ft. Flagler Range Complex includes explosives (2,4,6-trinitrotoluene [TNT] and ammonium picrate) and lead and steel from projectiles. Propellants were either single-base (nitrocellulose), double-base (nitrocellulose and NG [NG]), or triple-base (nitrocellulose, NG, and nitroguanidine).
- The projectiles were fired at offshore targets. Therefore, there is no exposure path for MC associated with projectiles near the batteries.
- There is potential for MC deposited from muzzle releases in front of the batteries. However, the guns were seldom used and research from CRREL<sup>1</sup> (Walsh, et. al., 2006) indicates that there is little MC associated with muzzle even in cases with much more frequent use.

### **Overview of Pathways**

Based on the discussion above, there are no exposure pathways for MC at the Range Complex AOC. No MC sampling is proposed.

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<sup>1</sup> U.S. Army Engineer Research and Development Center Cold Regions Research and Engineering Laboratory, 72 Lyme Rd., Hanover, NH, 03755-1290

## **Conceptual Site Model – Ammunition Bunker AOC**

The Ammunition Bunker is a single AOC. Figures 2 and 3 show the location of the Ammunition Bunker AOC. The location of this AOC is taken from the War Department map that was obtained during the TPP Meeting. The ammunition bunker was likely used from between 1945 and 1952 to store munitions used for training following World War II. The War Department map is included in this document as Attachment A.

### **Current and Future Land Use**

- Currently, the Ammunition Bunker AOC is part of the Ft. Flagler State Park which offers camping, boating, fishing, shoreline use, hiking, and historical interpretive information.
- For the foreseeable future, it is likely that the Ammunition Bunker AOC will continue to be part of the Ft. Flagler State Park.

### **Potential Contaminant Sources**

- The Ammunition Bunker was used between 1942 and 1954 for ammunition storage.

An analysis of the exposure media, pathways and receptors for MEC and MC are discussed below and summarized in Table 2.

### **MEC Evaluation**

#### **Types of MEC**

- All types of munitions used at Ft. Flagler between 1942 and 1954 may have been stored here. However, munitions for the artillery batteries would not have been stored at this location as each battery had its own storage bunker. The types of MEC may have included small arms, hand grenades, training grenade containing riot control gas (chloroacetophenone [CN]), 2.36-inch and 3.5-inch practice and high explosive rockets, practice and live hand grenades, and candles, etc that were used for gas training.

#### **Surface Exposure Pathway**

- The potential route of human exposure to MEC or munitions debris includes direct contact by vehicles, foot traffic, or handling. This would include park workers and visitors.
- The potential route of wildlife exposure to MEC or munitions debris would be by directly walking on them.

#### **Subsurface Exposure Pathway**

- The potential routes of human exposure to MEC or munitions debris would be by intrusive drilling or digging activities. This includes park workers and visitors.
- The potential route of wildlife exposure to MEC or munitions debris would be by burrowing activities.

#### **MEC Evaluation/Investigation Needed**

- Visual reconnaissance will be performed around Ammunition Bunker to verify current conditions at the site.

## **MC Evaluation**

### **Types of MC**

- The anticipated MC at the Ft. Flagler Ammunition Bunker AOC is lead from small arms, metals from munitions, propellants (single- or double-base powder), explosives (including NG and pentaerythritol tetranitrate [PETN]), and perchlorate.

### **Overview of Pathways**

Affected media and potential pathways for MC include:

- **Soil:** At the Ammunition Bunker AOC, soil is the primary medium of concern because of possible MC in the soil from training activities. The soil also serves as a secondary source of potential air, sediment, surface water, or groundwater contamination.
- **Sediment/Surface Water:** Sediments may accumulate in the area through ponding of precipitation. Sediment also serves as a secondary source for surface water and groundwater contamination. There is no established surface water drainage at the AOC; however, there are intermittent streams. The only nearby surface water is Puget Sound, a very large, tidal, saltwater body that contains abundant ecological receptors. Surface water will be evaluated via sediments.
- **Groundwater:** Groundwater is considered a potentially affected media because it is present within 100 ft of ground surface. However, the groundwater pathway is not complete as there are no downgradient groundwater users in the area.
- **Air:** Air is a potential medium of concern because of the possibility of inhalation of contaminated soil particles. However, air is not an affected media under current land use, thus the pathway is incomplete.

Exposure media at the Ammunition Bunker AOC include soil, sediment, and surface water.

### **Soil Exposure Pathway**

#### **Exposure Routes**

- The potential routes of human exposure to contaminated soils include incidental ingestion of and dermal contact with contaminated media, as well as inhalation of soil particulates during intrusive work.
- The potential routes of wildlife exposure to contaminated soils include ingestion of and direct contact with contaminated media. Plants may uptake MC and then subsequently be eaten by wildlife. Burrowing animals may ingest MC-contaminated soil and subsequently be eaten by predators.

#### **Receptors**

- State Park workers and visitors.
- Wildlife.

#### **MC Soil Evaluation/Investigation Needed**

- If during the visual reconnaissance, evidence of MEC or MEC debris is located in the area surrounding the bunker, one composite soil sample will be collected from the location of MEC or MEC debris. The samples will be analyzed for select metals

(aluminum, chromium, copper, iron, lead, manganese, molybdenum, and nickel) and explosives, including NG and PETN. The select metals list is based on expected metals contained in munitions used at Ft. Flagler.

### **Sediment and Surface Water Exposure Pathway**

#### **Exposure Routes**

- The potential routes of human exposure to contaminated sediment include incidental ingestion and dermal contact with sediments/surface water.
- The potential routes of wildlife (including aquatic organisms) exposure to contaminated sediment include ingestion of and direct contact with sediment/surface water.

#### **Receptors**

- State Park workers and visitors.
- Wildlife.

### **MC Sediment and Surface Water Evaluation/Investigation Needed**

- A visual survey will be conducted to verify current site conditions. If evidence of MEC or MEC debris is observed in the area surrounding the bunker, one discrete sediment sample will be collected from a water accumulation area. The sample will be analyzed for select metals (aluminum, chromium, copper, iron, lead, manganese, molybdenum, and nickel) and explosives, including NG and PETN.
- No surface water samples will be collected from Puget Sound because of the length of time since DoD use of this AOC, and because any accumulation of contaminants in a body of water the size of Puget Sound is expected to be below analytical detection limits and levels of concern.

## **Conceptual Site Model – Transition Range 1 AOC**

Transition Range 1 is a single AOC shown on Figures 2 and 5. The boundaries of this AOC were taken from the INPR Supplement. The Transition Range consisted of individual firing lanes which soldiers transitioned along engaging targets from various positions (fox hole, window, and prone) and at varying distances.

Figure 6 illustrates the CSM for the Transition Range 1 AOC and potential pathways of MC contamination.

### **Current and Future Land Use**

- Currently, the Transition Range 1 AOC is part of the Ft. Flagler State Park which offers camping, boating, fishing, shoreline use, hiking, and historical interpretive information. The AOC is located south of the Cantonment Area, park administrative offices, and visitor areas.
- Hiking trails traverse the Transition Range 1 AOC.
- For the foreseeable future, it is likely that the Transition Range 1 AOC will continue to be part of the Ft. Flagler State Park.

### **Potential Contaminant Sources**

- According to the INPR Supplement Transition Range 1 was used between 1942 and 1954 for small arms use.

An analysis of the exposure media, pathways and receptors for MEC and MC are discussed below and summarized in Table 2.

### **MEC Evaluation**

#### **Types of MEC**

- Because this AOC was used for small arms only, MEC (other than small arms) is not expected to be present. The potential for live small arms rounds exists, but these do not pose a significant explosive hazard.

#### **Surface Exposure Pathway**

- Because there is no MEC with significant explosive hazard at this AOC, the surface exposure pathway is incomplete.

#### **Subsurface Exposure Pathway**

- Because there is no MEC with significant explosive hazard at this AOC, the subsurface exposure pathway is incomplete.

#### **MEC Evaluation/Investigation Needed**

- A visual reconnaissance will be conducted to verify current conditions at the site.

### **MC Evaluation**

#### **Types of MC**

- The anticipated MC at the Ft. Flagler Transition Range 1 AOC is lead from small arms. Propellants (single- or double-base powder) for the small arms are not thought to pose a

significant impact. However, research from CRREL<sup>2</sup> indicates that there is little MC associated with muzzle deposits, even if the range was used frequently.

## **Overview of Pathways**

Affected media and potential pathways for MC include:

- **Soil:** At the Transition Range 1 AOC, soil is the primary medium of concern because of possible MC in the soil from training activities. The soil also serves as a secondary source of potential air, sediment, surface water, or groundwater contamination.
- **Sediment and Surface Water:** Sediments may accumulate in the area through ponding of precipitation. Sediment also serves as a secondary source for surface water and groundwater contamination. There is no established surface water drainage at the AOC. The only nearby surface water is Puget Sound, a very large, tidal, saltwater body that contains abundant ecological receptors. Surface water will be evaluated via sediments.
- **Groundwater:** Groundwater is considered a potentially affected media because it is present within 100 ft of ground surface. However, the groundwater pathway is not complete as there are no downgradient groundwater users in the area.
- **Air:** Air is a potential medium of concern because of the possibility of inhalation of contaminated soil particles. However, air is not an affected media under current land use, thus the pathway is incomplete.

Exposure media at the Transition Range 1 AOC include soil, sediment, and surface water.

## **Soil Exposure Pathway**

### **Exposure Routes**

- The potential routes of human exposure to contaminated soils include incidental ingestion of and dermal contact with contaminated media, as well as inhalation of soil particulates during intrusive work.
- The potential routes of wildlife exposure to contaminated soils include ingestion of and direct contact with contaminated media. Plants may uptake MC and then subsequently be eaten by wildlife. Burrowing animals may ingest MC-contaminated soil and subsequently be eaten by predators.

### **Receptors**

- State Park workers and visitors.
- Wildlife.

### **MC Soil Evaluation/Investigation Needed**

- Two composite soil samples are proposed to be collected from this AOC near the location of the target berm. Samples will be analyzed for lead only.

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<sup>2</sup> U.S. Army Engineer Research and Development Center Cold Regions Research and Engineering Laboratory, 72 Lyme Rd., Hanover, NH, 03755-1290

## **Sediment and Surface Water Exposure Pathways**

### **Exposure Routes**

- The potential routes of human exposure to contaminated sediment include incidental ingestion and dermal contact with sediment/surface water.
- The potential routes of wildlife (including aquatic organisms) exposure to contaminated sediment include ingestion of and direct contact with sediment/surface water.

### **Receptors**

- State Park workers and visitors.
- Wildlife.

### **MC Sediment and Surface Water Evaluation/Investigation Needed**

- One sediment sample will be collected from a water accumulation area within the AOC. The sample will be analyzed for lead only.
- No surface water samples will be collected from Puget Sound because of the length of time since DoD use of this AOC, and because any accumulation of contaminants in a body of water the size of Puget Sound is expected to be below analytical detection limits and levels of concern.

## **Conceptual Site Model – Transition Range 2 AOC**

Transition Range 2 is a single AOC shown on Figures 2 and 7. The location of this AOC is taken from the War Department map that was obtained during the TPP Meeting. This War Department map is included in this document as Attachment A. The Transition Range consisted of individual firing lanes which soldiers transitioned along engaging targets from various positions (fox hole, window, and prone) and at varying distances. Figure 6 illustrates the CSM for the Transition Range 2 AOC and potential pathway of MC contamination.

### **Current and Future Land Use**

- Currently, the Transition Range 2 AOC is part of the Ft. Flagler State Park which offers camping, boating, fishing, shoreline use, hiking, and historical interpretive information. The AOC is located along the southern boundary of the State Park, near the main entrance road.
- An access road traverses the southern boundary of the Transition Range 2 AOC.
- It is likely that for the foreseeable future, the Transition Range 2 AOC will continue to be part of the Ft. Flagler State Park.

### **Potential Contaminant Sources**

- According to the ASR and INPR Supplement available information indicated that the range was 55 x 130 yards in size and contained 12 targets; however, the location of the AOC was not known.
- Small arms were used at the AOC between 1942 and 1954

An analysis of the exposure media, pathways and receptors for MEC and MC are discussed below and summarized in Table 2.

### **MEC Evaluation**

#### **Types of MEC**

- Because this AOC was used for small arms only, MEC (other than small arms) is not expected to be present. The potential for live small arms rounds exists, but these do not pose a significant explosive hazard.

#### **Surface Exposure Pathway**

- Because there is no MEC with significant explosive hazard at this AOC, the surface exposure pathway is incomplete.

#### **Subsurface Exposure Pathway**

- Because there is no MEC with significant explosive hazard at this AOC, the subsurface exposure pathway is incomplete.

#### **MEC Evaluation/Investigation Needed**

- A visual reconnaissance will be conducted to verify current conditions at the site.

## **MC Evaluation**

### **Types of MC**

- The MC anticipated at the Ft. Flagler Transition Range 2 AOC is lead from small arms. Propellants (single- or double-base powder) for the small arms are not thought to pose a significant impact. However, research from CRREL<sup>3</sup> indicates that there is little MC associated with muzzle deposits, even if the range was used frequently.

### **Overview of Pathways**

Affected media and potential pathways for MC include:

- **Soil:** At the Transition Range 2 AOC, soil is the primary medium of concern because of possible MC in the soil from training activities. The soil also serves as a secondary source of potential air, sediment, surface water, or groundwater contamination.
- **Sediment and Surface Water:** Sediments may accumulate in the area through ponding of precipitation. Sediment also serves as a secondary source for surface water and groundwater contamination. There is no established surface water drainage at the AOC. The only nearby surface water is Puget Sound, a very large, tidal, saltwater body that contains abundant ecological receptors. Surface water will be evaluated via sediments.
- **Groundwater:** Groundwater is considered a potentially affected media because it is present within 100 ft of ground surface. However, the groundwater pathway is not complete as there are no downgradient groundwater users in the area.
- **Air:** Air is a potential medium of concern because of the possibility of inhalation of contaminated soil particles. However, air is not an affected media under current land use, thus the pathway is incomplete.

Exposure media at the Transition Range 2 AOC include soil, sediment, and surface water.

### **Soil Exposure Pathway**

#### **Exposure Routes**

- The potential routes of human exposure to contaminated soils include incidental ingestion of and dermal contact with contaminated media, as well as inhalation of soil particulates during intrusive work.
- The potential routes of wildlife exposure to contaminated soils include ingestion of and direct contact with contaminated media. Plants may uptake MC and then subsequently be eaten by wildlife. Burrowing animals may ingest MC-contaminated soil and subsequently be eaten by predators.

#### **Receptors**

- State Park workers and visitors.
- Wildlife.

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<sup>3</sup> U.S. Army Engineer Research and Development Center Cold Regions Research and Engineering Laboratory, 72 Lyme Rd., Hanover, NH, 03755-1290

### **MC Soil Evaluation/Investigation Needed**

- Two composite soil samples are proposed to be collected from this AOC near the location of the target berm. Samples will be analyzed for lead only.

### **Sediment and Surface Water Exposure Pathway**

#### **Exposure Routes**

- The potential routes of human exposure to contaminated sediment include incidental ingestion and dermal contact with sediment/surface water.
- The potential routes of wildlife (including aquatic organisms) exposure to contaminated sediment include ingestion of and direct contact with sediment/surface water.

#### **Receptors**

- State Park workers and visitors.
- Wildlife.

### **MC Sediment and Surface Water Evaluation/Investigation Needed**

- One sediment sample will be collected from a water accumulation area within the AOC. The sample will be analyzed for lead only.
- No surface water samples will be collected from Puget Sound because of the length of time since DoD use of this AOC, and because any accumulation of contaminants in a body of water the size of Puget Sound is expected to be below analytical detection limits and levels of concern.

## **Conceptual Site Model – Gas Chamber AOC**

The Gas Chamber is a single AOC shown on Figures 2 and 8. The boundaries of this AOC were taken from the INPR Supplement. The Gas Chamber was located within the bunkered area of Battery Wansboro after the artillery guns were removed. The Gas Chamber was used to familiarize and train troops in the use of gas masks. The room used for the gas chamber is empty.

### **Current and Future Land Use**

- Currently, the Gas Chamber AOC is part of the Ft. Flagler State Park which offers camping, boating, fishing, shoreline use, hiking, and historical interpretive information. The AOC is located within Battery Wansboro on the southeast side of the FUDS.
- The AOC is used by visitors on a daily basis.
- For the foreseeable future, it is likely that the Gas Chamber AOC will continue to be part of the Ft. Flagler State Park.

### **Potential Contaminant Sources**

- According to the INPR Supplement the Gas Chamber was used between 1942 and 1954 for gas training of troops.

An analysis of the exposure media, pathways and receptors for MEC and MC are discussed below and summarized in Table 2.

### **MEC Evaluation**

#### **Types of MEC**

- The only munitions identified as used at this AOC were gas grenades containing riot control agent CN-1. There is minimal explosive hazard associated with gas grenades.

#### **Surface Exposure Pathway**

- Because there is no MEC at this AOC, the surface exposure pathway is incomplete.

#### **Subsurface Exposure Pathway**

- Because there is no MEC at this AOC, the subsurface exposure pathway is incomplete.

#### **MEC Evaluation/Investigation Needed**

- A visual reconnaissance will be conducted to verify current conditions at the site. No MEC is expected to be present.

### **MC Evaluation**

#### **Types of MC**

- The MC at the Ft. Flagler Gas Chamber AOC is riot control agent CN-1. CN-1 is an irritant that is similar to mace.

#### **Overview of Pathways**

Affected media and potential pathways for MC include:

- Soil: Soil is the primary medium of concern because of possible MC in the soil from training activities. However, riot control agents are not persistent and any release to soil would be expected to be neutralized by weathering and time and not be present in the soil today. There is no complete soil pathway.
- Sediment and Surface Water: Sediments may accumulate in the area through ponding of precipitation. There is no established surface water drainage at the AOC. The only surface water is Puget Sound. Riot control agents are not persistent and any release to sediment or surface water would be expected to be neutralized by weathering and time and not be present today. There is no complete sediment or surface water pathway.
- Groundwater: Groundwater is considered a potentially affected media because it is present within 100 ft of ground surface. However, riot control agents are not persistent and any release to soil and eventually groundwater would be expected to be neutralized by weathering and time and not be present in the soil today. There is no complete groundwater pathway.
- Air: Air is a potential medium of concern because of the possibility of inhalation of contaminated soil particles. However, air is not an affected media under current land use, thus the pathway is incomplete.

Based on the discussion above, there are no complete exposure pathways for MC at the Gas Chamber AOC. No MC sampling is proposed.

## **Conceptual Site Model – Rifle Grenade/Anti-Tank Rocket Range AOC**

The Rifle Grenade/Anti-Tank Rocket Range AOC is an amphibious assault training area located near the lower campground at the Ft. Flagler State Park. This AOC is shown on Figures 2 and 9. A portion of this AOC was cleared of UXO in 1992 (IT, 1992). The cleared area is shown on Figure 9. All vegetation (except standing trees) was removed from most of the clearance area and 100 percent of the ground surface of the clearance area was cleared using a handheld magnetometer. The eastern leg of the clearance area did not receive a 100 percent clearance because of heavy forestation and downed trees. This AOC includes a 1000-inch/Machine Gun Range, which was identified on the War Department map that was obtained during the TPP Meeting. This War Department map is included in this document as Attachment A.

### **Current and Future Land Use**

- Currently, the Rifle Grenade/Anti-Tank Rocket Range AOC is part of the Ft. Flagler State Park which offers camping, boating, fishing, shoreline use, hiking, and historical interpretive information. A camping area is located within this AOC.
- For the foreseeable future, it is likely that the Range Complex AOC will continue to be part of the Ft. Flagler State Park.

### **Potential Contaminant Sources**

- According to the ASR the Rifle Grenade/Anti-Tank Rocket Range was used between 1942 and 1954 for amphibious assault exercises. Munitions used included 3.5-inch and 2.36-inch rockets, and small arms.
- The 1000-inch/Machine Gun Range included small arms and machine gun use.
- The location of the beach portion of this AOC coincides with the Debarkation Area identified in the War Department map (Attachment A). The two areas are included as one AOC in this TPP Memorandum. The map identified the Debarkation Area as having “beach obstacles.”
- During the 1992 UXO Clearance, the following MEC and MEC debris were recovered:
  - 2.36-inch expended rocket motors (172 items);
  - 2.36-inch rockets with live warhead (3 items);
  - 2.36-inch rockets with live fuse (2 items);
  - 3.5-inch expended rocket motors (2 items);
  - 1 live training hand grenade;
  - 1 Bangalore torpedo fuse housing, inert;
  - Anti-tank/anti-vehicle mines, inert (12 items); and
  - Empty .30-caliber casings (16 items).

An analysis of the exposure media, pathways and receptors for MEC and MC are discussed below and summarized in Table 2.

## **MEC Evaluation**

### **Types of MEC**

- Potential MEC within the Rifle Grenade/Anti-Tank Rocket Range AOC are listed on Table 1 and include rockets, hand grenades, mines, and small arms. Explosive hazards from the mines and small arms are not expected.

### **Surface Exposure Pathway**

- The potential route of human exposure to MEC or munitions debris includes direct contact by vehicles, foot traffic, or handling. This would include park workers and visitors.
- The potential route of wildlife exposure to MEC or munitions debris would be by directly walking on them.

### **Subsurface Exposure Pathway**

- The potential routes of human exposure to MEC or munitions debris would be by intrusive drilling or digging activities. This includes park workers and visitors.
- The potential route of wildlife exposure to MEC or munitions debris would be by burrowing activities.

### **MEC Evaluation/Investigation Needed**

- Visual reconnaissance aided by a handheld magnetometer will be performed by a trained UXO technician within a portion of the Rifle Grenade/Anti-Tank Rocket Range AOC. Based on the 1992 UXO clearance, there is a possibility that MEC is present in the eastern portion of the clearance area, which was not cleared to 100 percent because of heavy vegetation and downed trees. However, it should be noted that this area is very heavily forested with fallen trees and heavy underbrush and only limited reconnaissance can be performed.

## **MC Evaluation**

### **Types of MC**

- The anticipated MC at the Ft. Flagler Rifle Grenade/Anti-Tank Rocket Range AOC is steel from rockets, lead from small arms, propellant from the rocket motors, and explosives.
- The propellant for the 3.5-inch rockets likely contained potassium perchlorate.

### **Overview of Pathways**

Affected media and potential pathways for MC include:

- **Soil:** At the Rifle Grenade/Anti-Tank Rocket Range, soil is the primary medium of concern because of possible MC in the soil from training activities. The soil also serves as a secondary source of potential air, sediment, surface water, or groundwater contamination.
- **Sediment and Surface Water:** Sediments may accumulate in the area in small ponds or puddles. Sediment serves as a potential source for surface water, groundwater, and air

contamination. There is no established surface water drainage at the AOC. The only surface water is Puget Sound. Surface water will be evaluated via sediments.

- Groundwater: Groundwater is considered a potentially affected media because it is present within 100 ft of ground surface. However, the groundwater pathway is not complete as there are no downgradient groundwater users in the area.
- Air: Air is a potential medium of concern because of the possibility of inhalation of contaminated soil particles. However, air is not an affected media under current land use, thus the pathway is incomplete.

Exposure media at the Rifle Grenade/Anti-Tank Rocket Range AOC include only soil and sediment.

### **Soil Exposure Pathway**

#### **Exposure Routes**

- The potential routes of human exposure to contaminated soils include incidental ingestion of and dermal contact with contaminated media, as well as inhalation of soil particulates during intrusive work.
- The potential routes for wildlife exposure to contaminated soils include ingestion of and direct contact with contaminated media. Plants may uptake MC and then subsequently be eaten by wildlife. Burrowing animals may ingest MC-contaminated soil and subsequently be eaten by predators.

#### **Receptors**

- State Park workers and visitors.
- Wildlife.

#### **MC Soil Evaluation/Investigation Needed**

- Three composite soil samples will be collected from this AOC. Two of the samples will be collected at locations of expended rocket motors removed during the 1992 clearance action. The third sample will be randomly located in the eastern portion of the clearance area.
- Samples will be analyzed for select metals (aluminum, chromium, copper, iron, lead, manganese, molybdenum, and nickel) and explosives, including NG and PETN.

### **Sediment and Surface Water Exposure Pathway**

#### **Exposure Routes**

- The potential routes of human exposure to contaminated sediment include incidental ingestion and dermal contact with sediment/surface water.
- The potential routes of wildlife (including aquatic organisms) exposure to contaminated sediment include ingestion of and direct contact with sediment/surface water.

#### **Receptors**

- State Park workers and visitors.
- Wildlife.

### **MC Sediment and Surface Water Evaluation/Investigation Needed**

- One sediment sample will be collected from a water accumulation area within the AOC. The sample will be analyzed for select metals (aluminum, chromium, copper, iron, lead, manganese, molybdenum, and nickel) and explosives, including NG and PETN.
- No surface water samples will be collected from Puget Sound because of the length of time since DoD use of this AOC, and because any accumulation of contaminants in a body of water the size of Puget Sound is expected to be below analytical detection limits and levels of concern.

## **Conceptual Site Model – Live Grenade Court**

The Live Grenade Court is a single AOC as shown on Figures 2 and 10. This AOC is located in the southeast corner of the FUDS and Ft. Flagler State Park and just north of the Practice Grenade Court AOC. The AOC was used to train troops in the use of live grenades. The location of this AOC is taken from the War Department map that was obtained during the TPP Meeting. This War Department map is included in this document as Attachment A. Figure 11 illustrates the CSM for the Live Grenade Range AOC and potential pathways of MC contamination.

### **Current and Future Land Use**

- Currently, the Live Grenade Court AOC is part of the Ft. Flagler State Park which offers camping, boating, fishing, shoreline use, hiking, and historical interpretive information.
- For the foreseeable future, it is likely that the Live Grenade Court AOC will continue to be part of the Ft. Flagler State Park.

### **Potential Contaminant Sources**

- The court ranges were assumed to be used by the Army between 1942 and 1954.
- The courts were used for training in the use of live (explosive) and/or training hand grenades.
- Grenades were thrown from individual throwing bays constructed from sandbags or concrete, or from a trench.
- Grenades were thrown toward targets in an impact area approximately 25 yards from the throwing line (see Figure 11 Conceptual Site Model Grenade Court).
- A danger area of approximately 600 ft would have been established around each court.

An analysis of the exposure media, pathways and receptors for MEC and MC are discussed below and summarized in Table 2.

### **MEC Evaluation**

#### **Types of MEC**

- The munitions used included the Mk II fragmentation hand grenade.
- M21 practice grenades, which contained only small spotting charges of black powder, may also have been used.
- A potential hazard from MEC exists in unexploded grenades.

#### **Surface Exposure Pathway**

- The potential route of human exposure to MEC or munitions debris includes direct contact by vehicles, foot traffic, or handling. Human exposure would potentially include park workers and visitors.
- The potential route of wildlife exposure to MEC or munitions debris would be by direct contact.

### **Subsurface Exposure Pathway**

- The potential routes of human exposure to MEC or munitions debris would be through intrusive activity or geologic instability (erosion, freeze-thaw, etc.).
- The potential route of wildlife exposure to MEC or munitions debris would be by burrowing activities or geologic instability.

### **MEC Evaluation/Investigation Needed**

- The presence of MEC in the Live Grenade Court is unknown. Visual reconnaissance aided by a handheld magnetometer will be performed by a trained UXO technician. The reconnaissance will traverse across the AOC to identify MEC or MEC debris. However, it should be noted that the area is heavily forested with underbrush that may present obstacles to the reconnaissance.

### **MC Evaluation**

#### **Types of MC**

- The anticipated MC at the explosive munitions ranges is primarily residual explosive compounds from grenades that underwent high-order (normal) or low-order detonation, or from undetonated munitions. The explosive charges used in the Mk II grenades were 2 ounces of TNT (or E.C. blank fire smokeless powder, consisting largely of nitrocellulose, in older models).
- To a lesser degree, there is a potential for the presence of elevated concentrations of metals from the grenade housing and components which are made primarily from cast iron and steel.

#### **Overview of Pathways**

Affected media and potential pathways for MC include:

- **Soil:** At the Live Grenade Range, soil is the primary medium of concern because of possible MC in the soil from training activities. The soil also serves as a secondary source of potential air, sediment, surface water, or groundwater contamination.
- **Sediment and Surface Water:** Sediments may accumulate in the area in small ponds or puddles. Sediment serves as a potential source for surface water, groundwater, and air contamination. There is no established surface water drainage at the AOC. The only surface water is Puget Sound. Surface water will be evaluated via sediments.
- **Groundwater:** Groundwater is considered a potentially affected media because it is present within 100 ft of ground surface. However, the groundwater pathway is not complete as there are no downgradient groundwater users in the area.
- **Air:** Air is a potential medium of concern because of the possibility of inhalation of contaminated soil particles. However, air is not an affected media under current land use, thus the pathway is incomplete.

Exposure media at the Live Grenade Range AOC include soil, sediment and surface water.

## **Soil Exposure Pathway**

### **Exposure Routes**

- The potential routes of human exposure to contaminated soils include incidental ingestion of and dermal contact with contaminated media, as well as inhalation of soil particulates during intrusive work.
- The potential routes of wildlife exposure to contaminated soils include ingestion of and direct contact with contaminated media. Plants may uptake MC and then subsequently be eaten by wildlife. Burrowing animals may ingest MC-contaminated soil and subsequently be eaten by predators.

### **Receptors**

- State Park workers and visitors.
- Wildlife.

### **MC Soil Evaluation/Investigation Needed**

- One composite soil sample will be collected from this AOC. The sample will be located following completion of the visual reconnaissance and identification of MEC or MEC debris. The sample location will be selected from an identified MEC debris location. If no MEC debris is identified, the sample location will be near the center of the AOC.
- The soil sample will be analyzed for select metals (aluminum, chromium, copper, iron, lead, manganese, molybdenum, and nickel) and explosives.

## **Sediment and Surface Water Exposure Pathway**

### **Exposure Routes**

- The potential routes of human exposure to contaminated sediment include incidental ingestion and dermal contact with sediment/surface water.
- The potential routes of wildlife (including aquatic organisms) exposure to contaminated sediment include ingestion of and direct contact with sediment/surface water.

### **Receptors**

- State Park workers and visitors.
- Wildlife.

### **MC Sediment and Surface Water Evaluation/Investigation Needed**

- No sediment samples will be collected from this AOC. The location of the AOC is relatively flat and overland flow is not expected.
- No surface water samples will be collected from Puget Sound because of the length of time since DoD use of this AOC, and because any accumulation of contaminants in a body of water the size of Puget Sound is expected to be below analytical detection limits and levels of concern.

## **Conceptual Site Model – Practice Grenade Court**

The Practice Grenade Court is a single AOC as shown on Figures 2 and 10. This AOC is located in the southeast corner of the FUDS and Ft. Flagler State Park and just south of the Live Grenade Court AOC. The AOC was used to train troops in the use of grenades using either inert grenades or grenades with small spotting charges. The location of this AOC is taken from the War Department map that was obtained during the TPP Meeting. This War Department map is included in this document as Attachment A.

### **Current and Future Land Use**

- Currently, the Practice Grenade Court AOC is part of the Ft. Flagler State Park which offers camping, boating, fishing, shoreline use, hiking, and historical interpretive information.
- For the foreseeable future, it is likely that the Practice Grenade Court AOC will continue to be part of the Ft. Flagler State Park.
- The AOC is within a heavily forested area with underbrush.

### **Potential Contaminant Sources**

- The AOC is assumed to have been used between 1942 and 1954 similar to other troop training activities at Ft. Flagler.
- The courts were used for training in the use of practice and/or training hand grenades.
- Grenades were thrown from individual throwing bays constructed from sandbags or concrete, or from a trench.
- Grenades were thrown toward targets in an impact area approximately 25 yards from the throwing line (see Figure 11 Conceptual Site Model Grenade Court).
- No danger area would have been established around a practice grenade court.

An analysis of the exposure media, pathways and receptors for MEC and MC are discussed below and summarized in Table 2.

### **MEC Evaluation**

#### **Types of MEC**

- The munitions used at the practice courts would have included the Mk1A1 training grenades, an inert device made of cast iron with the approximate shape, size, and weight of an actual hand grenade.
- The munitions used at the practice courts may also have included the M21 practice grenades, reusable devices which contained only small charges of black powder to simulate the detonation of a live grenade.
- There is not a significant hazard from MEC associated with the practice courts, based on the training devices used, and as indicated in Table 1.

#### **Surface Exposure Pathway**

- Because there is no MEC with significant explosive hazard at this AOC, the surface exposure pathway is incomplete.

### **Subsurface Exposure Pathway**

- Because there is no MEC with significant explosive hazard at this AOC, the subsurface exposure pathway is incomplete.

### **MEC Evaluation/Investigation Needed**

- A visual reconnaissance will be conducted at the Practice Grenade Court AOC to document current conditions.

### **MC Evaluation**

#### **Types of MC**

- The small quantity of black powder (consisting of potassium nitrate, sulfur, and charcoal) associated with training grenades does not pose a significant risk of environmental contamination, as indicated in Table 1.

### **MC Evaluation/Investigation Needed**

No sampling is required for the Practice Grenade Courts.

### **Overview of Pathways**

Based on the discussion above, there are no exposure pathways for MC at the Practice Grenade Court AOC. No MC sampling is proposed.

## **Conceptual Site Model – Rifle Range AOC**

The Rifle Range is a single AOC shown on Figures 2 and 12. According to the ASR there was a rifle range near the lighthouse when Ft. Flagler was first built. The butt to this range was torn down in 1932 to salvage lead and copper from the expended bullets. A new range was built on the same location during World War II. The range was used to train troops in the use of small arms. Figure 13 illustrates the CSM for the Rifle Range and potential pathway of MC contamination.

### **Current and Future Land Use**

- Currently, the Rifle Range AOC is part of the Ft. Flagler State Park which offers camping, boating, fishing, shoreline use, hiking, and historical interpretive information. This AOC is located near the lighthouse at Marrowstone Point.
- Hiking trails traverse the Rifle Range AOC, and an interpretive trail occupies the rifle range location.
- The target area was cleared of brush by State Park volunteers and one of the targets was reconstructed. The configuration of this range is firing from south to north, which is different from the configuration shown in the ASR. The berm in front of the targets is clearly visible and State Park volunteers have reported that a wall was built behind the targets to protect the power plant below Battery Lee
- For the foreseeable future, it is likely that the Range Complex AOC will continue to be part of the Ft. Flagler State Park.

### **Potential Contaminant Sources – Rifle Range**

- According to the ASR the Rifle Range was used between 1942 and 1954 for small arms use, and use of the range area likely occurred as far back as 1900.

An analysis of the exposure media, pathways and receptors for MEC and MC are discussed below and summarized in Table 2.

### **MEC Evaluation**

#### **Types of MEC**

- Because this AOC was used for small arms only, MEC (other than small arms) is not expected to be present. The potential for live small arms rounds exists, but these do not pose a significant explosive hazard.

#### **Surface Exposure Pathway**

- Because there is no MEC with significant explosive hazard at this AOC, the surface exposure pathway is incomplete.

#### **Subsurface Exposure Pathway**

- Because there is no MEC with significant explosive hazard at this AOC, the subsurface exposure pathway is incomplete.

## **MEC Evaluation/Investigation Needed**

- A visual reconnaissance will be performed to verify current site conditions and map the range.

## **MC Evaluation**

### **Types of MC**

- The anticipated MC at the Ft. Flagler Rifle Range AOC is lead from small arms. Propellants (single-base or double-base powder) for the small arms are not thought to pose a significant impact.

### **Overview of Pathways**

Affected media and potential pathways for MC include:

- **Soil:** At the Rifle Range AOC, soil is the primary medium of concern because of possible MC in the soil from training activities. The soil also serves as a secondary source of potential air, sediment, surface water, or groundwater contamination.
- **Sediment and Surface Water:** Sediments may accumulate in the area through ponding of precipitation. The sediment also serves as a secondary source for surface water and groundwater contamination. There are one or more ponds in the area between the firing points and targets. These are not considered to be a pathway because of their location well in front of the targets and it is understood that these may have been constructed after the use of the range ended in 1954.
- **Groundwater:** Groundwater is considered a potentially affected media because it is present within 100 ft of ground surface. However, the groundwater pathway is not complete as there are no downgradient groundwater users in the area.
- **Air:** Air is a potential medium of concern because of the possibility of inhalation of contaminated soil particles. However, air is not an affected media under current land use, thus the pathway is incomplete.

Exposure media at the Rifle Range AOC include only soil and sediments.

### **Soil Exposure Pathway**

#### **Exposure Routes**

- The potential routes of human exposure to contaminated soils include incidental ingestion of and dermal contact with contaminated media, as well as inhalation of soil particulates during intrusive work.
- The potential routes for wildlife exposure to contaminated soils include ingestion of and direct contact with contaminated media. Plants may uptake MC and then subsequently be eaten by wildlife. Burrowing animals may ingest MC-contaminated soil and subsequently be eaten by predators.

#### **Receptors**

- State Park workers and visitors.
- Wildlife.

### **MC Soil Evaluation/Investigation Needed**

- Two composite soil samples will be collected from this AOC at locations near the target berm. Samples will be analyzed for lead only.

### **Sediment Exposure Pathway**

#### **Exposure Routes**

- The potential routes of human exposure to contaminated sediment include incidental ingestion and dermal contact with sediments.
- The potential routes of wildlife (including aquatic organisms) exposure to contaminated sediment include ingestion of and direct contact with sediment.

#### **Receptors**

- State Park workers and visitors.
- Wildlife.

### **MC Sediment Evaluation/Investigation Needed**

One sediment sample will be collected from a water accumulation area in front of the target berm where runoff would be expected. The sample will be analyzed for lead only.

## **Conceptual Site Model – Demolition Area AOC**

The Demolition Area is a single AOC shown on Figures 2 and 14. This AOC was not identified until the TPP Meeting, when the location was shown on the old War Department map (Attachment A). The AOC is located in the northwest corner of the FUDS in an embayment. The War Department map indicated the area was within a tidal zone that flooded at each high tide. The area has since been backfilled with gravel and soil to create a picnic and camping area that is several feet above the high tide mark. The grass is mowed regularly during the growing season. The depth to the detonation area may be as much as 10 ft. Figure 15 is a graphic representation of the CSM for the Demolition Area.

All that is known of this area is from the War Department Map and the notation “Detonation area.”

### **Current and Future Land Use**

- Currently, the Demolition Area AOC is part of the Ft. Flagler State Park which offers camping, boating, fishing, shoreline use, hiking, and historical interpretive information.
- This AOC is located near the lower campground, and used for picnicking, camping, and beach combing.
- For the foreseeable future, it is likely that the Demolition Area AOC will continue to be part of the Ft. Flagler State Park.

### **Potential Contaminant Sources**

- There is no mention of the dates of use for the Demolition Area. However, based on use of other training ranges and maneuver areas the likely period of use is 1942 to 1954.

An analysis of the exposure media, pathways and receptors for MEC and MC are discussed below and summarized in Table 2.

### **MEC Evaluation**

#### **Types of MEC**

- The types of MEC destroyed at this AOC are unknown. However, on the War Department map legend the words “Rifle Grenade” were written under “Demolition Area.” This may indicate that rifle grenades (M6A1, M7A1, M28, and M29 rockets) used at the Debarkation Area and Rocket Range were the munitions destroyed at the AOC. There is also the potential that discarded propellant bags and high explosives from the artillery batteries were also detonated at this location.

#### **Surface Exposure Pathway**

- Because this AOC has been backfilled with at least several feet of backfill and may be as much as 10 ft, no MEC or MEC debris is at the surface. Therefore, the surface exposure pathway is incomplete.

#### **Subsurface Exposure Pathway**

- The Demolition Area has been backfilled and at a depth below ground surface by as much as 10 ft. The subsurface exposure pathway is incomplete, unless heavy equipment excavation was to occur.

## **MEC Evaluation/Investigation Needed**

- A visual reconnaissance will be performed within the Demolition Area AOC to document current conditions and checking for signs of erosion that could lead to exposure of potential buried munitions. The primary area of the survey is along the beach and shoreline. The Demolition Area is backfilled with gravel and soil. The site is completely grassed and is mowed regularly during the growing season.

## **MC Evaluation**

### **Types of MC**

- The anticipated MC at the Demolition Area is sheet metal from the M6A1, M7A1, M28, and M29 rocket casings and explosives from the rockets and propellants and explosives from the artillery batteries.

### **Overview of Pathways**

Affected media and potential pathways for MC include:

- **Soil:** At the Demolition Area AOC, subsurface soil is the primary medium of concern because of possible MC in the soil covered by backfill material. The AOC has been covered with as much as 10 ft of backfill. The surface soil is an incomplete pathway. Subsurface soil is considered a potentially complete pathway only if subsurface excavation were to occur. The subsurface soil also serves as a secondary source of potential surface water contamination.
- **Sediment:** Because the AOC is located in the beach area, all solid media is considered soil and therefore sediment is not present.
- **Surface Water:** The surface water body that would be impacted would be the small estuary that is connected to Puget Sound. This pathway is potentially complete.
- **Groundwater:** Groundwater is considered a potentially affected media. However, the AOC is at the beach and groundwater directly interfaces with Puget Sound, the surface water body. The groundwater would be saline and not used for a drinking water source. This pathway is incomplete as there is no downgradient user.
- **Air:** Air is a potential medium of concern because of the possibility of inhalation of contaminated soil particles. However, air is not an affected media under current land use, thus the pathway is incomplete.

Exposure media at the Demolition Area AOC include only soil and surface water.

### **Soil Exposure Pathway**

#### **Exposure Routes**

- The potential routes of human exposure to contaminated soils include incidental ingestion of and dermal contact with contaminated media, as well as inhalation of soil particulates during intrusive work.
- The potential routes for wildlife exposure to contaminated soils include ingestion of and direct contact with contaminated media. Plants may uptake MC and then

subsequently be eaten by wildlife. Burrowing animals may ingest MC-contaminated soil and subsequently be eaten by predators.

### **Receptors**

- State Park workers and visitors.
- Wildlife.

### **MC Soil Evaluation/Investigation Needed**

- No surface or subsurface soil sampling will be performed at this AOC. There is no surface soil pathway at this AOC. The subsurface soil pathway is to saline water linked Puget Sound. The saline water within the buried subsurface is routinely flushed by tidal action and if any impacts were there they have likely been diluted by the flushing action.

### **Surface Water Exposure Pathway**

#### **Exposure Routes**

- The potential routes of human exposure to contaminated surface water include incidental ingestion and dermal contact with surface water.
- The potential routes of wildlife (including aquatic organisms) exposure to contaminated surface water include ingestion of and direct contact with surface water.

### **Receptors**

- State Park workers and visitors.
- Wildlife.

### **MC Surface Water Evaluation/Investigation Needed**

- No surface water samples will be collected from Puget Sound. The water body is very large and water moves in and out of the beach area via tidal action. Any accumulation of contaminants in the water is expected to be below analytical detection limits and levels of concern.

## **Conceptual Site Model – Quartermaster Wharf Disposal Area AOC**

The Quartermaster Wharf Disposal Area is a single AOC shown on Figures 2 and 16. The boundaries of this AOC were taken from the ASR. The Quartermaster Wharf Disposal Area AOC consists of the beach south of the old wharf. According to the ASR this AOC was used as a disposal area, and several rounds of .30-caliber ammunition were recovered from the area by a State Park volunteer. It is thought that damaged or unwanted supplies were disposed to the beach.

### **Current and Future Land Use**

- Currently, the Quartermaster Wharf Disposal Area AOC is part of the Ft. Flagler State Park which offers camping, boating, fishing, shoreline use, hiking, and historical interpretive information. This AOC is located near Battery Wansboro, and makes up the eastern shore of the Park,
- For the foreseeable future, it is likely that the Quartermaster Wharf Disposal Area AOC will continue to be part of the Ft. Flagler State Park.

### **Potential Contaminant Sources**

- According to the ASR this AOC was used as a disposal area, and several rounds of .30-caliber ammunition were recovered from the area by a State Park volunteer.
- It is thought that damaged or unwanted supplies were disposed to the beach.

An analysis of the exposure media, pathways and receptors for MEC and MC are discussed below and summarized in Table 2.

### **MEC Evaluation**

#### **Types of MEC**

- The only reported munitions recovered from this area are small arms rounds. However, other ordnance may have been disposed.

#### **Surface Exposure Pathway**

- The surface exposure pathway is for park workers or visitors to step on or pick up MEC.

#### **Subsurface Exposure Pathway**

- The subsurface pathway would be by digging activities by park workers or park visitors. Note that this beach is not used for shell fish gathering.

#### **MEC Evaluation/Investigation Needed**

- A visual reconnaissance will be performed within the Quartermaster Wharf Disposal Area AOC to verify current conditions at the site.

### **MC Evaluation**

#### **Types of MC**

- The anticipated MC at the Quartermaster Wharf Disposal Area AOC is lead from small arms and explosives from munitions that may have been discarded on the beach.

## **Overview of Pathways**

Affected media and potential pathways for MC include:

- Soil: At the Quartermaster Wharf Disposal Area AOC, soil (beach sand) is the primary medium of concern because of possible MC in the soil from disposal activities. The soil also serves as a secondary source of surface water contamination.
- Sediment: Because this AOC is on the beach sediments are not present. This is an incomplete pathway.
- Surface Water: The only surface water is Puget Sound, a very large, tidal, saltwater body that contains abundant ecological receptors.
- Groundwater: Because of the presence of Puget Sound, movement of MC to groundwater would likely not occur as the salt water from Puget Sound flushes the near surface groundwater body in the vicinity of the beach.
- Air: Air is a potential medium of concern because of the possibility of inhalation of contaminated soil particles. However, air is not an affected media under current land use, thus the pathway is incomplete.

Exposure media at the Quartermaster Wharf Disposal Area AOC include soil and surface water.

### **Soil Exposure Pathway**

#### **Exposure Routes**

- The potential routes of human exposure to contaminated soils include incidental ingestion of and dermal contact with contaminated media, as well as inhalation of soil particulates during intrusive work.
- The potential routes of wildlife exposure to contaminated soils include ingestion of and direct contact with contaminated media. Aquatic organisms may uptake MC and then subsequently be eaten by wildlife. Burrowing animals may ingest MC-contaminated soil and subsequently be eaten by predators.

#### **Receptors**

- State Park workers and visitors.
- Wildlife.

#### **MC Soil Evaluation/Investigation Needed**

- One composite soil sample is proposed to be collected from this AOC. The sample will be analyzed for explosives, including NG and PETN. No analysis for lead or other metals will be performed, because the area was also used for disposal of items other than munitions. The likelihood of differentiating between MC (metals or lead) from munitions and those from other refuse or disposed item would not be possible.

### **Surface Water Exposure Pathway**

#### **Exposure Routes**

- The potential routes of human exposure to contaminated surface water include incidental ingestion and dermal contact with surface water.

- The potential routes of wildlife (including aquatic organisms) exposure to contaminated surface water include ingestion of and direct contact with surface water.

### **Receptors**

- State Park workers and visitors.
- Wildlife.

### **MC Surface Water Evaluation/Investigation Needed**

- No surface water samples will be collected from Puget Sound because of the length of time since DoD use of this AOC, and because any accumulation of contaminants in a body of water the size of Puget Sound is expected to be below analytical detection limits and levels of concern.

### **Data Gaps**

- The SI being performed at Ft. Flagler will identify MEC and MC impacts to soil and sediments at the FUDS.
- The presence of MEC was established at the Ft. Flagler Rocket Range following a clearance action in 1992 by the discovery of live 2.36-inch rockets and MEC debris. It is uncertain whether additional MEC is present south of the area cleared at the Rocket Range.
- No other MEC has been reported.

Results of the current status of data requirements with respect to MEC and MC for the AOCs are summarized below:

**See table next page.**

<b>AOC</b>	<b>Presence of MEC</b>	<b>Presence of MC</b>	<b>Proposed Inspection Activities</b>
Range Complex	None, based on configuration and use	None, based on configuration and use	Visual reconnaissance; no sampling.
Ammunition Bunker	Unknown	Unknown	Visual reconnaissance; soil and sediment sampling if MEC or MEC debris is found; analyze for select metals and explosives including NG and PETN.
Transition Range 1	Small arms	Unknown	Visual reconnaissance; soil and sediment sampling; analyze for lead.
Transition Range 2	Small arms	Unknown	Visual reconnaissance; soil and sediment sampling; analyze for lead.
Gas Chamber	None	None	Visual reconnaissance; no sampling.
Rifle Grenade/ Anti-Tank Rocket Range	Potential in areas adjacent to 1992 UXO clearance	Unknown	Visual reconnaissance with magnetometer; soil and sediment sampling; analyze for select metals and explosives including NG and PETN.
Live Grenade Court	Unknown	Unknown	Visual reconnaissance with magnetometer; soil sampling; analyze for select metals and explosives.
Practice Grenade Court	None	None	Visual reconnaissance; no sampling.
Rifle Range	Small arms	Unknown	Visual reconnaissance; soil and sediment sampling; analyze for lead.
Demolition Area	None	Unknown	Visual reconnaissance; no sampling.
Quartermaster Wharf Disposal Area	Small arms	Unknown	Visual reconnaissance; soil sampling; analyze for explosives, including NG and PETN.

**APPENDIX B**

**USACE INTERIM GUIDANCE DOCUMENT 06-05**

**AND**

**SAFETY ADVISORY 06-2**



DEPARTMENT OF THE ARMY  
HUNTSVILLE CENTER, CORPS OF ENGINEERS  
P.O. BOX 1600  
HUNTSVILLE, ALABAMA 35807-4301

REPLY TO  
ATTENTION OF:

MAR 16 2006

CEHNC-OE-CX

MEMORANDUM FOR SEE DISTRIBUTION

SUBJECT: Procedure for Preliminary Assessment (PA) and Site Inspection (SI) Teams that Encounter Unexploded Ordnance (UXO) While Gathering Non-UXO Field Data, Military Munitions Center of Expertise (MM CX) Interim Guidance Document (IGD) 06-05

1. PURPOSE: This procedure describes the responsibilities of project teams during the preliminary assessment and site investigation phases should unexploded ordnance (UXO) be discovered.
2. APPLICABILITY: This guidance is applicable to the geographic military Districts, Military Munitions Response Program (MMRP) Design Centers, Major Subordinate Commands (MSCs), and designated Remedial Action Districts performing MMRP response actions.

3. REQUIREMENTS AND PROCEDURES:

a. During site visits to formerly used defense site (FUDS) properties to gather PA or SI information, in the rare instance that a UXO-qualified individual identifies an item that is an explosive hazard, the following actions will occur:

(1) The property owner or individual granting rights of entry to the property will be notified of the hazard and advised to call the local emergency response authority (i.e., police, sheriff, or fire department). The individual will also be informed that if they do not call the local response authority within 1 hour, the individual who identified the UXO item will notify the local emergency response authority.

(2) The local response authority will decide how to respond to the reported incident, including deciding not to respond (e.g., if the local response authority is already aware of the hazards on the property). If the local response authority decides to respond, the individual who identified the item or his designee will mark the location of the item and provide accurate location information to the emergency response authority. The individual who identified the item or his designee will generally remain in the area until the local response authority arrives, unless specifically indicated by the appropriate response authority that the individual may leave the area.

(3) During the SI, the state regulator may also be notified at their request.

MAR 1 6 2006

CEHNC-OE-CX

SUBJECT: Procedure for Preliminary Assessment (PA) and Site Inspection (SI) Teams that Encounter Unexploded Ordnance (UXO) While Gathering Non-UXO Field Data, Military Munitions Center of Expertise (MM CX) Interim Guidance Document (IGD) 06-05

b. During site visits to active installations or Base Realignment and Closure (BRAC) sites to gather PA or SI information, in the rare instance that a UXO-qualified individual identifies an item that is an explosive hazard, the following actions will occur:

(1) The installation point of contact (POC) or the BRAC coordinator will be notified of the hazard and requested to notify explosive ordnance disposal (EOD) through their channels.

(2) The installation/EOD will make the determination if they are going to respond to the incident. The installation/EOD may be aware of the hazards at the site and make the decision not to respond. If the installation/EOD decides to respond, the individual who identified the item or his designee will mark the location and provide accurate location information to the installation/EOD unit and will remain in the area unless the installation/EOD unit requests otherwise.

c. Neither the US Army Corps of Engineers personnel, nor their contractors have the authority to call EOD to respond to an explosive hazard. This call is the responsibility of the local emergency response authority for FUDS properties and it must come through the proper chain of command on installations.

d. AR 75-14 and AR 75-15 contain the information on how EOD responds to explosives hazards.

4. EFFECTIVE DATES: The requirements and procedures set forth in this interim guidance are effective immediately. They will remain in effect indefinitely, unless superseded by other policy or regulation.

5. POINT OF CONTACT: If you need additional information, please contact Mr. Brad McCowan at 256-895-1174.



CAROL A. YOUKEY, P.E.  
Chief, Center of Expertise for Ordnance  
and Explosives Directorate



DEPARTMENT OF THE ARMY  
HUNTSVILLE CENTER, CORPS OF ENGINEERS  
P.O. BOX 1600  
HUNTSVILLE, ALABAMA 35807-4301

May 23, 2006

REPLY TO  
ATTENTION OF:

OE Safety Division for Ordnance  
and Explosives Directorate

Shaw Environmental  
4171 Essen Lane  
Baton Rouge, Louisiana 70809

Dear Sir/Madam:

This is Safety Advisory 06-2 – Munitions and Explosives of Concern (MEC) Safety During Site Inspections (SI), Pre-Work Plan Visits, Archive Search Reports (ASR) Investigations and Other Site Visits of a Non-Intrusive Nature.

Reference EP 75-1-1, EP 385-1-95a, and Interim Guidance Document (IGD), March 15, 2006.

The following procedures will be followed if an item is found that has an explosive hazard during the activities identified in the subject line:

a. MEC items are not to be moved or disturbed during the above subject SI, Pre-Work Plan visits, ASR Investigations and other site visits of a non-intrusive nature.

b. The locations of any discovered explosive hazardous items should be marked for accurate relocating purposes and the information provided to the designated Point of Contact (POC) and any emergency response authorities as may be required.

c. During site visits to active Installations and/or Base Realignment and Closure (BRAC) sites the identified Installation POC or the BRAC coordinator should be notified of discovered MEC hazards. They then will request any appropriate emergency response action as deemed necessary through their channels if required.

d. When a site visit is on a Formerly Utilized Defense Site, the property owner shall be notified in the event of finding any found explosive hazards along with the location of the explosive item(s) found, the property owner should then in turn notify their local emergency response authorities.

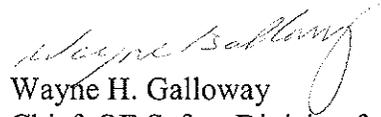
e. During these site visits all required MEC security requirements should be implemented as necessary and required. All team members are to be instructed in and made aware of any MEC security requirements.

f. All team members will be briefed on these procedures prior to any site investigations being performed and daily before any work begins.

This Safety Advisory is intended to serve as an explosives safety reminder.

Comments or questions about this Safety Advisory can be directed to the undersigned at (256) 895-1598/82.

Sincerely,



Wayne H. Galloway  
Chief, OE Safety Division for  
Ordnance and Explosives Directorate

**APPENDIX C**  
**SITE SAFETY AND HEALTH PLAN ADDENDUM**

<b>ADDENDUM OR-2 TO SITE SAFETY AND HEALTH PLAN (SSHP) REVIEWS AND APPROVAL</b> US Army Corps of Engineers, Omaha District	This SSHP is a part of the Omaha District Safety Program. Please read and comply with USACE EM 385-1-1 and CENWO OM 385-1-1.
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<b>Reviewer</b>	<b>Date</b>	<b>Signatures</b>
<b>Authored by:</b> Pamela Moore	<i>Dec 18</i>	<b>Signature:</b> 
<b>Peer Review by:</b> Dale Landon	<b>12/18</b>	<b>Signature:</b> 
<b>Quality Control Review (QCR) by:</b> Kathy Stroppel-Holl	<i>12/18/06</i>	<b>Signature:</b> 
<b>Project Manager Reviewed by:</b> Peter Kelsall	<i>12/18/06</i>	<b>Signature:</b> 

<b>USACE Omaha District MM DC OE Safety Specialist Review:</b> Andrew G. Marks		<b>Signature:</b>
<b>USACE Omaha District MM DC Project Manager Acceptance:</b> Mike Watson		<b>Signature:</b>

<b>ADDENDUM OR-2 TO SITE SAFETY AND HEALTH PLAN (SSHP)</b> <b>TITLE PAGE</b> US Army Corps of Engineers, Omaha District	This SSHP is a part of the Omaha District Safety Program. Please read and comply with USACE EM 385-1-1 and CENWO OM 385-1-1.
<b>PROJECT NAME: FUDS SI – FORT FLAGLER MILITARY RESERVATION</b>	
<b>PURPOSE OF ADDENDUM:</b>  This Addendum provides details specific to activities at this FUDS that were not provided in the approved Accident Prevention Plan and Site Safety and Health Plan included in the “Final Type I Work Plan, Site Inspections at Multiple Sites, NWO Region” (Shaw, 2006).	
<b>DESCRIBE THE CHANGES EFFECTED BY THIS ADDENDUM:</b>  Add site-specific supplemental information.	

## SITE SAFETY AND HEALTH PLAN ADDENDUM

FOR

Site Name:	Ft. Flagler Military Reservation
Site Location:	Former Ft. Flagler is located in Jefferson County, WA on the west side of Puget Sound near Port Townsend, WA. Port Townsend is approximately 18 miles from Ft. Flagler.
Purpose of Visit:	Site Inspection of the FUDS for MEC reconnaissance and MC sampling.
Date(s) of Site Visit:	Approximately January 2007
Office:	Shaw Environmental, Inc. Richland, Washington office
Address:	1045 Jadwin Ave, Suite C Richland, Washington 99352
Telephone:	(509) 946-2062

Date Prepared: 11 December 2006

Site inspection work at this FUDS will be conducted in accordance with the approved Accident Prevention Plan and Site Safety and Health Plan (SSHP) included in Appendix D of the “Final Type I Work Plan, Site Inspections at Multiple Sites, NWO Region” (Shaw, 2006). This Addendum provides details specific to activities at this FUDS that were not provided in the SSHP.

I. SITE DESCRIPTION AND PREVIOUS INVESTIGATIONS

(For complete background, see text and figures of Site-Specific Work Plan included with this document. A brief summary follows.)

A. SITE DESCRIPTION:

- Size: Ft. Flagler is currently a State Park consisting of approximately 812 acres,
- Consists of 11 AOCs.
- Present Usage (Check all that apply)

<input type="checkbox"/> Military	<input checked="" type="checkbox"/> Recreational	<input type="checkbox"/> Agricultural
<input type="checkbox"/> Residential	<input type="checkbox"/> Commercial	<input type="checkbox"/> Landfill
<input checked="" type="checkbox"/> Natural Area	<input type="checkbox"/> Industrial	
<input checked="" type="checkbox"/> Other Specify: State Park with campgrounds, picnic areas, buildings, and visitor facilities.		

<input type="checkbox"/> Secured	<input type="checkbox"/> Active	<input type="checkbox"/> Unknown
<input checked="" type="checkbox"/> Unsecured	<input checked="" type="checkbox"/> Inactive	

B. PAST USES:

- The U.S. government acquired 550 acres of land for Ft. Flagler in 1866. Construction of the first coastal batteries did not begin until 1897. Additional acreage was acquired over the years until the site grew to 809 acres.
- Between 1900 and 1946, the site was used as a coastal defense installation.
- During World War II, the Navy also operated an underwater listening station at Ft. Flagler.
- In 1950, all harbor defenses around Puget Sound were abolished including Ft. Flagler. The site was used for amphibious training and maneuvers after the coastal artillery weapons were removed.
- In 1953, Ft. Flagler was closed and the property was eventually (1954) transferred to the State of Washington for use as a State Park.

C. SURROUNDING POPULATION:

<input checked="" type="checkbox"/> Rural	<input checked="" type="checkbox"/> Residential	<input checked="" type="checkbox"/> Commercial
<input type="checkbox"/> Urban	<input type="checkbox"/> Industrial	
<input type="checkbox"/> Other Specify		

#### D. PREVIOUS SAMPLING/INVESTIGATION RESULTS:

##### (1) MEC ENCOUNTERED:

The Quartermaster Wharf Disposal Area Beach AOC appears to have a disposal site where unwanted supplies were discarded on the beach. A park volunteer has found two, five-round .30-caliber ammunition clips on the beach. State Parks has a list of items found in this area, possibly including a live grenade. WDOE believes the ASR suggests this was an Open Burn/Open Detonation (OB/OD) area.

A portion of the Rifle Grenade/Anti-Tank Rocket Range was cleared of UXO in 1992. The following MEC and MEC debris were recovered:

- 2.36-inch expended rocket motors, 172 items.
- 2.36-inch rockets with live warhead, 3 items.
- 2.36-inch rockets with live fuse, 2 items.
- 3.5-inch expended rocket motors, 2 items.
- 1 live training hand grenade.
- 1 Bangalore torpedo fuse housing, inert.
- Anti-tank/anti-vehicle mines, inert, 12 items.
- Empty .30-caliber casings, 16 items.

##### (2) SAMPLES: (Air, Water, Soil, and Vegetation):

- Soil is the primary medium of concern because of possible MC and MEC in the soil from training activities. The soil also serves as a secondary source of potential air, sediment, surface water, or groundwater contamination.
- Sediment/Surface Water: Sediments may accumulate in the area through ponding of precipitation. The sediment also serves as a secondary source for surface water and groundwater contamination. There are one or more ponds in the area between the firing points and targets. These are not considered to be a pathway because of their location well in front of the targets and it is understood that these may have been constructed after the use of the range ended in 1954.
- Groundwater: Groundwater is considered a potentially affected media because it is present within 100 ft of ground surface. However, the groundwater pathway is not complete as there are no downgradient groundwater users in the area.
- Air: Air is a potential medium of concern because of the possibility of inhalation of contaminated soil particles. However, air is not an affected media under current land use, thus the pathway is incomplete.
- Thirteen underground fuel tanks were removed under the Hazardous, Toxic, and Radioactive Waste program (undated). MEC or MC related items were not addressed in that project. No hazardous substance have been found.

- In 1992, a time-critical removal action (TCRA) was completed to remove anti-tank rockets and other MEC from the rocket range.

II. DESCRIPTION OF ON-SITE ACTIVITIES:

<input checked="" type="checkbox"/> Walk Through	<input checked="" type="checkbox"/> Drive Through	<input type="checkbox"/> Fly Over
<input checked="" type="checkbox"/> On-Road	<input type="checkbox"/> Off-Road	<input checked="" type="checkbox"/> On-Path
<input checked="" type="checkbox"/> Off-Path		
<input checked="" type="checkbox"/> Other Specify: Soil and sediment sampling		

Activities/Tasks to be Performed (Summarize)

A visual reconnaissance of portions of the Live Grenade Court and Rifle Grenade/Anti-Tank Rocket Range will be performed to assess the presence/absence of MEC within the eastern portion of the AOC. The reconnaissance will be conducted by a qualified UXO technician, with the aid of a handheld magnetometer to assess the presence or absence of MEC within a portion of the AOC. Several transects will be walked during which visual observations and magnetic anomalies will be noted. Transects will be recorded using a global positioning system (GPS), and appropriate features influencing the survey will be noted, such as vegetation density and type, topography, etc. If MEC is found, the qualified UXO technician will attempt to make a determination of the hazard, and appropriate notifications will be made as detailed in the Work Plan and SSWP. Note that the area proposed for a visual reconnaissance is very heavily forested with heavy underbrush and many fallen trees. The UXO technician will attempt to perform reconnaissance; however, if the underbrush becomes too thick, the reconnaissance will be abandoned.

A strictly visual survey will be conducted around each of the artillery batteries, the Ammunition Bunker, Transition Ranges 1 and 2, the Practice Grenade Court, and the Quartermaster Wharf Disposal Site to confirm the conceptual site model that the presence of MEC or munitions debris is unlikely due to the very regulated use of propellants and munitions. A visual survey will also be completed along the shoreline at the Demolition Area to confirm that the area was completely backfilled and that no munitions debris is surfacing along the shoreline.

At other AOCs, a visual reconnaissance will be completed at all sampling locations to aid in sample location selection and to allow the sampler to work safely.

Soil and sediment sampling will be performed at locations that have been cleared by the UXO technician. Samples will be collected to determine MC impacts. Sampling locations will be recorded using GPS. Sampling protocols will be as specified in the SSWP and the Type I Work Plan.

III. SITE PERSONNEL AND RESPONSIBILITIES:

Name/Responsibility	Training					
	HAZWOPER 40-hour	8-hour HAZWOPER refresher	Hazardous Waste Site Supervisor	First Aid	Cardiopulmonary Resuscitation	UXO Specialist
<b>Simon Payne</b> Field Team Leader/SSHO	X	X	X	X	X	
<b>Rob Irons</b> (1137) UXO Technician	X	X				X

IV. HAZARD ANALYSIS:

A. SAFETY AND HEALTH HAZARDS ANTICIPATED:

<input type="checkbox"/> Heat Stress	<input checked="" type="checkbox"/> Cold Stress	<input checked="" type="checkbox"/> Tripping Hazard
<input type="checkbox"/> Noise	<input type="checkbox"/> Electrical	<input type="checkbox"/> Falling Objects
<input checked="" type="checkbox"/> Foot Hazard	<input checked="" type="checkbox"/> Biological	<input type="checkbox"/> Overhead Hazard
<input type="checkbox"/> Radiological	<input type="checkbox"/> Confined Space	<input checked="" type="checkbox"/> Water
<input checked="" type="checkbox"/> Explosive	<input type="checkbox"/> Climbing	<input type="checkbox"/> Flammable
<input checked="" type="checkbox"/> Other Specify : munitions or UXO debris		

B. OVERALL HAZARD EVALUATION:

<input type="checkbox"/> High	<input type="checkbox"/> Moderate	<input checked="" type="checkbox"/> Low	<input type="checkbox"/> Unknown
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JUSTIFICATION: (Provide a brief justification supporting the overall evaluation.)

Munitions debris and UXO have been documented or observed near certain AOCs. Anomaly avoidance will be conducted to minimize contact with MEC.
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V. SITE INSTRUCTIONS FOR MEC AVOIDANCE:

See Section 4.3 of the SSHP for full scope of MEC avoidance requirements.

- a. DO NOT touch or move any ordnance items regardless of the marking or apparent condition.
- b. DO NOT visit an ordnance site if an electrical storm is occurring or approaching. If a storm approaches during a site visit, leave the site immediately and seek shelter.
- c. DO NOT use radio or cellular phones in the vicinity of suspect ordnance items.
- d. DO NOT walk across an area where the ground cannot be seen. If dead vegetation or dead animals are observed, leave the area immediately due to potential chemical agent contamination.
- e. DO NOT drive vehicles into suspected MEC areas; use clearly marked lanes.
- f. DO NOT carry matches, lighted cigarettes, lighters or other flame producing devices into a MEC site.
- g. DO NOT rely on color codes for positive identification of ordnance items or their contents.

- h. Only the on-site UXO Specialist is allowed to approach suspected ordnance items to take photographs, and prepare a full description (take notes of the markings or any other identifiers/features).
- i. The location of any ordnance items found during the site investigation should be clearly marked so it can be easily located and avoided.
- j. Always assume ordnance items contain a live charge until it can be determined otherwise.

Section 4.3 of the SSHP defines on-site MEC avoidance requirements for FUDS properties. In general, the purpose of MEC or anomaly avoidance during SI activities is to avoid any potential surface or subsurface anomalies. Intrusive anomaly investigation is not authorized during MEC avoidance operations. The reconnaissance and sampling field work shall include a minimum of two people, one of whom shall be a UXO technician. This team will be on-site during all sampling activities. Sampling personnel must be escorted at all times in areas potentially containing MEC until the UXO team has completed the access surveys and the cleared areas are marked. If anomalies or MEC are detected, the UXO team will halt escorted personnel in place, select a course around the item, and instruct escorted personnel to follow. If MEC is encountered, Shaw will stop work in the vicinity and make notifications as outlined in the Work Plan. Shaw is not to conduct further investigation or removal of any MEC.

## VI. SITE CONTROL AND COMMUNICATIONS:

### A. SITE WORK ZONES:

Rigid demarcation of work zones, e.g., using barricades or caution tape, will generally not be required for this project. The Field Team Leader/SSHO, in consultation with the UXO Technician, will determine the boundary of an Exclusion Zone (EZ) to be established around a specific area of activity, appropriate to the potential hazards. The boundaries may be described by physical features, e.g., fences, tree lines, or topographic features, or may be defined by a radius around the center of activity. The EZ boundary will be verbally communicated to team members, who will maintain a watch to assure that only field team members are within the work zone. If a bystander or intruder approaches the EZ, the field team will cease work and ask the person to remain outside the area. A Contamination Reduction Zone (CRZ) will generally not be required because personnel decontamination is not anticipated. If required, a CRZ will be established in a manner similar to that described for the EZ. The support zone will consist of all portions of the site not defined as an EZ or CRZ.

### B. COMMUNICATIONS:

(1) ON-SITE: Verbal communications will be used among team members to communicate to each other on-site. If this communication is not possible, the following hand signals will be used.

GRIP PARTNER'S WRIST OR BOTH HANDS AROUND WAIST – Leave the area immediately.

HAND GRIPPING NOSE – Unusual smell detected.

THUMBS UP – OK, I am alright or I understand.

THUMBS DOWN – No, negative.

(2) OFF-SITE: Off-site communications will be established at the site and may be include an on-site cellular phone or the nearest public phone or private phone that may be readily accessed.

Cellular Phone: (206) 730-4845

Public/Private phone

TELEPHONE NUMBERS:

1. MEDICAL FACILITY (Emergency Care): Jefferson Healthcare 834 Sheridan Ave. Port Townsend, WA 98368	(360) 385-2200
2. MEDICAL FACILITY (Non-Emergency Care-Shaw-Approved Occupational Health Clinic): Prompt Care @ Doctor's Clinic 1651 NE Bentley Dr. Bremerton, WA 98311	(360) 782-3400
3. FIRE DEPARTMENT:	call 911
4. POLICE DEPARTMENT: Jefferson County Sheriff	(360) 385-3831 or 911
6. Ft. Flagler State Parks office:	(360) 385-1259
7. POISON CONTROL CENTER	(800) 222-1222
8. USACE MM DC PROJECT MANAGER: Mike Watson	(402) 221-7703
9. USACE PROJECT MANAGER: Mike Nelson	(206) 764-3458
10. USACE OE Safety: Glenn Marks	(402) 221-7683 (Office) (402) 740-4954 (Cell)
11. SHAW PROJECT MANAGER: Peter Kelsall	(303) 793-5252 (Office) (303) 981-8435 (Cell)
12. SHAW TECHNICAL LEAD: Dale Landon	(509) 946-2069 (Office) (509) 521-1437 (Cell)
13. SHAW FIELD TEAM LEADER: Simon Payne	(425) 402-3256 (Office) (206) 730-4845 (Cell)
14. SHAW OE SAFETY: Brian Hamilton	(303) 690-3117 (Office) (303) 809-0416 (cell)
15. SHAW UXO TECHNICIANS: Rob Irons	(530) 713-2245 (Cell)

(3) EMERGENCY SIGNALS: In the case of small groups, a verbal signal for emergencies shall suffice. The emergency signal for large groups should be incorporated at the discretion of the UXO Technician.

Verbal

Nonverbal (Specify)

**VII. EMERGENCY RESPONSE:**

(1) ACCIDENTS: Safety-related incidents and accidents will be immediately reported to the Shaw Project Manager and the USACE MM DC Project Manager. Additional notifications within the USACE organization will be coordinated by the USACE MM DC Project Manager. Additional accident reporting responsibilities of Shaw personnel are described in Section 1.9 of the Accident Prevention Plan.

(2) DIRECTIONS TO THE NEAREST HOSPITAL/MEDICAL FACILITY:

Jefferson Healthcare 834 Sheridan Ave. Port Townsend, WA 98368 (360) 85-2200 Hours of Operation <b>Open 24 hours</b>	<b>Services Provided</b>	<ul style="list-style-type: none"> <li>- Hospitals</li> <li>- Emergency Care</li> <li>- Rehabilitation</li> <li>- Outpatient Care</li> </ul>	<ul style="list-style-type: none"> <li>- Referrals</li> <li>- Surgery</li> <li>- X-rays</li> <li>- Inpatient Care</li> <li>- CAT Scans</li> </ul>
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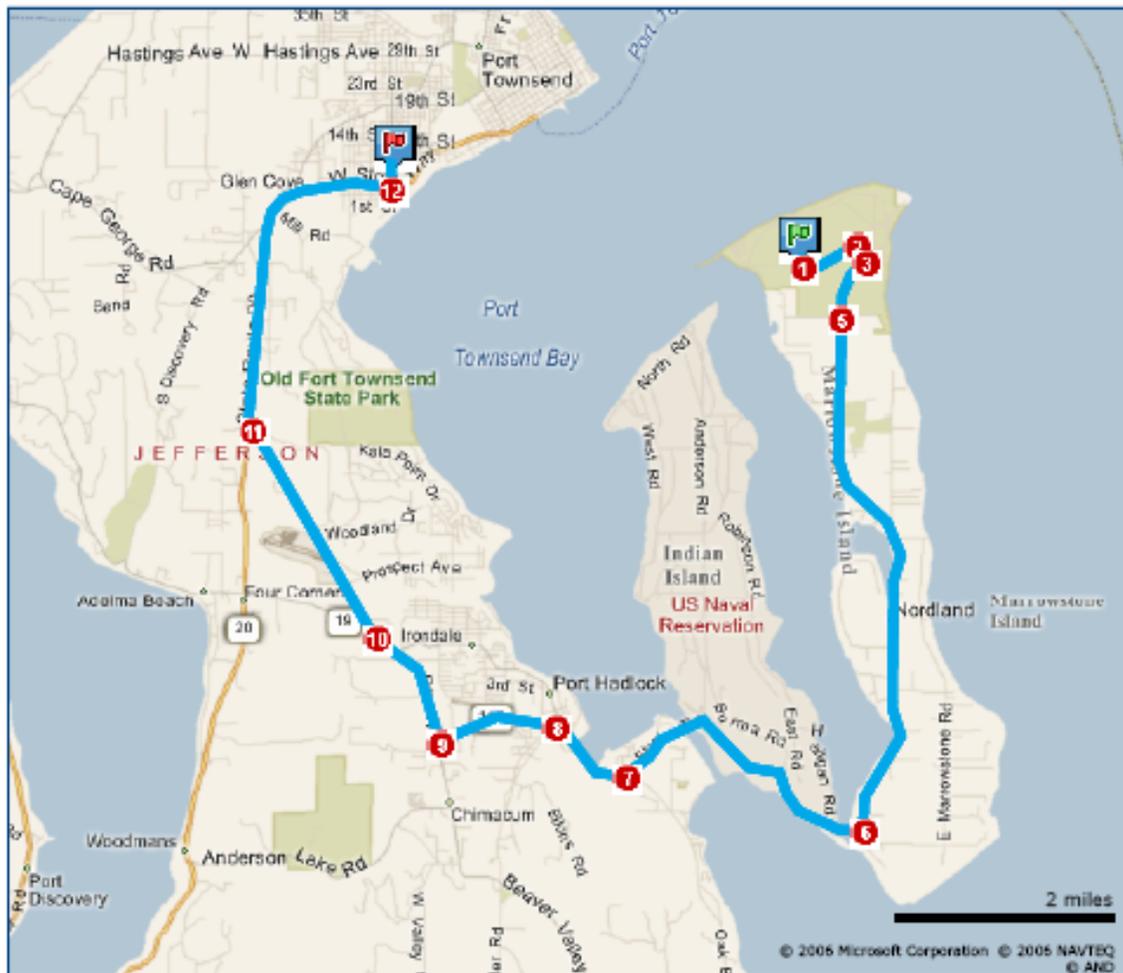
**Direction**

1. East onto Flagler Campground Rd
2. Right onto SR-116

**Distance**

0.5 mi

**See Map on Next Page**



Directions	Distance	Detail Map
<b>Start:</b> Depart on Local road(s) (South)	0.1 mi	
<b>1:</b> Turn LEFT (East) onto Flagler Campground Rd	0.5 mi	
<b>2:</b> Turn RIGHT (South-East) onto Wansboro Rd	0.2 mi	
<b>3:</b> Turn RIGHT (South-West) onto Flagler Rd	0.6 mi	
<b>4:</b> Road name changes to SR-116 [Flagler Rd]		
<b>5:</b> Bear LEFT (South) onto SR-116 [Flagler Rd Ext]	5 mi	
<b>6:</b> Turn RIGHT (West) onto SR-116 [Flagler Rd]	2.8 mi	
<b>7:</b> Bear RIGHT (West) onto SR-116 [Oak Bay Rd]	0.9 mi	
<b>8:</b> Bear LEFT (West) onto SR-116 [Ness Corner Rd]	1.1 mi	
<b>9:</b> Turn RIGHT (North) onto SR-19 [Rhody Dr]	1.2 mi	
<b>10:</b> Keep STRAIGHT onto SR-19 [Airport Cutoff Rd]	2.2 mi	
<b>11:</b> Keep STRAIGHT onto SR-20	3.2 mi	
<b>12:</b> Turn LEFT (North) onto Sheridan Ave	0.2 mi	
<b>End:</b> Arrive at 834 Sheridan Ave., Port Townsend, Washington		

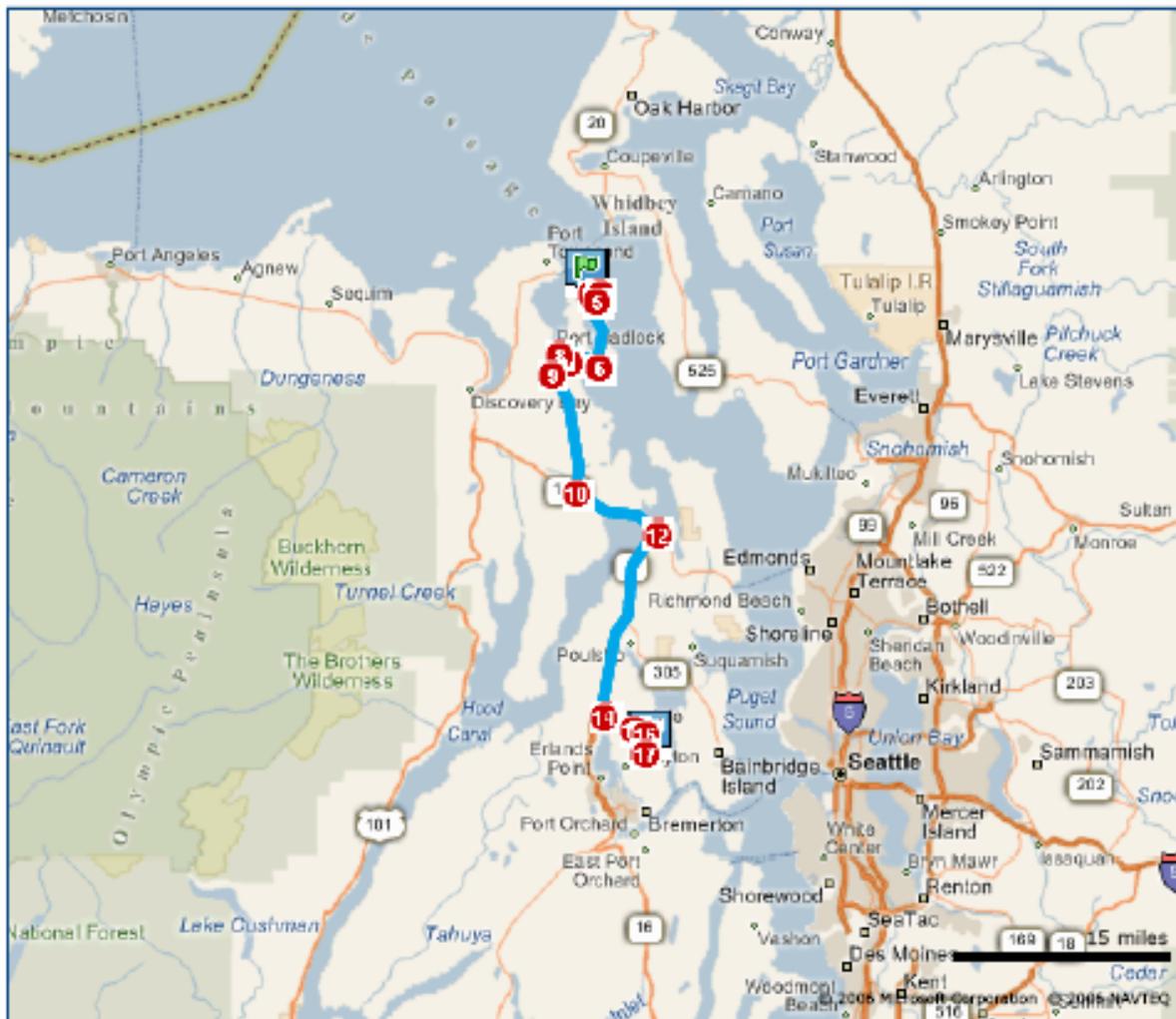
(3) DIRECTIONS TO THE NON-EMERGENCY FACILITY:

**Non-Emergency Facility:**

The following occupational health clinic is approved by Health Resources for non-life-threatening medical treatment of Shaw employees:

<b>Location</b>	<b>City</b>	<b>Clinic</b>	<b>Address</b>	<b>Zip</b>	<b>Telephone</b>	<b>Contact</b>
Bremerton, WA	Bremerton, WA	Prompt Care @ Doctor's Clinic	1651 NE Bentley Dr.	98311	360-782-3400	

**See Directions on Next Page**



Directions	Distance	Detail Map
<b>Start:</b> Depart on Local road(s) (South)	0.1 mi	
<b>1:</b> Turn LEFT (East) onto Flagler Campground Rd	0.5 mi	
<b>2:</b> Turn RIGHT (South-East) onto Wansboro Rd	0.2 mi	
<b>3:</b> Turn RIGHT (South-West) onto Flagler Rd	0.6 mi	
<b>4:</b> Road name changes to SR-116 [Flagler Rd]		
<b>5:</b> Bear LEFT (South) onto SR-116 [Flagler Rd Ext]	5 mi	
<b>6:</b> Turn RIGHT (West) onto SR-116 [Flagler Rd]	2.8 mi	
<b>7:</b> Bear RIGHT (West) onto SR-116 [Oak Bay Rd]	0.9 mi	
<b>8:</b> Turn LEFT (South-West) onto Chimacum Rd	1.6 mi	
<b>9:</b> Turn LEFT (East) onto SR-19 [Beaver Valley Rd]	9.1 mi	
<b>10:</b> Turn LEFT (East) onto SR-104	6.6 mi	
<b>11:</b> Keep RIGHT onto Local road(s)	0.1 mi	
<b>12:</b> Bear RIGHT (West) onto SR-3	13.9 mi	
<b>13:</b> Turn RIGHT onto Ramp towards Wa-303 / E Bremerton	0.1 mi	
<b>14:</b> Take Ramp (RIGHT) onto SR-303 [NW Waaga Way] towards Fairgrounds / East Bremerton	2.7 mi	
<b>15:</b> Keep STRAIGHT onto SR-303 [NE Waaga Way]	1 mi	
<b>16:</b> Bear RIGHT (South) onto SR-303	1.3 mi	
<b>17:</b> Turn LEFT (East) onto NE Bentley Dr	0.1 mi	
<b>End:</b> Arrive at 1651 Bentley Dr., Bremerton, WA		

## VIII. PERSONAL PROTECTIVE EQUIPMENT:

For field work to be performed at this site, Level D is required. Level D Protection requirements are defined in section 5.1.5 of the SSHP (Type I Work Plan, Appendix D, Attachment A, Shaw 2006a). In general, the use of hard hats is required on all USACE work sites, except on MEC-contaminated sites. Hard hats will only be worn if an overhead hazard is identified. No overhead hazards have been identified. If hard hats are worn, they will be securely fastened to the wearers head.

Contingency: Evacuate site if higher level of protection is needed.

## IX. DECONTAMINATION PROCEDURES:

Decontamination procedures are not anticipated as Level D PPE is being used. If decontamination is deemed necessary, procedures defined in Section 7.0 of the SSHP of the Work Plan will be followed. Team members are cautioned not to walk, kneel, or sit on any surface with potential leaks, spills, or contamination.

## X. TRAINING:

Training specific to this site includes Hazard Communications and MEC safety procedures as determined by the UXO Technician.

## XI. GENERAL:

### **Site Visitors**

The number of persons visiting the site will be held to a minimum. The UXO Technician can supervise no more than six non-UXO qualified persons while on MEC sites performing intrusive or non-intrusive work.

### **Modifications to SSHP Addendum**

The Field Team Leader may modify this SSHP Addendum if site conditions warrant. All changes to the SSHP Addendum require USACE review and concurrence before new procedures can be applied in the field.

### **Severe Weather Contingency Plan**

Sudden changes in the weather, extreme weather conditions, and natural disasters can create a number of subsequent hazards. Inclement weather may cause poor working conditions including slip, trip and fall hazards to exist. Natural disasters can create many secondary hazards such as release of hazardous materials to the environment, structure failure, and fires.

Weather conditions will be monitored throughout the day by all field team members. Additionally, field personnel should be aware of/informed of daily weather forecasts. Local weather broadcasts and information from a severe weather alert radio will be monitored by the

Field Team Leader, SSHO, or designee when the likelihood for severe weather exists. The location of Tornado Shelters that may be located in the general area where field work is being performed will be identified. Severe weather may include:

- Tornadoes,
- Thunderstorms (lightning, rain, flash flooding),
- Hail, and
- High wind.

Generally, cellular telephone communication will be used to alert crews to threatening weather. The necessary precautions or response, as directed by the Field Team Leader, to implement the Severe Weather Contingency Plan include:

- Drilling and sampling operations will be suspended when the potential for lightning occurs. Operations may resume 30 minutes after the last observed lightning strike.
- For most types of severe weather, personnel should take refuge in vehicles or inside a designated office.
- In the event of a tornado, personnel should take cover in a basement, ditch, culvert, open “igloo,” or interior room of a strong building. Personnel should be aware that ditches and culverts may fill up with water quickly and should only use these as shelters as a last resort.
- The Field Team Leader must decide what operations, if any, are safe to perform based on existing conditions and anticipated conditions.

Additional information will be developed and communicated to personnel before commencing new tasks or activities. It may be necessary to halt certain hazardous operations or stop work altogether to allow the weather situation to pass.

Routinely monitoring weather conditions and reports may help reduce the impact of severe weather and natural disasters. The best protection against most severe weather episodes and natural disasters is to avoid them. This means seeking shelter before the storm hits. If lightning is a threat, stay away from pipes and electrical equipment and watch for damage caused by nearby lightning strikes.

**SAFETY BRIEFING CHECKLIST**  
(Check subjects discussed)

SITE NAME: Fort Flagler Military Reservation	DATE/TIME:        /
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GENERAL INFORMATION

- PURPOSE OF VISIT
- IDENTIFY KEY SITE PERSONNEL
- TRAINING AND MEDICAL REQUIREMENTS

SPECIFIC INFORMATION

- SITE DESCRIPTION/PAST USES
- RESULTS OF PREVIOUS STUDIES
- POTENTIAL SITE HAZARDS
- MEC SAFETY PROCEDURES
- SITE SOPs
- SITE CONTROL AND COMMUNICATIONS
- EMERGENCY RESPONSE
  - LOCATION OF FIRST AID KIT
  - EMERGENCY PHONE NUMBERS & LOCATION
  - LOCATION OF AND MAP TO NEAREST MEDICAL FACILITY
  - PPE AND DECONTAMINATION

Stress the following during the briefing: If hazardous conditions arise, stop work, evacuate the area, and notify the SSHO and Shaw PM immediately.

PLAN ACCEPTANCE FORM

SITE SAFETY AND HEALTH PLAN AND ADDENDUM

FOR

Site Name: Ft. Flagler Military Reservation

Location: Jefferson County, WA

I have read and agree to abide by the contents of the Site Safety and Health Plan and Addendum and I have attended the Safety Briefing for the aforementioned site.

NAME (PRINTED)	OFFICE	SIGNATURE	DATE

Person presenting the safety briefing:

\_\_\_\_\_  
SIGNATURE

\_\_\_\_\_  
DATE