

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

**Final Technical Project Planning
Memorandum
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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December 18, 2006


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Final Technical Project Planning Memorandum

**Site Inspection
Fort Flagler Military Reservation
Formerly Used Defense Site
FUDS ID F10WA0316**

Military Munitions Response Program

Documentation for Technical Project Planning Meeting
Washington Department of Ecology
Lacey, Washington
July 24, 2006

Hosted by U.S. Army Corps of Engineers

Prepared by Shaw Environmental, Inc.

December 18, 2006

Concurrences

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TABLE OF CONTENTS

ABBREVIATIONS AND ACRONYMS	ii
ADMINISTRATIVE INFORMATION	1
Technical Project Planning Meeting Summary	4
SITE INSPECTION OBJECTIVES	2
Goal.....	3
Objectives	3
Roles & Responsibilities.....	3
Site Inspection Process	4
Technical Project Planning Process	4
BACKGROUND INFORMATION	5
Site Description and Regulatory History	6
Operational History and MEC/MC Characteristics	7
Groundwater	8
Surface Water.....	8
Terrestrial Exposure.....	8
Air	9
CONCEPTUAL SITE MODEL	10
Overview.....	11
Conceptual Site Model – Range Complex AOC	13
Conceptual Site Model – Ammunition Bunker AOC	15
Conceptual Site Model – Transition Range 1 AOC.....	18
Conceptual Site Model – Transition Range 2 AOC.....	21
Conceptual Site Model – Gas Chamber AOC	24
Conceptual Site Model – Rifle Grenade/Anti-Tank Rocket Range AOC	26
Conceptual Site Model – Live Grenade Court.....	30
Conceptual Site Model – Practice Grenade Court	33
Conceptual Site Model – Rifle Range AOC	35
Conceptual Site Model – Demolition Area AOC	38
Conceptual Site Model – Quartermaster Wharf Disposal Area AOC	41
Data Gaps.....	44
PROPOSED SAMPLING SCHEME	45
Proposed Field Investigation.....	46
TPP MEETING NOTES AND DATA QUALITY OBJECTIVES	50
Technical Project Planning and Development of Data Quality Objectives	51
TPP Phases.....	51
Data Quality Objectives	55
Next Steps	57
FIGURES	58
TABLES	59
DRAFT WORKSHEETS	60
ATTACHMENT A	61

ABBREVIATIONS AND ACRONYMS

AOC	area of concern
ASR	Archives Search Report
bgs	below ground surface
CN	chloroacetophenone
CRREL	Cold Regions Research and Engineering Laboratory
CSM	Conceptual Site Model
DoD	Department of Defense
DQO	Data Quality Objective
°F	degrees Fahrenheit
ft	foot or feet
Ft. Flagler	Fort Flagler Military Reservation
FUDS	Formerly Used Defense Site
GPS	global positioning system
HRS	Hazard Ranking System
HTRW	Hazardous, Toxic, and Radioactive Waste
HMX	octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine
INPR	Inventory Project Report
MC	munitions constituents
MEC	munitions and explosives of concern
mm	millimeter
MMRP	Military Munitions Response Program
MRSP	Munitions Response Site Prioritization Protocol
NDAI	No Department of Defense Action Indicated
NG	nitroglycerin
NOAA	National Oceanic & Atmospheric Administration
OB/OD	Open Burning/Open Detonation
PCOC	potential contaminant of concern
PETN	pentaerythritol tetranitrate
RAC	Risk Assessment Code
RDX	hexahydro-1,3,5-trinitro-1,3,5-triazine
RI	Remedial Investigation
RI/FS	Remedial Investigation/Feasibility Study
Shaw	Shaw Environmental, Inc.
SHPO	State Historic Preservation Office
SI	Site Inspection
SSWP	Site-Specific Work Plan
State Parks	Washington State Parks Department
TCRA	time-critical removal action
Tetryl	methyl-2,4,6-trinitrophenylnitramine
TNT	2,4,6-trinitrotoluene
TPP	Technical Project Planning
USACE	U.S. Army Corps of Engineers
USEPA	U.S. Environmental Protection Agency
UTL	upper tolerance limit
UXO	unexploded ordnance
WDOE	Washington Department of Ecology

Administrative Information

***Site Inspection
Ft. Flagler Military Reservation***

***Technical Project Planning Meeting
July 24, 2006***

The Technical Project Planning (TPP) Memorandum is one in a series of documents used during the Site Inspection (SI) process to document the information collected and processes used to evaluate Formerly Used Defense Sites (FUDS) for the possible presence of munitions and explosives of concern (MEC) and/or munitions constituents (MC). TPP meeting information provided in the Memorandum reflects both the original version of information shared with meeting participants, as well as changes/updates to site-specific information obtained during the TPP Meeting.

The TPP Meeting for the former Fort Flagler Military Reservation (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 U.S. Army Corps of Engineers (USACE) – Omaha Design Center and Seattle District, the Washington Department of Ecology (WDOE), Washington State Parks Department (State Parks), and Shaw Environmental, Inc. (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 attendees as the earlier meeting in addition to three State Parks volunteers. 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.

The TPP Memorandum documents discussions for the TPP Meeting and includes the sections described below:

- **Administrative Information:** includes meeting logistics, the list of attendees, and a summary of the meeting;
- **Site Inspection Objectives:** provides the goal and objectives of the SI, roles and responsibilities, the SI process, and the TPP process;
- **Background Information:** includes site and project history, area physical setting, a summary of previous environmental work, and an introduction to the areas of concern (AOCs) addressed by the SI;
- **Conceptual Site Model (CSM):** identifies environmental attributes, potential human and ecological receptors in the area's environment, and the relationships between these factors;
- **Proposed Sampling Scheme:** describes the type and quantity of samples to be taken, and the analytical methods to be used for characterizing the AOC;
- **TPP Notes and Data Quality Objectives (DQOs):** captures project and site-specific information as discussed during the TPP meeting to ensure the necessary and appropriate information is shared among meeting participants, and that meeting participants concur with the identified goal, objectives, and approach used to complete the SI process; and
- **Worksheets:** includes the **Site Information Worksheet, Draft Munitions Response Site Prioritization Protocol (MRSPP) Data Gaps, and Hazard Ranking System (HRS) Data Gaps.**

Site: Fort Flagler Military Reservation

Location: Lacey, Washington

USACE District: Seattle

TPP #1 Meeting Location: Washington Department of Ecology, Lacey, Washington

TPP #1 Meeting Date: 7/24/06

Agenda

- **Convene at Washington Department of Ecology Office**
 - Introductions
 - Review Site Inspection Objectives
 - Goals, Objectives, Roles & Responsibilities
 - Site Inspection Process
 - TPP Process
 - Review of Background Information
- **Break for Lunch**
- **Technical Project Planning Discussion**
- **Conclude Meeting**
- **Public Meeting (evening)**

TPP Meeting Attendees

Michael Watson	USACE
Mike Nelson	USACE
Greg Johnson	WDOE
Sandra Caldwell	WDOE
Barry Rozowski	WDOE
Mike Zimmerman	Washington State Parks
Ted Smith	Washington State Parks
Dale Landon	Shaw
Peter Kelsall	Shaw

Technical Project Planning Meeting 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.

Agencies Meeting

AOCs: 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. 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 s/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 is shown on the historic map (Attachment A) 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 in 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 results of the visual inspection conducted 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.
- Areas around the batteries are paved with 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).
- 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.

Site Inspection Objectives

***Site Inspection
Ft. Flagler Military Reservation***

***Technical Project Planning Meeting
July 24, 2006***

Goal

- The USACE is conducting SIs of FUDS properties to determine if any MEC or related MC are present on property formerly owned or leased by the Department of Defense (DoD).

Objectives

- Determine if the site requires further response action due to the presence of MEC/MC.
- Collect minimum information needed to:
 - Eliminate a site from further consideration if:
 - No evidence of MEC and/or
 - Concentrations of MC in samples are below risk-based action levels, or below background concentrations; or
 - Determine the potential need for removal action or initiation of the Remedial Investigation/Feasibility Study (RI/FS) if:
 - MEC identified and/or
 - Concentrations of MC in samples exceed risk-based action levels and background concentrations.
 - Provide sufficient data to support prioritization of future actions under the HRS and MRSPP.

Roles & Responsibilities

- **USACE:** Acts as the executing agency for the DoD with regard to the FUDS program. In this role, the USACE has decision making authority and is responsible for ensuring work is conducted in accordance with applicable USACE and federal guidance. Additionally, USACE coordinates and works with project team members to meet needs expressed by regulatory agencies and stakeholders to the extent possible within programmatic guidelines.
- **Regulatory Agency:** Participates in planning of SI activities to ensure the project meets applicable state standards and requirements.
- **Property Owner(s):** Provides available and pertinent information about the area, provides insight on current and anticipated future land uses for the property, and participates in project team discussions.
- **Shaw:** As a contractor to the USACE, conducts work on behalf of the USACE, provides TPP materials, and conducts and reports SI activities.

Site Inspection Process

- Data review,
- TPP,
- Site-Specific Work Plan (SSWP),
- SI field activities – reconnaissance, sampling, and analysis, and
- SI Report.

Technical Project Planning Process

- Conduct TPP meeting(s) with key organizations and stakeholders;
- Identify stakeholder(s) concerns;
- Identify all AOCs for this SI;
- Review site information;
- Verify current and anticipated future land use;
- Develop CSM;
- Identify data gaps;
- Plan how to address data gaps;
- Develop DQOs for meeting SI requirements; and
- Concur on SI field work approach.

Background Information

***Site Inspection
Ft. Flagler Military Reservation***

***Technical Project Planning Meeting
July 24, 2006***

Site Description and Regulatory History

Historical information (including references to interviews and historical documents) contained in this package was obtained from the USCAE 2005 ASR and 2004 Inventory Project Report (INPR) Supplement for Ft. Flagler.

Ft. Flagler was originally used (1899 through 1946) as a coastal artillery battery to protect Puget Sound from enemy ships. Following World War II, the site was used for training engineers and amphibious units.

Site Location

- The former Ft. Flagler is located in Jefferson County, Washington, near Port Townsend, Washington on the west side of Puget Sound (Figure 1).
- Ft. Flagler occupied 812.7 acres that were acquired between 1866 and 1952.

Physical Setting

- Ft. Flagler 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).
- Ft. Flagler is a forested site containing conifers (fir and cedar) and deciduous (alder and oak) trees and heavy underbrush.
- The site is currently a state park, with campgrounds, picnic areas, buildings, and visitor facilities.
- Port Townsend, Washington, is the nearest incorporated community (approximately 18 miles by road and 4 miles by water) with a population of 8,810 (2004 estimated census).
- The climate at Ft. Flagler 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.
- Ft. Flagler FUDS is currently owned by the Washington State Parks Department and the United States Geological Survey, which maintains an experimental station at the site.
- Site access is uncontrolled.

Previous Investigations and Regulatory History

- Ft. Flagler was certified as being decontaminated in 1954 and again in 1959.

- A Findings and Determination of Eligibility and an INPR were completed in 1991, which concluded that Ft. Flagler had been formerly used by the War Department.
- In 1992, a time-critical removal action (TCRA) was completed to remove anti-tank rockets and other MEC from the rocket range.
- Thirteen underground fuel tanks were removed under the Hazardous, Toxic, and Radioactive Waste (HTRW) program (undated). MEC or MC related items were not addressed in that project.
- The 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.
- The 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. 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). Below are the RAC scores.

Area	RAC Score	MEC Found
Rocket Range	5	No
Rifle Range	5	No
Transition Range	5	No
Quartermaster Wharf Disposal Area	3	Yes – small arms
Remaining Lands	5	No
Offshore Ordnance Area	5	No

Operational History and MEC/MC Characteristics

Historic Military Operations

- 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.

MEC/MC Characteristics

- Based on the ASR and the INPR Supplement, and information gathered during the TPP meeting, the MEC used at Ft. Flagler 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 grenade,
 - M21 practice hand grenade,
 - .50-caliber machine guns, and
 - 2.36-inch and 3.5-inch anti-tank rockets.

Groundwater

- 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 depth to water, based on wells immediately south of the park, is between 58 to 125 ft.

Surface Water

- There are no established streams or fresh surface water on the site. Intermittent streams do occur during heavy precipitation events.
- Puget Sound, an intercoastal waterway (saltwater), surrounds the site on three sides (north, east, and west).

Terrestrial Exposure

- Based on the size and population of Jefferson County, Washington, the population density is approximately 10 persons per square mile.
- 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.
- The ASR identified only occasional transient bald eagles as the only protected species. The Washington Department of Fish and Wildlife and the U.S. Fish and Wildlife Service have been contacted to provide specific information about the site.
- There is one known archaeological site located within at Ft. Flagler. The specific location is not known. The office of Archaeology and Historic Preservation will be contacted to provide up-to-date information on the site.
- Ft. Flagler is listed on both the National Register of Historic Places and on the Washington Heritage Register.

Air

- Ft. Flagler State Park has full and part-time residents on site.
- The town of Port Townsend is approximately 4 miles to the west of the site.

Conceptual Site Model

*Site Inspection
Ft. Flagler Military Reservation*

*Technical Project Planning Meeting
July 24, 2006*

Overview

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.

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.

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 CRREL¹ 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.

¹ 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. This 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 CRREL² 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.

² 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 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 CRREL³ 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.

³ 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 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. 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 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 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 OC. 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. 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.

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. 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.

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 small arms or munitions 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:

AOC	Presence of MEC	Presence of MC	Proposed Inspection Activities
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 magnometer; soil and sediment sampling; analyze for select metals and explosives including NG and PETN.
Live Grenade Court	Unknown	Unknown	Visual reconnaissance with magnometer; 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.

Proposed Sampling Scheme

*Site Inspection
Ft. Flagler Military Reservation*

*Technical Project Planning Meeting
July 24, 2006*

Proposed Field Investigation

The proposed field investigation and sampling to be conducted at Ft. Flagler is detailed below. The investigation approach will be defined in more detail in an SSWP that will be submitted to WDOE and other stakeholders for review. The SSWP will reference technical details including sampling and analytical methods that are described in the *Final Type I Work Plan, Site Inspections at Multiple Sites (Type I Work Plan)* prepared by Shaw and submitted to USACE as final in February 2006.

Reconnaissance

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

- A strictly visual survey that will be conducted to confirm site conditions, such as the locations of buildings, and areas surrounded by mowed grass. This type of survey is not intended to assess the presence of MEC or munitions debris;
- A visual survey combined with the use of a handheld magnetometer that will be conducted to assess the presence of MEC or munitions debris; and
- A pre-sampling visual survey combined with the use of a handheld magnetometer that will be conducted at all soil sampling locations prior to sampling. This type of survey will be conducted to avoid MEC.

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

A strictly visual survey will be conducted around each of the artillery batteries in the Range Complex, the Ammunition Bunker, Transition Ranges 1 and 2, the Gas Chamber and Practice Grenade Court, and the Quartermaster Wharf Disposal Site to confirm the site conceptual model's prediction 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 survey will be conducted in the Demolition Area to confirm that the area was completely backfilled. The survey path will be along the shoreline, at the slope break between the mowed grass area and the beach.

Visual surveys combined with the use of a hand-held magnetometer will be conducted in areas of the Rifle Grenade/Anti-Tank Rocket Range and the Live Grenade Court, to assess the presence of MEC or munitions debris within the eastern portion of the AOC where MEC was found during the removal action that occurred in 1992. The approximate locations of the surveys 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. The UXO technician will attempt to perform reconnaissance; however, if the underbrush becomes too thick, the survey will be abandoned.

Prior to sampling, a visual survey combined with the use of a hand-held magnetometer will be conducted to identify evidence of MEC and/or range activities (presence of MEC or munitions debris, targets, etc). 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. The reconnaissance team will locate, identify, and stake sampling locations within the AOC. The amount and type of munitions debris observed on the ground will be noted.

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 staked sampling locations (using a hand-held GPS unit),
- Access limitations,
- Vegetative cover,
- Soil conditions,
- Presence or absence of water for surface water samples, and
- Other conditions encountered that impact sample collection.

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

Sampling

A visual reconnaissance, aided by a magnetometer, of AOCs will be performed 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 sample point locations. Digital photographs will be taken to document significant features and sampling locations.

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 Section 6.1 and Shaw Standard Operating Procedure (SOP) T-FS-101 of Appendix E of the *Final Type I Work Plan* (Shaw, 2006a).

The proposed sampling for the Ft. Flagler is summarized in Table 3.

Soil

Surface soil sampling is proposed at the Transition Range 1, Transition Range 2, Rifle Grenade/Anti-Tank Rocket Range, Live Grenade Range, and Quartermaster Wharf AOCs. Additionally, a contingency surface soil sample is allotted for the Ammunition Bunker, if needed. No surface soil sampling is proposed at the Range Complex AOC, the Gas Chamber AOC, the Practice Grenade Court AOC, or the Demolition Area AOC.

Surface soil samples will be collected at a depth of approximately 0 to 6 inches 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 3.

One contingency surface soil sample will be collected from the Ammunition Bunker AOC if evidence of MEC or MEC debris is located during the visual reconnaissance (Figure 3). If a surface soil sample is collected at the Ammunition Bunker AOC, the sample will be analyzed for select metals and explosives, including nitroglycerin (NG) and pentaerythritol tetranitrate (PETN), according to the methods specified below.

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 target berms in each range (Figures 5 and Figure 7, respectively). Samples collected from the Transition Ranges will be analyzed only for lead according to the method specified below.

Three surface soil samples will be collected from the Rifle Grenade/Anti-Tank Rocket Range AOC (Figure 9). Two of the three surface soil samples will be collected from locations where MEC or debris were observed during the 1992 TCRA. 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. These samples will be analyzed for select metals (aluminum, chromium, copper, iron, lead, manganese, molybdenum, and nickel) and explosives, including NG and PETN, according to the methods specified below.

One surface soil sample will be collected from the Live Grenade Court AOC following completion of the visual reconnaissance (Figure 10). The sample will be analyzed for select metals (aluminum, chromium, copper, iron, lead, manganese, molybdenum, and nickel) and explosives, including NG and PETN, according to the methods specified below.

Two surface soil samples will be collected from the Rifle Range AOC from locations near the target berm (Figure 12). These samples will be analyzed only for lead according to the method specified below.

One surface soil sample will be collected from the Quartermaster Wharf AOC (Figure 12). The sample will be analyzed for explosives (including NG and PETN) according to the methods specified below.

Sediment

Sediment sampling is proposed at the Transition 1, Transition 2, Ammunition Bunker, Rifle Grenade/Anti-Tank Rocket Range, and Rifle Range AOCs.

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 3.

One contingency sediment sample will be collected from the Ammunition Bunker AOC (Figure 3). The sample will be analyzed for select metals (aluminum, chromium, copper, iron, lead, manganese, molybdenum, and nickel) and explosives, including NG and PETN, according to the methods specified below.

One sediment sample each will be collected from water collection areas at the Transition Range 1 and from the Transition Range 2 AOCs (Figures 5 and 7, respectively). These sediment samples will be analyzed for lead according to the method specified below.

One sediment sample will be collected from a water collection area inside the Rifle Grenade/Anti-Tank Rocket Range AOC (Figure 9). The sample will be analyzed for select metals (aluminum, chromium, copper, iron, lead, manganese, molybdenum, and nickel) and explosives, including NG and PETN, according to the methods specified below.

One sediment sample will be collected from a water collection area in front of the target berm at the Rifle Range AOC (Figure 12). The sample will be analyzed for lead according to the method specified below.

Background

Ten soil samples, one sediment sample, and one beach sample will be collected from background locations (Figure 11). The composite soil sample locations will be determined in the field in areas that do not appear to have been impacted by past site operations. The background samples will be analyzed for Target Analyte List metals and molybdenum according to the methods specified below. The select metals list is based on expected metals contained in munitions used at Ft. Flagler. The soil background samples will be used to develop an upper tolerance limit (UTL) for comparison of metals concentrations in soil at the target areas. The background sediment sample will provide data to compare sediment samples to background values. The proposed background sampling is summarized in Table 3.

Analyses

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

- Select metals 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
- NG 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.

Tables 4 through 6 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.

TPP Meeting Notes and Data Quality Objectives

***Site Inspection
Ft. Flagler Military Reservation***

***Technical Project Planning Meeting
July 24, 2006***

Technical Project Planning and Development of Data Quality Objectives

- The USACE TPP process is a four-phase process:
 - Identify the current project,
 - Determine data needs,
 - Develop data collection options, and
 - Finalize data collection program.
- The purpose of TPP is to develop DQOs that document how the project makes decisions.
- DQOs are intended to capture project-specific information such as the intended data use(s), data needs, and how these items will be achieved.
- Information captured through DQOs will be used as a benchmark for determining whether identified objectives are met.

TPP Phases

Phase I: Identify the Current Project

1. Team members identified to date include: USACE – representatives from the Omaha Design Center and the Seattle District, Shaw as a USACE contractor, Washington Department of Ecology, Washington State Parks, and USEPA Region 10.

Question: Is there any person or organization missing from this Team?

The DNR owns the property at Quartermaster Wharf; Mike Nelson will contact the agency.

Federal property (Coast Guard and NOAA) is present near the Rifle Range.

Washington F&W owns the western end of spit.

Mike Nelson will determine whether there is a need to contact Indian tribes.

The USEPA is not involved beyond courtesy review of documents.

Steve Hahn is State Parks real estate contact.

2. The AOCs are identified as:

- Range Complex
 - Battery Bankhead
 - Battery Calwell
 - Battery Downes
 - Battery Gratton
 - Battery Lee

- Battery Rawlins (Anti-torpedo Boat Battery)
- Battery Revere
- Battery Wansboro
- Battery Wilhelm
- Anti-Aircraft Artillery Battery
- Transition Range 1
- Gas Chamber
- Rocket Range
- Transition Range 2
- Rifle Range

Question: Are there any other AOCs to be identified?

Yes. See discussion in TPP Summary.

3. Based on information available about the site and shared through discussions with USACE, are there concerns about this area that have been expressed by the Washington Department of Ecology, USEPA, or Washington State Parks, as well as by landowners.

Question: Are there additional concerns or issues from landowners or other stakeholders regarding the Ft. Flagler area?

Stakeholders discussed whether additional public notification is required.

Question: Are there any administrative or stakeholder concerns or constraints that would prevent site inspection activities from going forward on the decision path for this site?

The Quartermaster Wharf is a protected site with known archaeological interest. Ted Smith can provide contact for SHPO. It was agreed that December will be a good time for field work because of light public use. Posting of documents to a public web site was discussed and it was agreed that draft documents would not be posted. Per the agency's request, it was agreed that responses to WDOE comments would be included in final documents.

Phase II: Determine Data Needs

4. Existing site information includes an INPR Supplement and ASR both prepared by the USACE in 2004 and 2005, respectively. In addition, a TCRA was completed in 1992 at the Rocket Range.

Question: Are there any other pertinent documents relating to the site available?

State Parks can provide GIS data showing current park facilities

5. The site-specific approach for this SI involves collating and assessing available site information, to include site geology, hydrogeology, groundwater, surface water, ecological information, human use/access, and current and future land uses, as well as considering conduct of site inspection and sampling activities.

Question: Are there any other site aspects/information that should be considered?

None were identified.

6. Based on site use, soil is the primary affected medium at Ft. Flagler. Sediment/surface water is a potential pathway of MC because of the contact with park workers and visitors and wildlife and impacts to Puget Sound. Groundwater is not considered a pathway as there are no nearby downgradient wells. Air is also a potential pathway if soil particles become airborne. Considering current and future land use, primary receptors of any contaminants that may be present would most likely be individuals and animals using the area.

Question: Do team members concur with the CSM?

MEC will only be evaluated at the Rocket Range.

MC will be evaluated at the Transition Range 1, Rocket Range, and Rifle Range.

MC potential contaminants of concern (PCOCs) are select metals (aluminum, chromium, copper, iron, lead, manganese, molybdenum, and nickel) and explosives at the Range Complex and Rocket Range, and lead only at the Transition Range 1 and Rifle Range.

No sampling at the Gas Chamber.

Exposure pathways are through soils and sediments/surface water.

General agreement with approach with additional AOCs

7. Technical considerations and/or constraints need to be identified and addressed before conducting any additional sampling, and would depend on the approach and additional data needs decided upon by team members.

Questions:

- **Are any data missing?**
- **What is the nature of needed data?**
- **What information is necessary to support a decision of No Department of Defense Action Indicated (NDAI) or further action with regards to MEC? Is reconnaissance during the SI, together with the historical record of a munitions clearance at the time of range closure and a period of approximately 50 years without known MEC-related incidents, considered sufficient to determine the need for NDAI versus further action with respect to MEC?**
- **What data gaps would additional data meet for making a decision about the site?**

- **Are there any considerations/constraints that need to be addressed for collecting additional data?**

Addressed by other sections. Additional AOCs have been identified and added.

Phase III: Develop Data Collection Options

8. Proposed approach:

1. Conduct a visual survey around each artillery battery, ammunitions Bunker, Transition Ranges 1 and 2, the Gas chamber, Practice Grenade Court, and Quartermaster Wharf Disposal Site to confirm the CSM.
2. Conduct surface reconnaissance with magnetometer at the Rifle Grenade/Anti-Tank Rocket Range and Live Grenade Court for MEC.
3. Conduct a visual survey along the beach line at the Demolition Area to confirm that the area was completely backfilled.
4. Collect suitable background samples - 10 soil, one sediment, and one beach.
5. Collect composite soil samples and analyze for select metals (aluminum, chromium, copper, iron, lead, manganese, molybdenum, and nickel) and explosives at the Ammunition Bunker (contingency sample), Rifle Grenade/Anti-Tank Rocket Range, and Live Grenade Court, for lead only at Transition Ranges 1 and 2 and Rifle Range, and for explosives only at the Quartermaster Wharf Disposal Area.
6. Collect discrete sediment samples from water accumulation areas at one location each at the Ammunition Bunker (contingency sample), Transition Ranges 1 and 2, Rifle Grenade/Anti-Tank Rocket Range, and Rifle Range. Analyze for select metals (aluminum, chromium, copper, iron, lead, manganese, molybdenum, and nickel) and explosives at the Ammunition Bunker and Rifle Grenade/Anti-Tank Rocket Range, and for lead only at the Transition Ranges 1 and 2 and Rifle Range.

Question: Based on the desired decision endpoints and information known to date, what additional information is needed to reach a determination of NDAI or further action?

- The following reconnaissance results would support a recommendation for further action with respect to MEC:
 - Direct evidence is found of the presence of MEC, other than small arms, or evidence of potential MEC that is inconsistent with the Rocket Range CSM (e.g., debris from rockets, hand grenades, land mines.
 - Direct evidence of MEC is not found, but abundant munitions debris (other than from small arms) and/or magnetic anomalies are identified suggesting a potential for the presence of unexploded spotting charges or other MEC.
- The following reconnaissance results would support a recommendation for NDAI with respect to MEC:

- Direct evidence of MEC is not found; isolated munitions debris and/or magnetic anomalies consistent with the Rocket Range CSM are identified.
- No evidence of MEC, munitions debris, or magnetic anomalies are identified.

Question: Are the stakeholders in agreement with the sampling approach program?

Sampling approach developed for additional AOCs as noted earlier.

Question: Are the stakeholders in agreement with the proposed approach for collecting background data?

Sampling approach developed for additional AOCs as noted earlier.

Phase IV: Finalize Data Collection Program

9. What concentrations of PCOCs (metals and explosives) lead to decision end-points?

Note: Washington State standards are provided in Tables 4, 5, and 6.

Question: Are these the correct standards to be applied as screening values for human health and ecological risk assessment?

WDOE confirmed these are appropriate subject to further review of the document. The USEPA Region IX PRGs will apply when no Washington standards exists.

Question: Are there any additional sampling and analysis methodologies needed for all team members to arrive at a decision end-point?

None identified.

Question: Given the additional sampling and analysis methodologies, are there impacts to the project schedule that need to be accommodated?

None identified.

Data Quality Objectives

Upon agreement at the TPP meeting, the following decision rules will be applied with regard to MC sampling results:

- Below risk-based screening levels = NDAI;
- Above risk-based screening levels and background = RI/FS.

The following expanded project objectives have been developed.

Objective 1: Determine if the site requires additional investigation or can be recommended for NDAI based on the presence or absence of MEC.

DQO #1 – Utilizing trained UXO personnel and handheld magnetometers, a visual search will be conducted searching for physical evidence to indicate the presence of MEC (rockets, hand grenades, land mines), MEC on the surface, munitions debris, and soil discoloration indicative of explosives). The visual search will consist of a meandering path along trails and in accessible areas. The following decision rules will apply:

- The following reconnaissance results would support a recommendation for further action with respect to MEC:
 - Direct evidence is found of the presence of MEC (from historical records or SI activities), other than incidental small arms rounds, or evidence of potential MEC that is inconsistent with the individual AOC CSM (e.g., debris from munitions other than rockets, hand grenades, or land mines).
 - Direct evidence of MEC is not found, but abundant munitions debris and/or magnetic anomalies, other than from small arms, are identified suggesting a potential for the presence of unexploded MEC.
- The following reconnaissance results would support a recommendation for NDAI with respect to MEC:
 - Direct evidence of MEC is not found; isolated munitions debris and/or magnetic anomalies consistent with the site CSM are identified.
 - No evidence of MEC, munitions debris, or magnetic anomalies are identified.
- If there is indication of an imminent MEC hazard, the site may be recommended for a time-critical removal action (TCRA).

Objective 2: Determine if the site requires additional investigation or can be recommended for NDAI based on the presence or absence of MC above screening values.

DQO#2 – Soil and sediment samples will be collected and analytical results will be compared to screening values for human health and ecological risk assessment, and to background values for naturally occurring substances. The following decision rules will apply:

- 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.

Objective 3: Obtain data required for HRS scoring.

Data required for HRS scoring are identified in the HRS Data Gaps worksheet.

Objective 4: Obtain data required for MRSPP ranking.

Data required for MRSPP ranking are identified in the MRSPP worksheet.

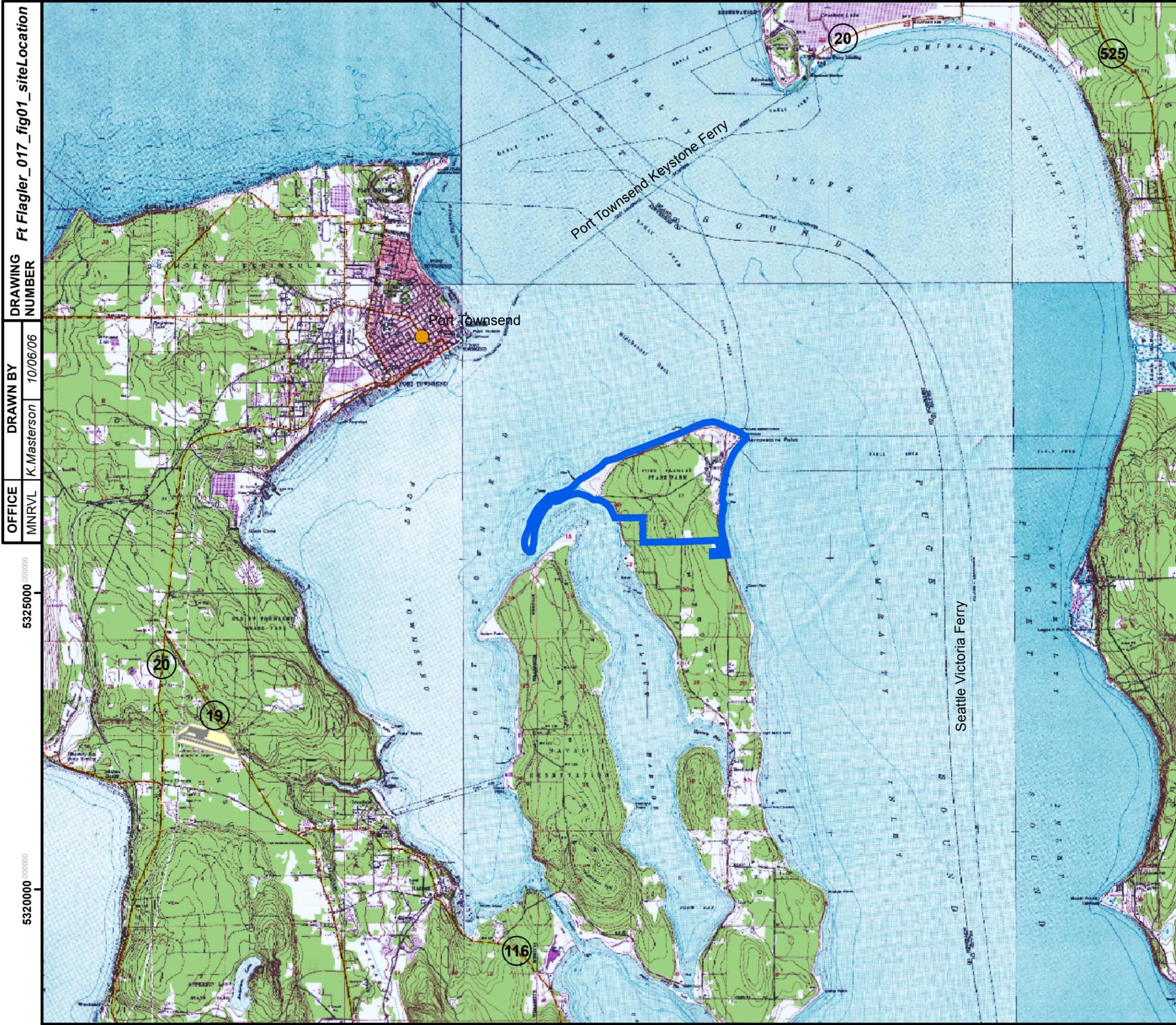
Next Steps

- Shaw will prepare the SSWP for review and comment.
- USACE will obtain necessary ROEs.
- Shaw will collect SI activities.
- Shaw will prepare the SI Report.
- Scheduling of a 2nd TPP meeting will occur as agreed upon by team members.

Figures

*Site Inspection
Ft. Flagler Military Reservation*

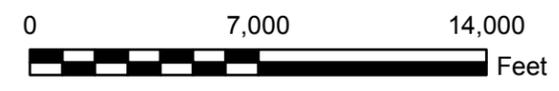
*Technical Project Planning Meeting
July 24, 2006*



DRAWING NUMBER: Ft Flagler_017_fig01_siteLocation
 DRAWN BY: K.Masterson
 DATE: 10/06/06
 OFFICE: MNRVL

Legend

- Fort Flagler Military Reservation Property Boundary



REFERENCE/PROJECTION: NAD 83 UTM Zone 10N



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FIGURE 1
SITE LOCATION
 FORT FLAGLER MILITARY RESERVATION



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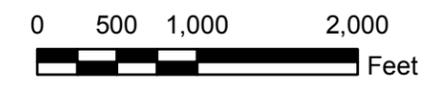
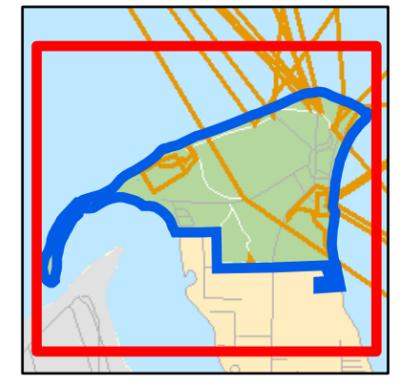


Legend

- Fort Flagler Military Reservation Property Boundary
- Fort Flagler Area of Concern
- Fort Flagler Area of Concern as Identified in the ASR Supplement
- 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

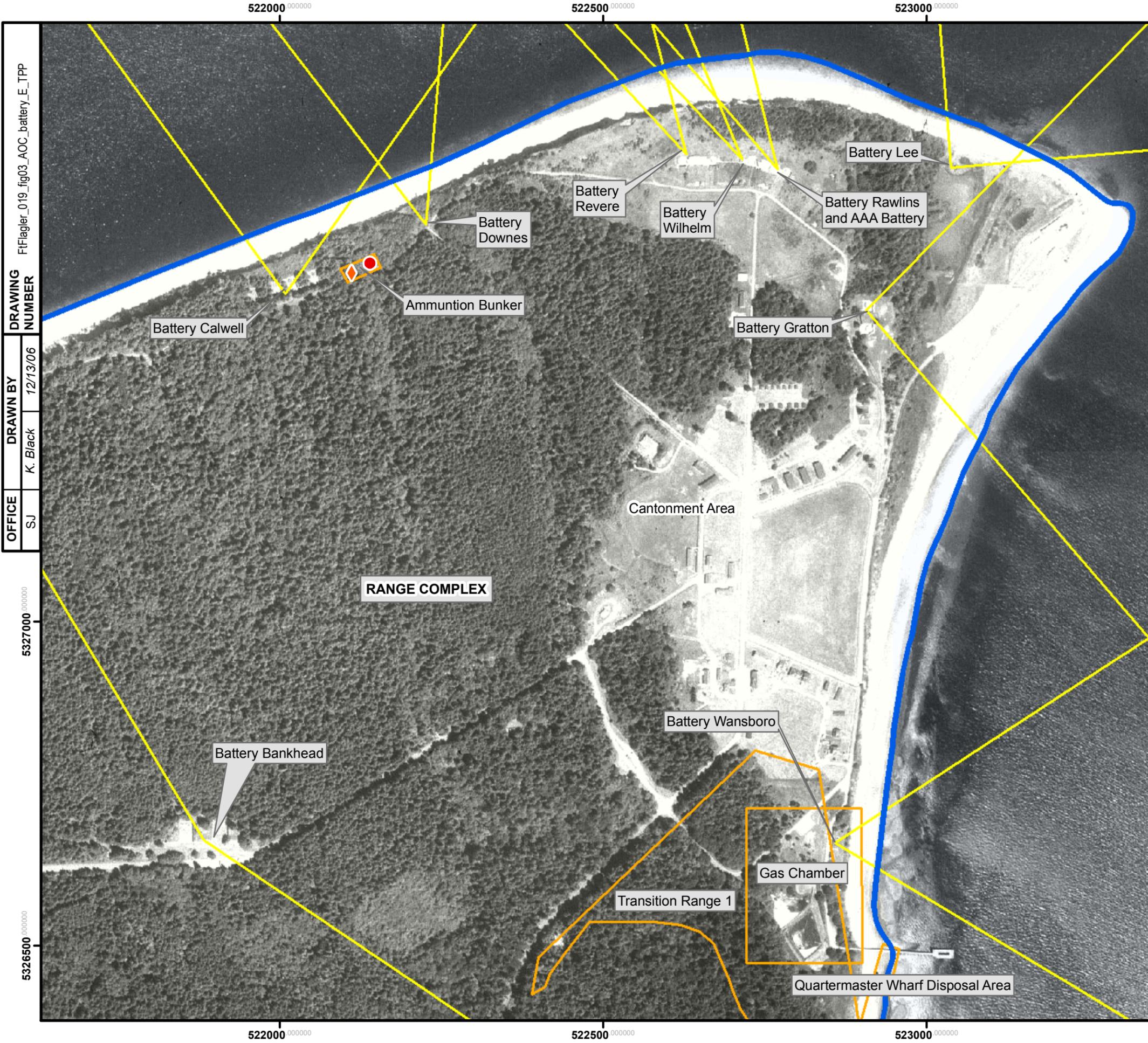
Shaw Environmental, Inc.

DRAWING NUMBER: FtFlagler_018_fig02_SiteLayout_TPP
 DRAWN BY: K. Black
 DATE: 12/13/06
 OFFICE: SJ

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DRAWING NUMBER: FFlagler_019_fig03_AOC_battery_E_TPP
 DRAWN BY: K. Black
 DATE: 12/13/06
 OFFICE: SJ

Legend

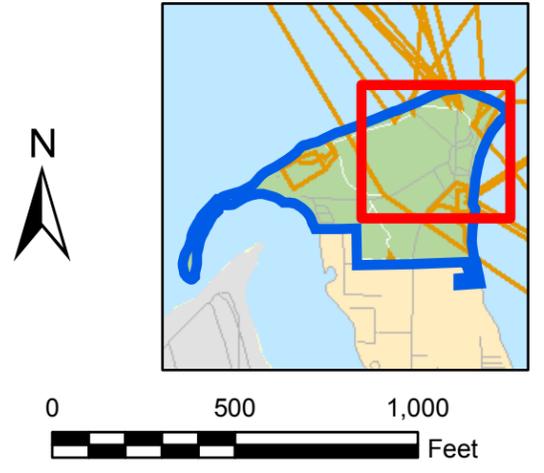
- Fort Flagler Military Reservation Property Boundary
- Fort Flagler Area of Concern
- Range Fan

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.



REFERENCE/PROJECTION: NAD 83 UTM Zone 10N

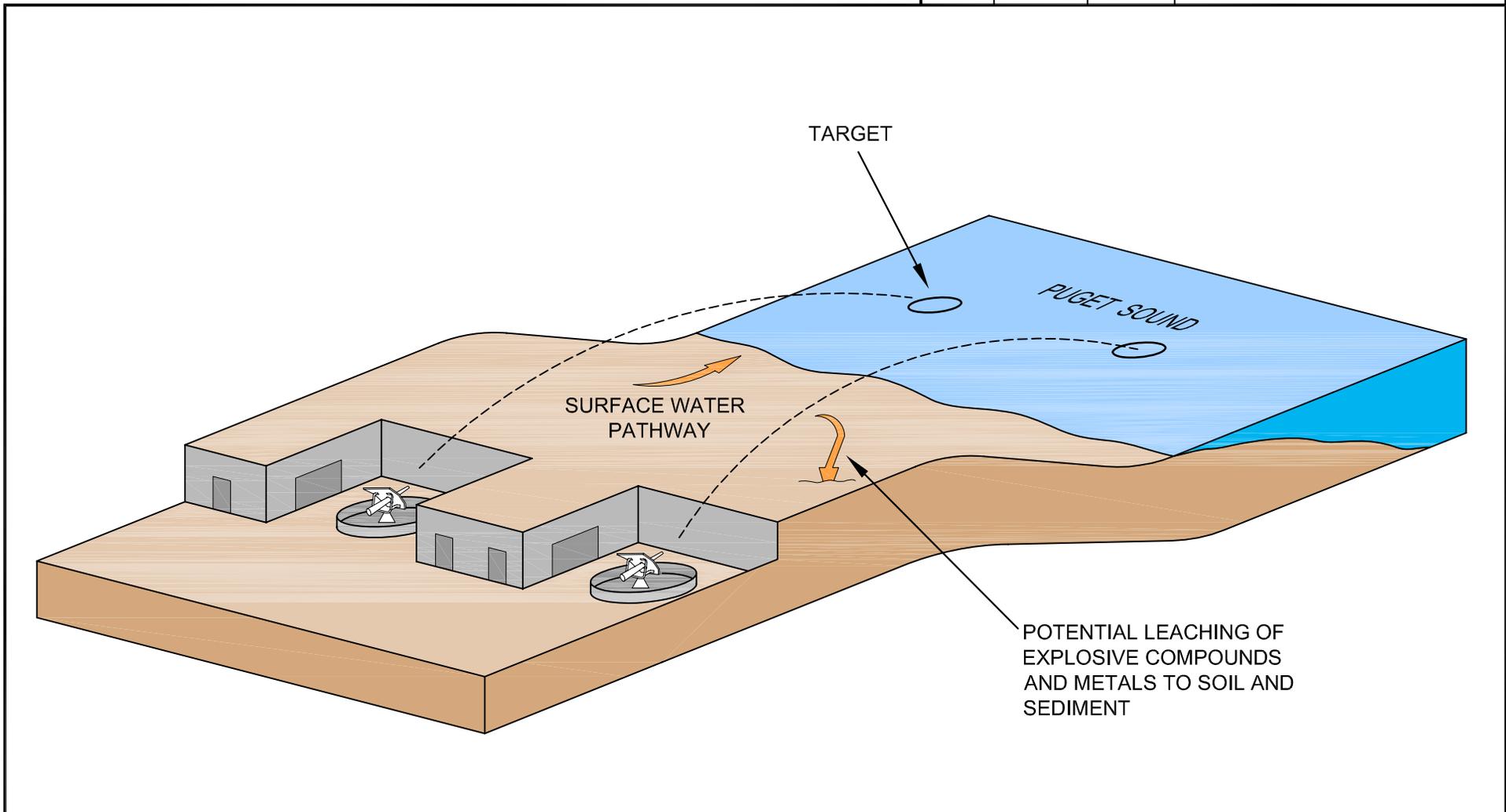
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FIGURE 3
RANGE COMPLEX AREA OF CONCERN

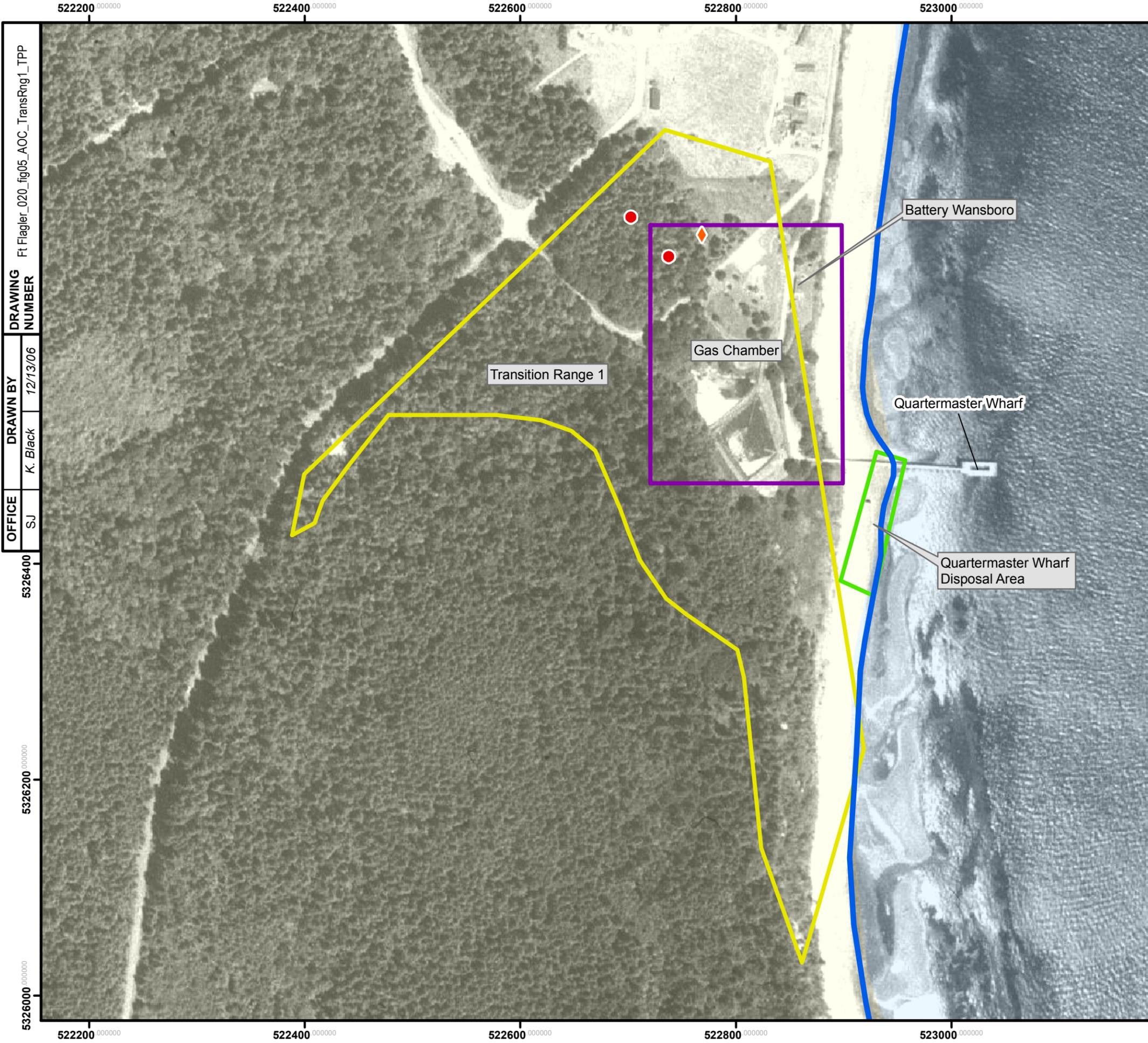
FORT FLAGLER MILITARY RESERVATION

OFFICE	DRAWN BY	DRAWING NUMBER
SJ	K. Black	10/04/06

116188SJ-A58



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FIGURE 4 CONCEPTUAL SITE MODEL COASTAL ARTILLERY BATTERY FORT FLAGLER MILITARY RESERVATION	
 Shaw Environmental, Inc.	



OFFICE: SJ
 DRAWN BY: K. Black
 DRAWING NUMBER: Ft Flagler_020_fig05_AOC_TransRng1_TPP
 5326400
 5326200
 5326000

Legend

- Fort Flagler Military Reservation Property Boundary
- Fort Flagler Areas of Concern
- Gas Chamber
- Quartermaster Wharf Disposal Area
- Transition Range 1
- 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.

N

0 300 600
Feet

REFERENCE/PROJECTION: NAD 83 UTM Zone 10N

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FIGURE 5
AREA OF CONCERN
TRANSITION RANGE 1
 FORT FLAGLER MILITARY RESERVATION

Shaw Environmental, Inc.

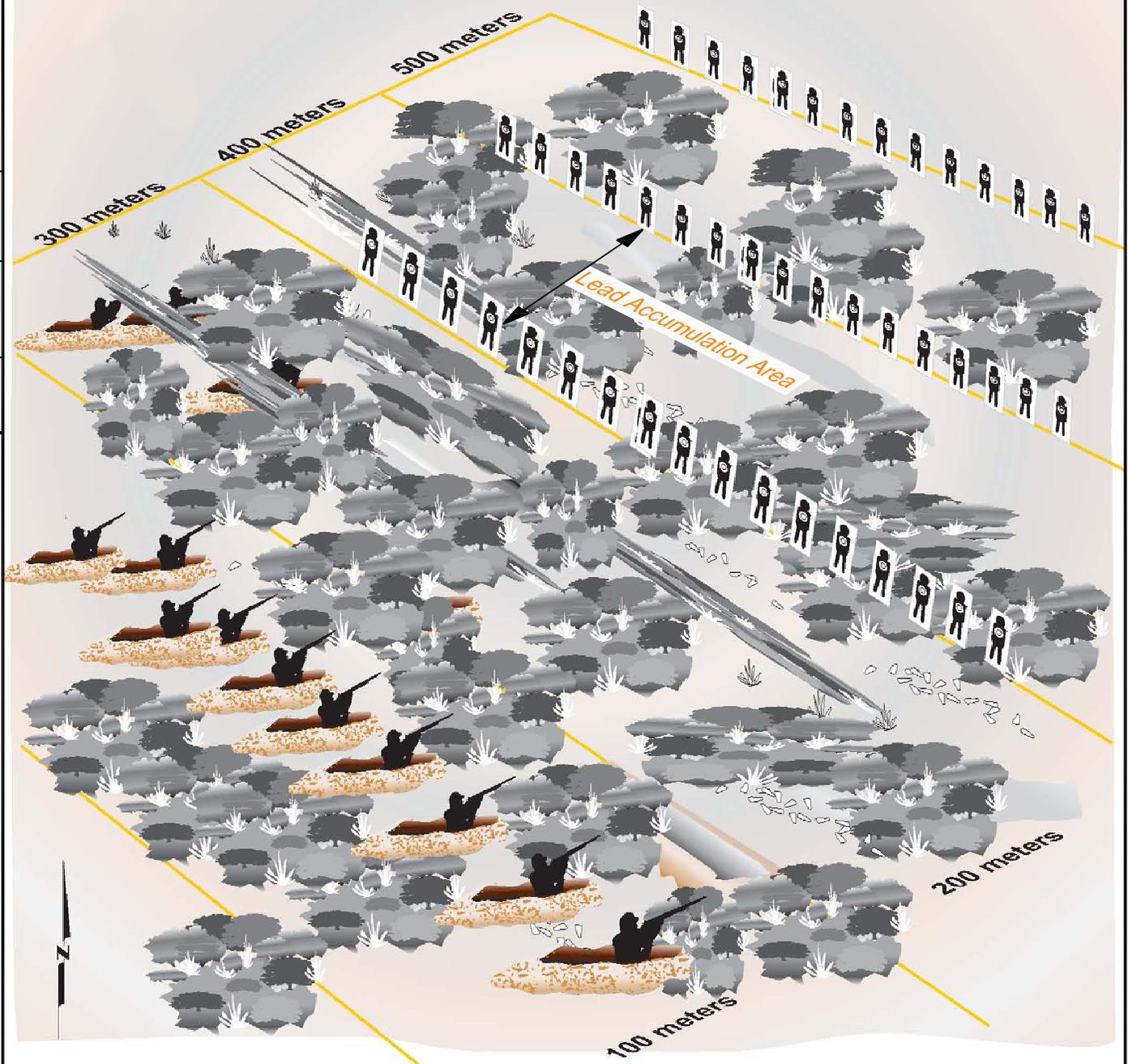
116188SJ-A57

DRAWING NUMBER

10/04/06

DRAWN BY
K. Black

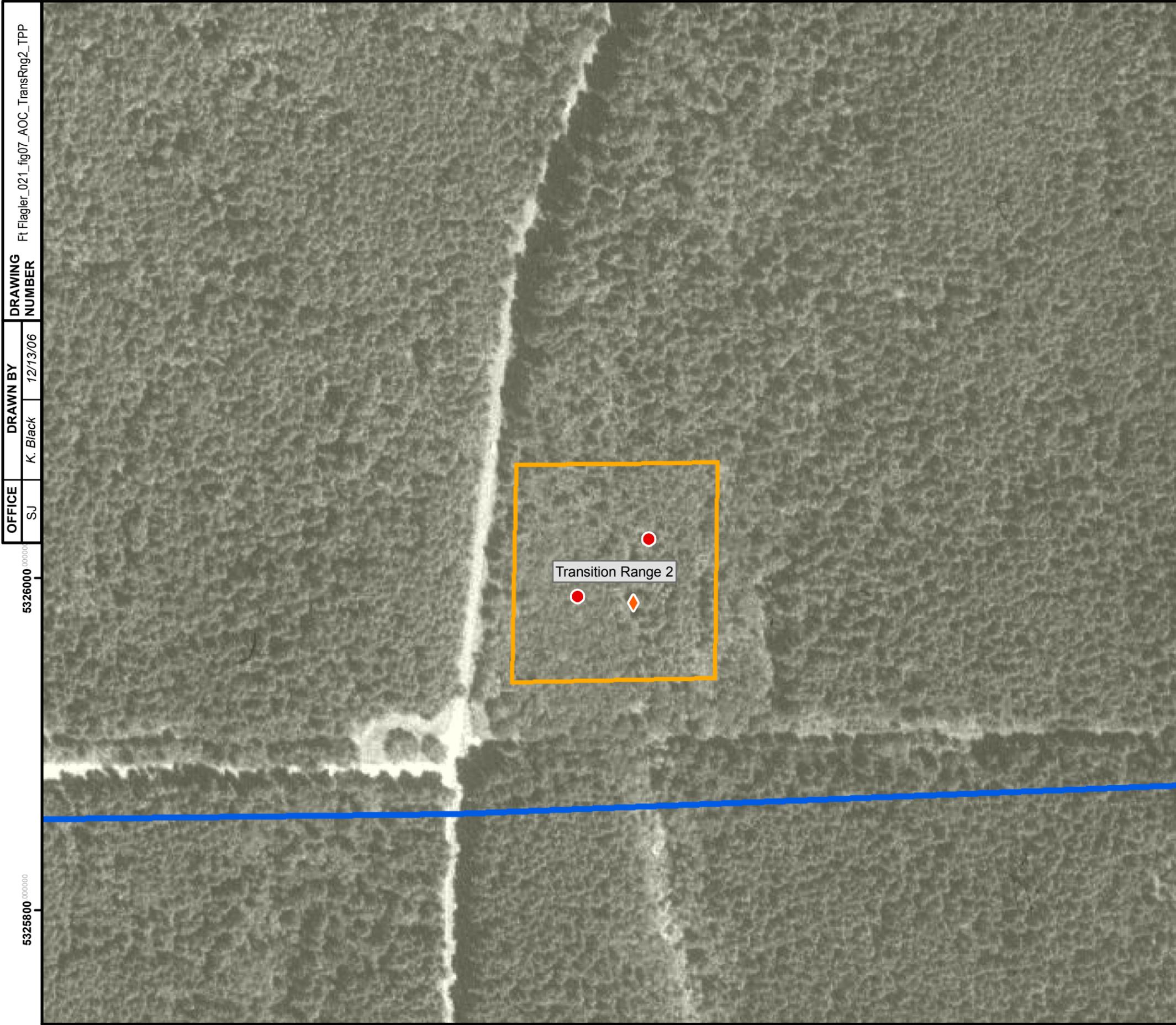
OFFICE
SJ



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FIGURE 6
CONCEPTUAL SITE MODEL
TRANSITION RANGE
FORT FLAGLER MILITARY RESERVATION

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 OFFICE SJ
 DRAWN BY K. Black
 DRAWING NUMBER 12/13/06
 Ft Flagler_021_fig07_AOC_TransRng2_TPP

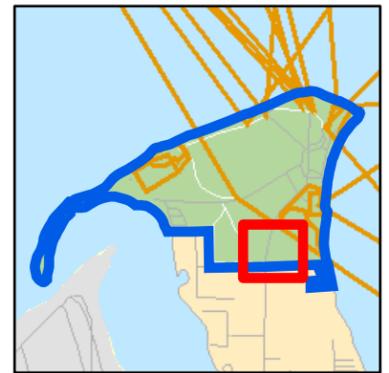
Legend

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

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 7
AREA OF CONCERN
TRANSITION RANGE 2

FORT FLAGLER MILITARY RESERVATION



52200 000000 522200 000000 522400 000000 522600 000000



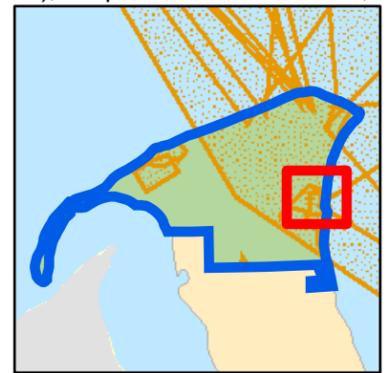
OFFICE: MNRVL
 DRAWN BY: K. Masterson
 DRAWING NUMBER: Ft Flagler_022_fig08_AOC_gas_TPP
 DATE: 10/06/06

Legend

- Fort Flagler Military Reservation Property Boundary
- Fort Flagler Areas of Concern**
- Battery Wansboro
- Gas Chamber Area
- Quartermaster Wharf Disposal Area
- Transition Range 1

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

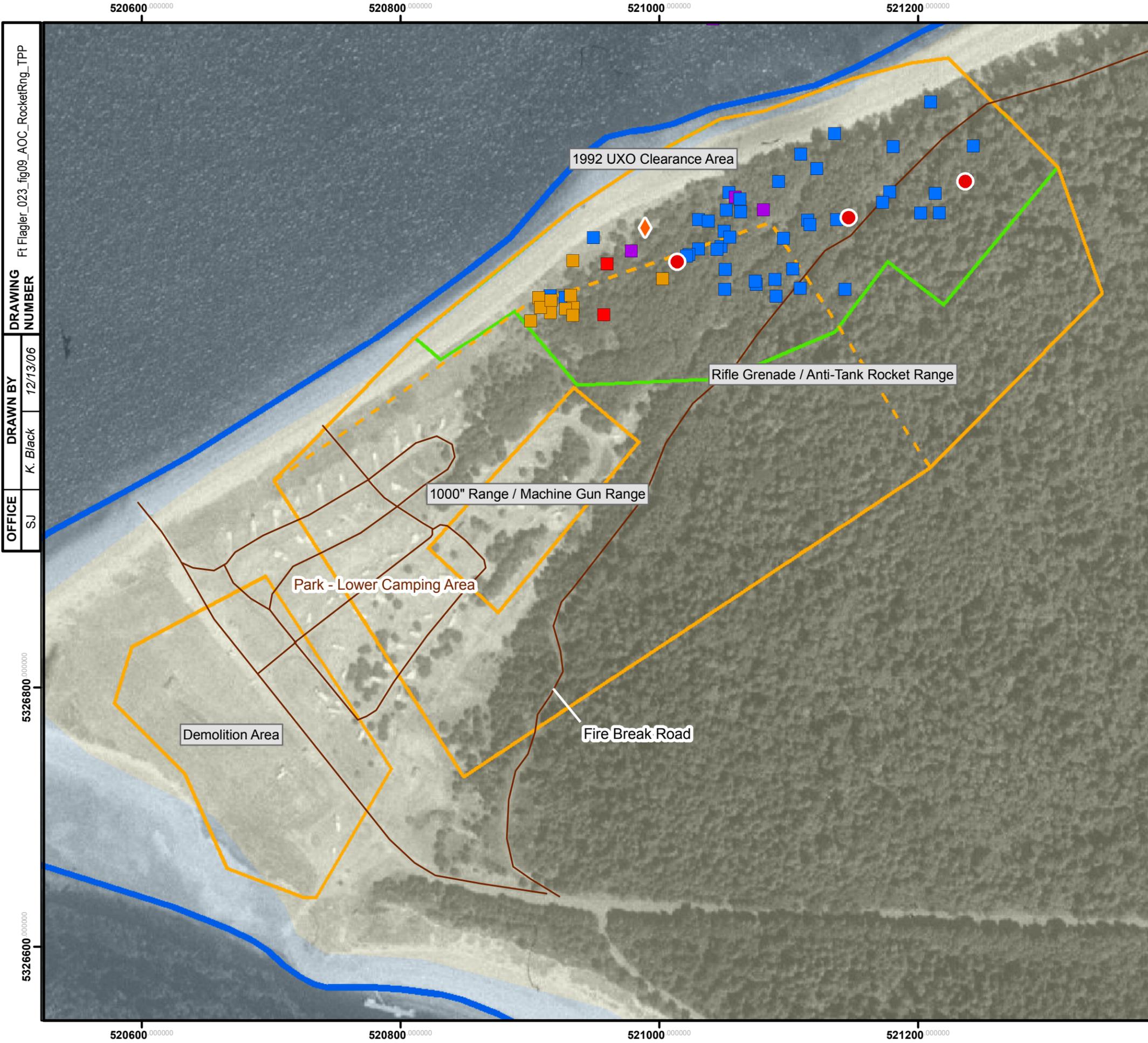


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FIGURE 8
AREA OF CONCERN
GAS CHAMBER

FORT FLAGLER MILITARY RESERVATION





DRAWING NUMBER: Ft Flagler_023_fig09_AOC_RocketRng_TPP
 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
- 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

Proposed Sampling Locations (approximate)

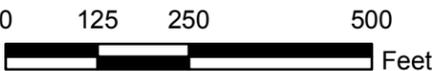
- ◆ Sediment
- Soil

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

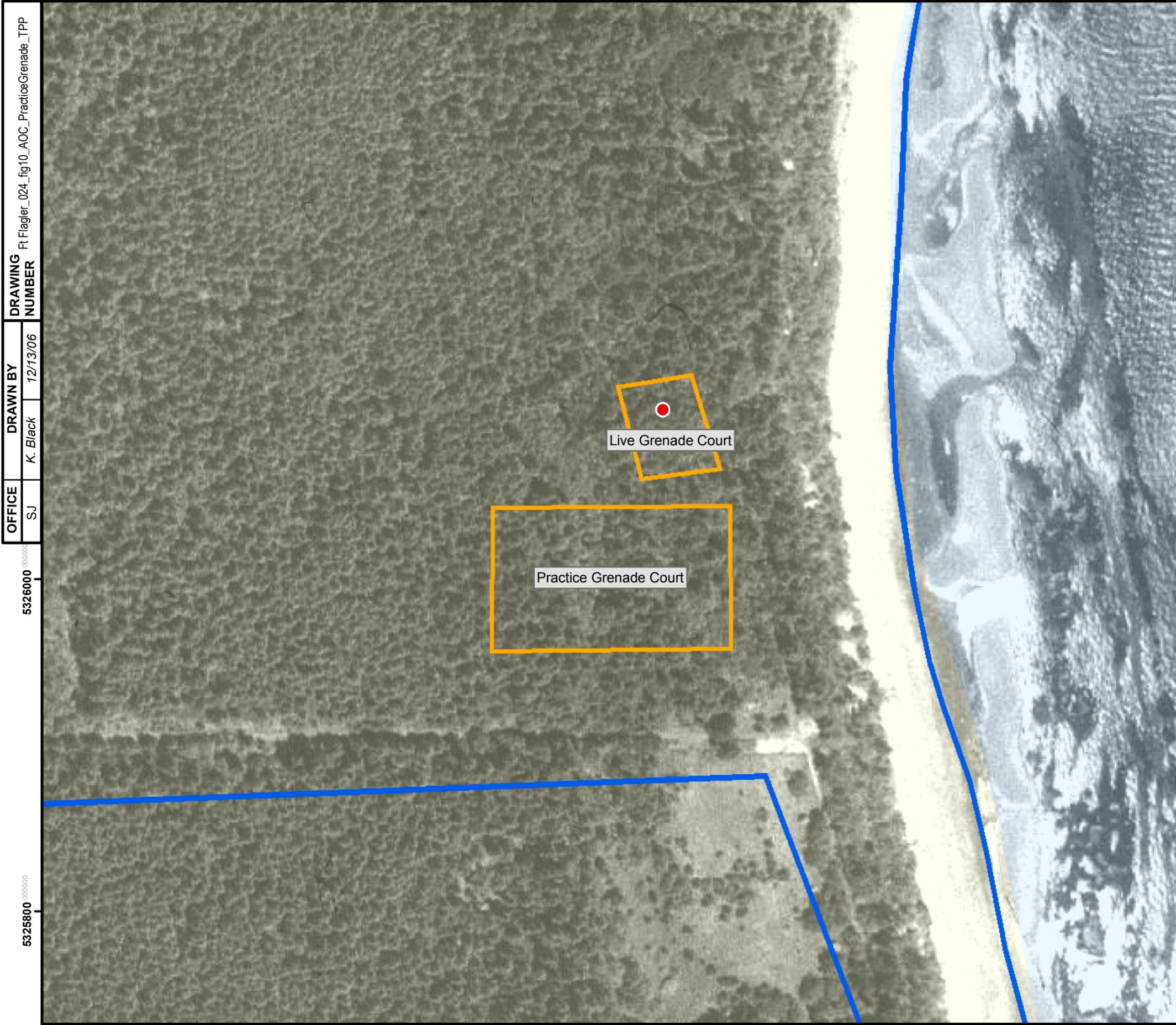
REFERENCE/PROJECTION: NAD 83 UTM Zone 10N


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FIGURE 9
AREA OF CONCERN
RIFLE GRENADE / ANTI-TANK ROCKET RANGE
 FORT FLAGLER MILITARY RESERVATION


 Shaw Environmental, Inc.

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OFFICE	SJ	DRAWN BY	K. Black
		DATE	12/13/06
DRAWING NUMBER		Ft Flagler_024_fig10_AOC_PracticeGrenade_TPP	

Legend

- Fort Flagler Military Reservation Property Boundary
- Fort Flagler Area of Concern
- Proposed Sampling Location (approximate) 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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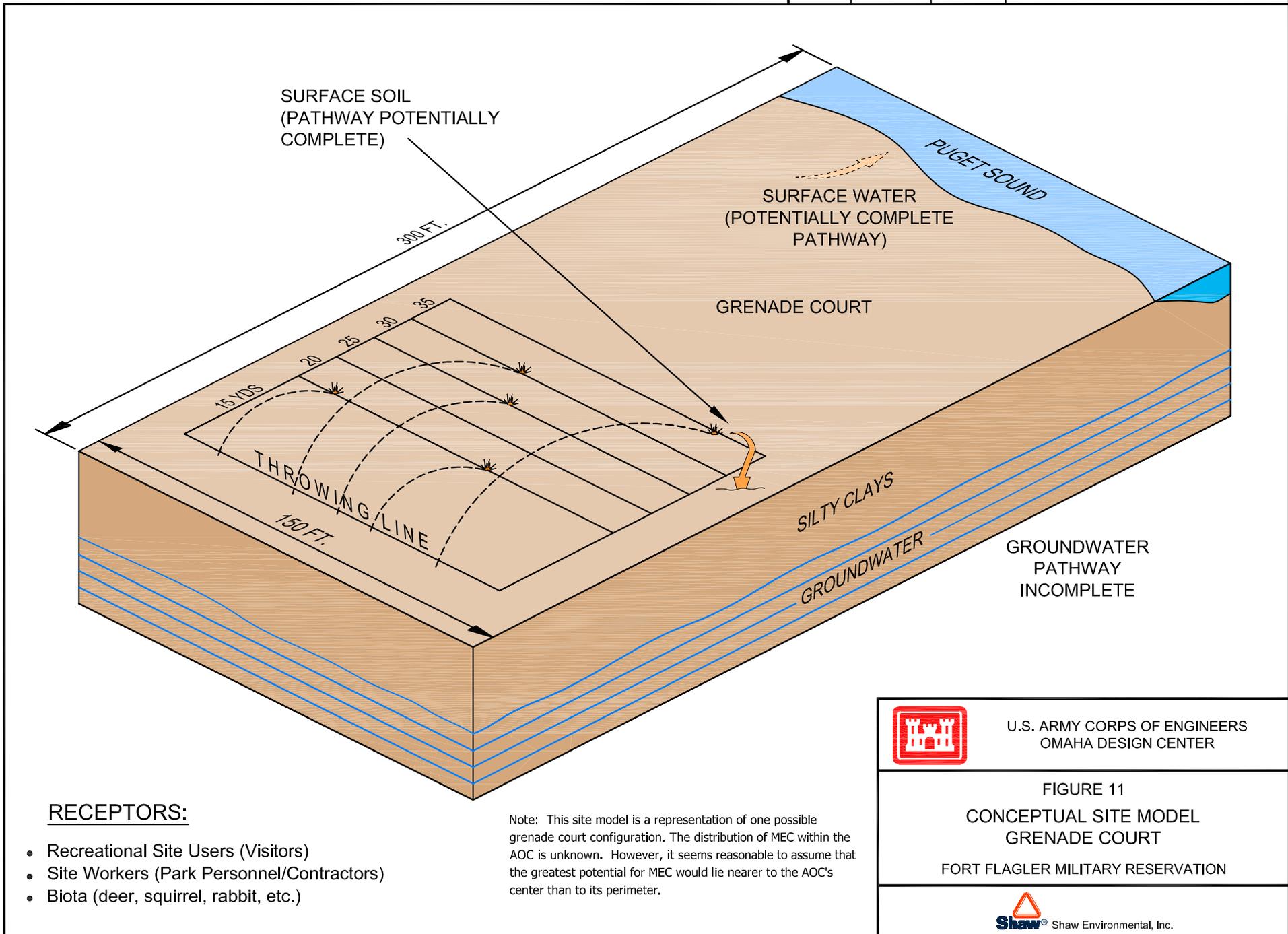
FIGURE 10
AREA OF CONCERN
LIVE AND PRACTICE GRENADE COURTS
 FORT FLAGLER MILITARY RESERVATION



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OFFICE	DRAWN BY	DRAWING NUMBER
SJ	K. Black	10/04/06

116188SJ-A70



RECEPTORS:

- Recreational Site Users (Visitors)
- Site Workers (Park Personnel/Contractors)
- Biota (deer, squirrel, rabbit, etc.)

Note: This site model is a representation of one possible grenade court configuration. The distribution of MEC within the AOC is unknown. However, it seems reasonable to assume that the greatest potential for MEC would lie nearer to the AOC's center than to its perimeter.



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FIGURE 11
 CONCEPTUAL SITE MODEL
 GRENADe COURT

FORT FLAGLER MILITARY RESERVATION





OFFICE: SJ
 DRAWN BY: K. Black
 DRAWING NUMBER: 12/13/06
 Ft Flagler_025_fig12_AOC_rifle_range_TPP

Legend

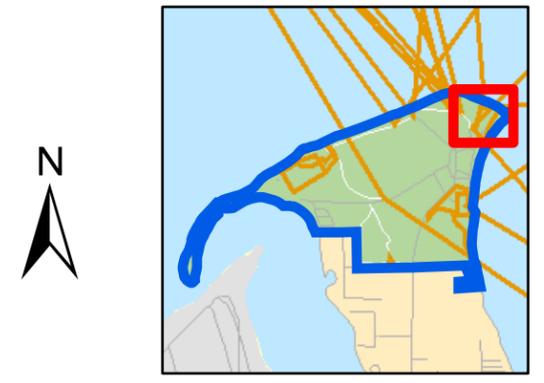
-  Fort Flagler Military Reservation Property Boundary
-  Fort Flagler Area of Concern

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.



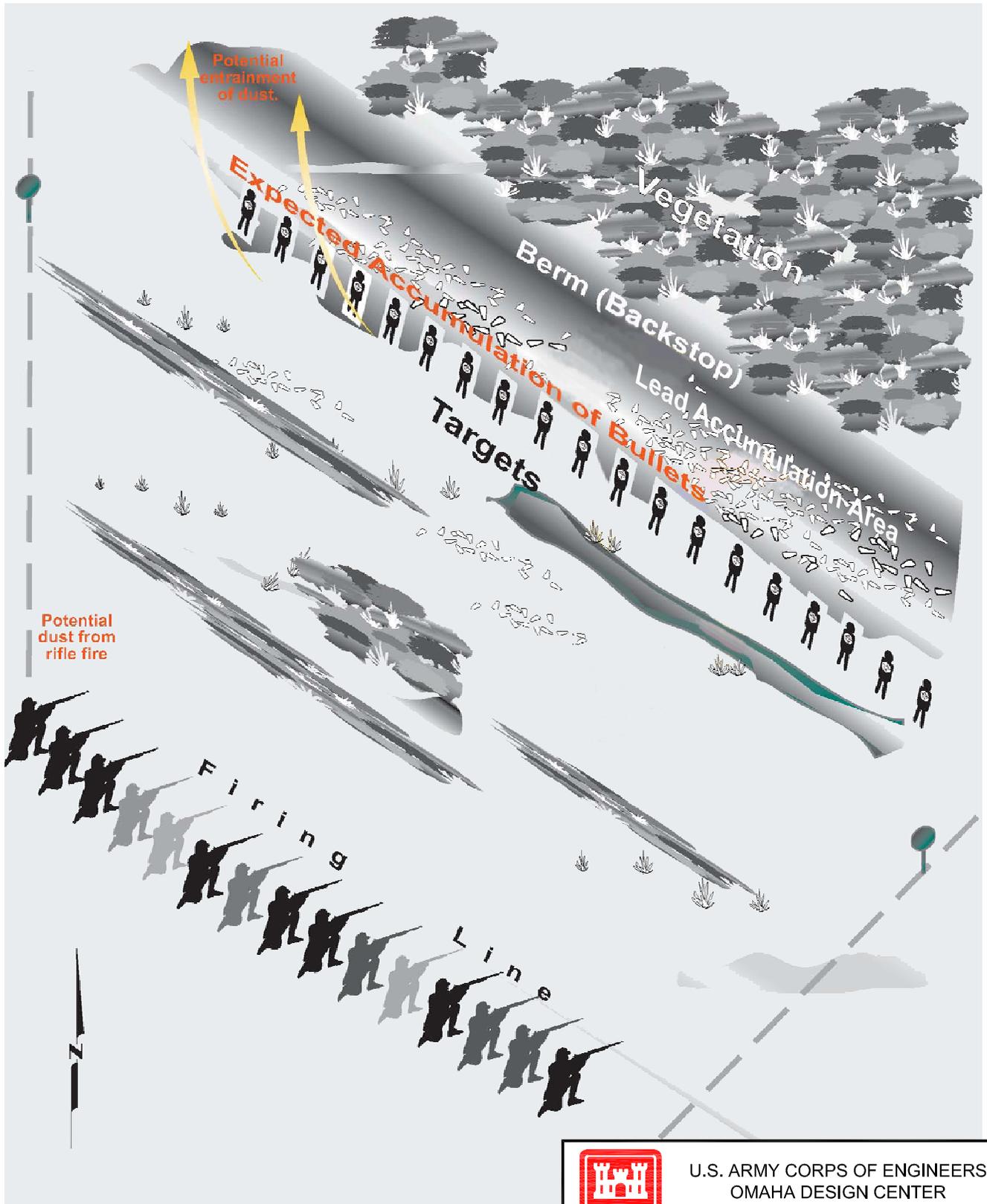
REFERENCE/PROJECTION: NAD 83 UTM Zone 10N


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FIGURE 12
AREA OF CONCERN
RIFLE RANGE
 FORT FLAGLER MILITARY RESERVATION


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SJ	K. Black	116188SJ-A56
		10/04/06



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FIGURE 13
CONCEPTUAL SITE MODEL
RIFLE RANGE WITH BERM
FORT FLAGLER MILITARY RESERVATION



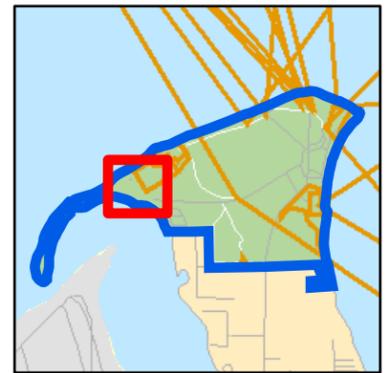
OFFICE: SJ
 DRAWN BY: K. Black
 DRAWING NUMBER: 12/13/06
 Ft Flagler_026_fig14_AOC_demolition_TPP

Legend

- Fort Flagler Military Reservation Property Boundary
- Fort Flagler Area of Concern
- 1992 UXO Clearance Area
- Campground Road/Trail

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 14
AREA OF CONCERN
DEMOLITION AREA

FORT FLAGLER MILITARY RESERVATION



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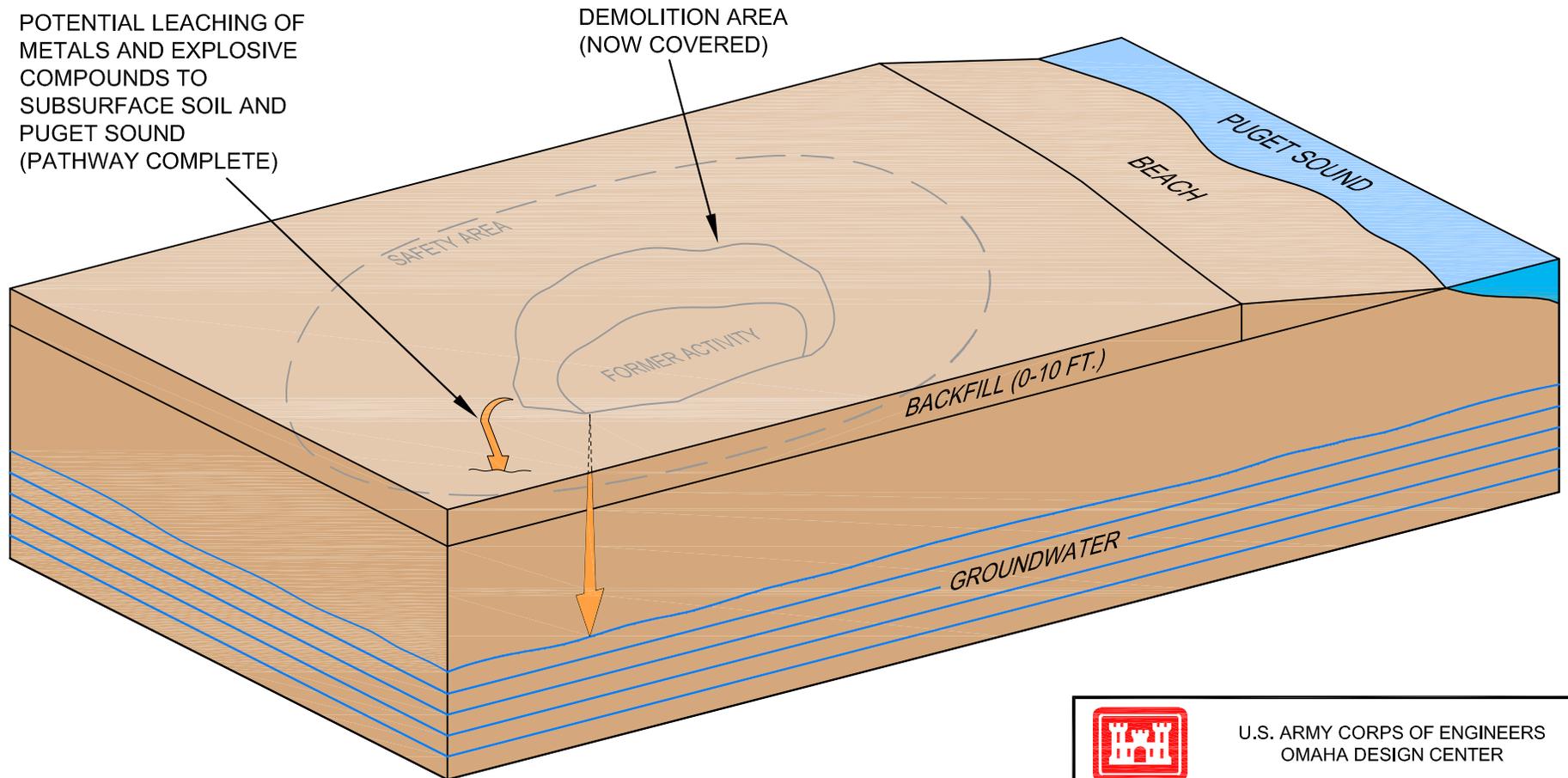
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OFFICE	DRAWN BY	DRAWING NUMBER
SJ	K. Black	116188SJ-A71



RECEPTORS:

- Park Workers Doing Excavation
- Biota (shell fish)

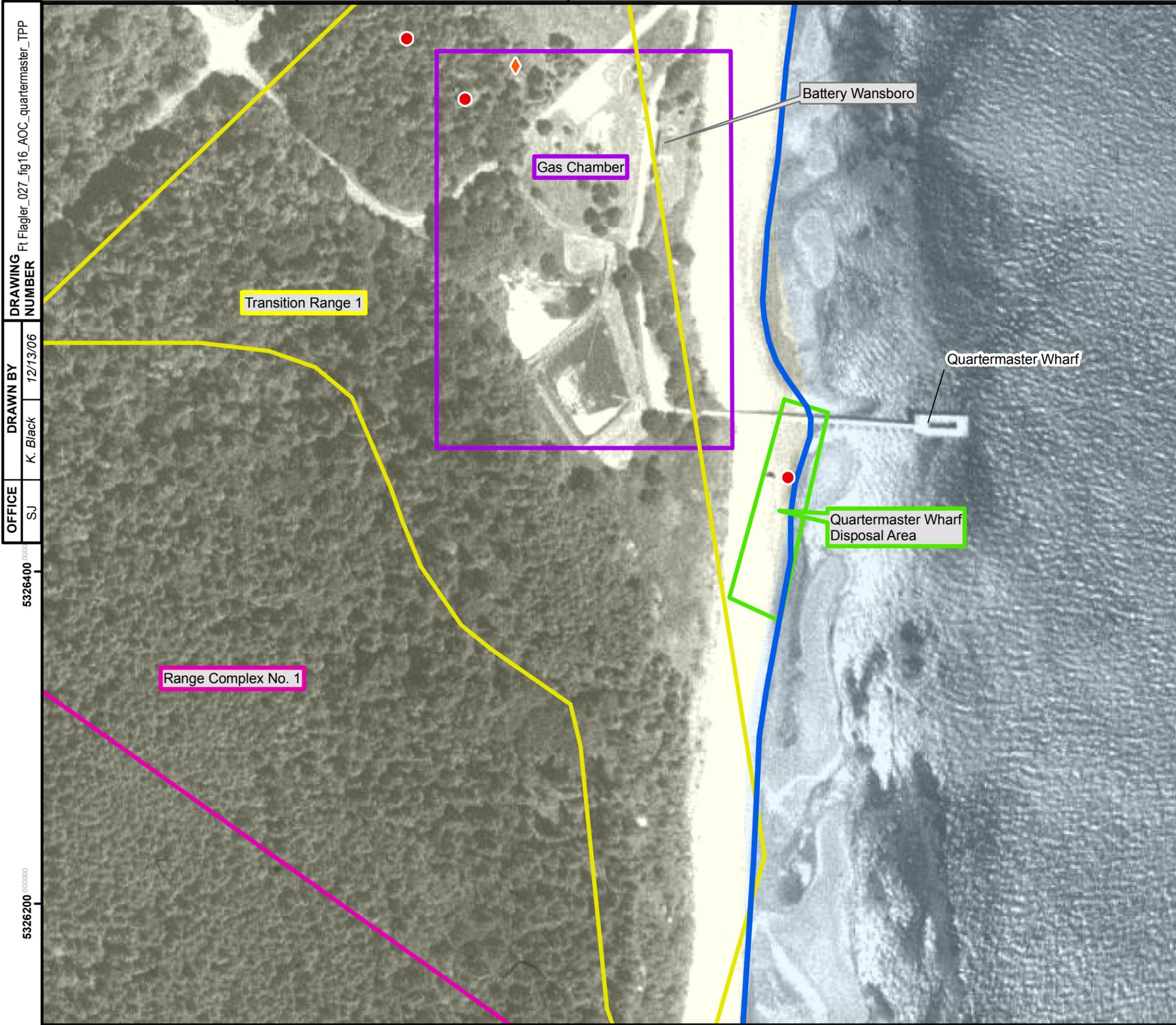


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FIGURE 15
CONCEPTUAL SITE MODEL
DEMOLITION AREA

FORT FLAGLER MILITARY RESERVATION





DRAWING NUMBER: Ft Flagler_027_fig16_AOC_quartermaster_TPP
 DRAWN BY: K. Black
 DATE: 12/13/06
 OFFICE: SJ

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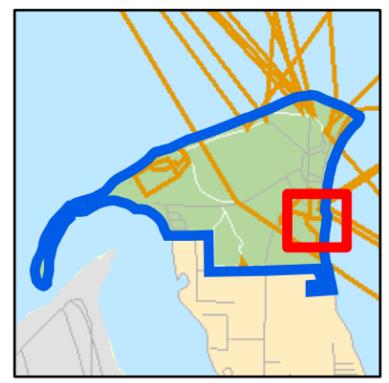
522600 000000 522800 000000 523000 000000

Legend

- Fort Flagler Military Reservation Property Boundary
- Fort Flagler Areas of Concern**
- Range Complex No. 1
- Gas Chamber
- Quartermaster Wharf Disposal Area
- Transition Range 1
- 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 16
AREA OF CONCERN
QUARMASTER WHARF DISPOSAL AREA
 FORT FLAGLER MILITARY RESERVATION

Tables

*Site Inspection
Ft. Flagler Military Reservation*

*Technical Project Planning Meeting
July 24, 2006*

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

AOC	Subrange /Battery	Munitions	Munitions Constituents	Land Use Controls
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).	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.	
	Battery Downes	3-inch Rapid Fire, M1903	Propellant – single-base (nitrocellulose) or triple base (nitrocellulose, NG, and nitroguanidine); HE Projectile – TNT.	
	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).	
	Battery Lee	5-inch Rapid Fire, M1897	Propellant – single-base (nitrocellulose) or triple base (nitrocellulose, NG, and nitroguanidine); Projectile – unknown.	
	Battery Rawlins	10-inch Rifle, MII	Propellant – single-base (nitrocellulose) or triple base (nitrocellulose, NG, and nitroguanidine); Projectile – unknown.	
	Battery Revere	10-inch Rifle, MII	Propellant – single-base (nitrocellulose) or triple base (nitrocellulose, NG, and nitroguanidine); Projectile – unknown.	
	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.	
	Battery Wilhelm	12-inch Rifle, M1888 MII	Propellant – single-base (nitrocellulose) or triple base (nitrocellulose, NG, and nitroguanidine); HE Projectile – Explosive D (ammonium picrate).	
	Anti-Torpedo Boat Battery	90-mm M1	Propellant – single-base (nitrocellulose), double-base (nitrocellulose and NG, or triple base (nitrocellulose, NG, and nitroguanidine)	
	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).	

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.	
	Rocket, M28, 3.5-inch	NG, nitrocellulose, potassium perchlorate, RDX, TNT.	
	Practice Rocket, M29, 3.5-inch	NG, nitrocellulose, potassium perchlorate.	
	Rocket, M6A1, 2.36-inch, Anti-Tank	Ballistite (nitrocellulose and NG); Pentolite (TNT & PETN).	
	Practice Rocket, M7A1, 2.36-inch, Anti-Tank	Ballistite (nitrocellulose and NG).	
	Mk II Fragment Hand Grenade	TNT, flaked or granular, older models used E.C. blank fire smokeless powder, perchlorate in fuze.	
	M21 Practice Hand Grenade	Black powder (potassium nitrate, sulfur, charcoal), perchlorate in fuze.	
	Mk 1A1 Practice Hand Grenade	Spotting charge.	
	Anti-Tank, Anti-Vehicle Mine	Inert.	
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.	No
Rifle Grenade/ Anti-Tank Rocket Range	Rocket, M28, 3.5-inch	NG, nitrocellulose, potassium perchlorate, RDX, TNT.	No
	Practice Rocket, M29, 3.5-inch	NG, nitrocellulose, potassium perchlorate.	
	Rocket, M6A1, 2.36-inch, Anti-Tank	Ballistite (nitrocellulose and NG); Pentolite (TNT & PETN).	
	Practice Rocket, M7A1, 2.36-inch, Anti-Tank	Ballistite (nitrocellulose and NG).	
	Anti-Tank/Anti-Vehicle Mine	Inert	

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

AOC	Munitions	Munitions Constituents	Land Use Controls
Live Grenade Court	Mk II Fragment Hand Grenade	TNT, flaked or granular, older models used E.C. blank fire smokeless powder, perchlorate in fuze.	No
	M21 Practice Hand Grenade	Black powder (potassium nitrate, sulfur, charcoal), perchlorate in fuze.	
Practice Grenade Court	M21 Practice Hand Grenade	Black powder (potassium nitrate, sulfur, charcoal), perchlorate in fuze.	No
	Mk 1A1 Practice Hand Grenade	Spotting charge.	
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.	
	Rocket, M28, 3.5-inch	NG, nitrocellulose, potassium perchlorate, RDX, TNT.	
	Practice Rocket, M29, 3.5-inch	NG, nitrocellulose, potassium perchlorate.	
	Rocket, M6A1, 2.36-inch, Anti-Tank	Ballistite (nitrocellulose and NG); Pentolite (TNT & PETN)	
	Practice Rocket, M7A1, 2.36-inch, Anti-Tank	Ballistite (nitrocellulose and NG).	
	Mk II Fragment Hand Grenade	TNT, flaked or granular, older models used E.C. blank fire smokeless powder, perchlorate in fuze.	
	M21 Practice Hand grenade	Black powder (potassium nitrate, sulfur, charcoal), perchlorate in fuze.	
Mk 1A1 Practice Hand Grenade	Spotting charge.		

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

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

**Table 2
MEC and MC Exposure Pathway Analysis**

Range Area & Type	MMRP Concern	Potential Contaminant of Concern (PCOCs)	Affected Media Potential Contaminant Sources/Fate and Transport	Exposure Routes and Potential Receptors			Data Gaps	Activities to Address Data Gaps (i.e., Sampling)
				Site Workers/ Contractor Personnel	Residents/ General Public	Ecological (Biota)		
Range Complex	MEC	MEC in the form of unfired propellant cartridges or discarded HE projectiles; presence of MEC unlikely based on use and configuration	Surface Soil • None.	• Incomplete pathway.	• Incomplete pathway.	• Not applicable.	• None	• Visual reconnaissance to verify current site conditions.
			Subsurface Soil • None	• Incomplete pathway.	• Incomplete pathway.	• Not applicable.	• None.	• Historical documents do not indicate range has buried MEC.
	MC	Select metals, explosives (nitrocellulose, NG, TNT, ammonium picrate); presence of MEC unlikely based on use and configuration	Soil • None.	• Incomplete pathway.	• Incomplete pathway.	• Incomplete pathway.	• None	• None
			Sediment/Surface Water • None	• Incomplete pathway.	• Incomplete pathway.	• Incomplete pathway.	• None	• None
			Groundwater • None.	• Incomplete pathway.	• Incomplete pathway.	• Incomplete pathway.	• None.	• None.
			Air • Not an affected media under current land use.	• Incomplete pathway.	• Incomplete pathway.	• Incomplete pathway.	• None.	• None

Table 2 (Continued)
MEC and MC Exposure Pathway Analysis

Range Area & Type	MMRP Concern	Potential Contaminant of Concern (PCOCs)	Affected Media Potential Contaminant Sources/Fate and Transport	Exposure Routes and Potential Receptors			Data Gaps	Activities to Address Data Gaps (i.e., Sampling)
				Site Workers/ Contractor Personnel	Residents/ General Public	Ecological (Biota)		
Ammunition Bunker	MEC	MEC in the form of 2.36-inch and 3.5-inch rockets, hand grenades, land mines, and small arms are a potential hazard.	Surface Soil <ul style="list-style-type: none"> MEC in the form of unexploded rockets, hand grenades, and land mines are a hazard. 	<ul style="list-style-type: none"> Complete pathway. Exposure routes <ul style="list-style-type: none"> Vehicle and foot traffic. 	<ul style="list-style-type: none"> Complete pathway. <ul style="list-style-type: none"> Exposure routes <ul style="list-style-type: none"> Foot traffic. 	<ul style="list-style-type: none"> Complete pathway. Exposure routes <ul style="list-style-type: none"> Foot traffic. 	<ul style="list-style-type: none"> Occurrence of MEC in bunker area is unknown. 	<ul style="list-style-type: none"> Visual reconnaissance to verify current site conditions.
			Subsurface Soil <ul style="list-style-type: none"> MEC in the form of unexploded rockets, hand grenades, and land mines are a hazard. 	<ul style="list-style-type: none"> Potentially complete pathway. Exposure routes <ul style="list-style-type: none"> Intrusive activities. Geologic instability. 	<ul style="list-style-type: none"> Potentially complete pathway. Exposure routes <ul style="list-style-type: none"> Intrusive activities. Geologic instability. 	<ul style="list-style-type: none"> Potentially complete pathway. Exposure routes <ul style="list-style-type: none"> Intrusive activities. Geologic instability. 	<ul style="list-style-type: none"> Occurrence of MEC in bunker area is unknown. 	<ul style="list-style-type: none"> No subsurface survey will be performed.
	MC	Select metals, explosives (nitrocellulose, NG, RDX, PETN, TNT), potassium perchlorate.	Soil <ul style="list-style-type: none"> Directly affected media. Potential metals and explosives contamination. Fate & Transport: Secondary source of potential surface water, sediment, and air contamination. 	<ul style="list-style-type: none"> Potentially complete pathway. Exposure routes: <ul style="list-style-type: none"> Incidental ingestion, Dermal contact, and Inhalation of soil particulates during intrusive work. 	<ul style="list-style-type: none"> Potentially complete pathway. Exposure routes: <ul style="list-style-type: none"> Incidental ingestion, Dermal contact, and Inhalation of soil particulates during intrusive work. 	<ul style="list-style-type: none"> Potentially complete pathway. Exposure routes: <ul style="list-style-type: none"> Ingestion, and Direct contact by area fauna. 	<ul style="list-style-type: none"> Analytical data for metals and explosives in soil do not exist. 	<ul style="list-style-type: none"> One contingency sample if MEC or MEC debris is located. Analyze sample for select metals (aluminum, chromium, copper, iron, lead, manganese, molybdenum, and nickel) and explosives, including NG and PETN.
			Sediment/Surface Water <ul style="list-style-type: none"> Potentially affected media – ponds. Potential metal and explosive contamination. Fate & Transport: Via surface runoff from impacted soil. 	<ul style="list-style-type: none"> Potentially complete pathway. Exposure routes: <ul style="list-style-type: none"> Incidental ingestion, Dermal contact, and Inhalation of surface water. 	<ul style="list-style-type: none"> Potentially complete pathway. Exposure routes: <ul style="list-style-type: none"> Incidental ingestion, Dermal contact, and Inhalation of surface water. 	<ul style="list-style-type: none"> Potentially complete pathway. Exposure routes: <ul style="list-style-type: none"> Ingestion, Direct contact by area fauna and aquatic organisms. 	<ul style="list-style-type: none"> Analytical data for metals in sediment/surface water do not exist. 	<ul style="list-style-type: none"> One contingency sample from water collection area. Analyze samples for select metals (aluminum, chromium, copper, iron, lead, manganese, molybdenum, and nickel) and explosives, including NG and PETN.
			Groundwater <ul style="list-style-type: none"> Potentially affected media. Potential metals and explosives contamination. Fate & Transport: Migration of metals directly to groundwater is unlikely because of relatively low mobility of metals lead in soil 	<ul style="list-style-type: none"> Incomplete pathway. <ul style="list-style-type: none"> No local wells. 	<ul style="list-style-type: none"> Incomplete pathway. <ul style="list-style-type: none"> No local wells. 	<ul style="list-style-type: none"> Incomplete pathway. <ul style="list-style-type: none"> No local wells. 	<ul style="list-style-type: none"> No groundwater analytical data exist for metals. 	<ul style="list-style-type: none"> No groundwater samples will be collected.
			Air <ul style="list-style-type: none"> Not an affected media under current land use. 	<ul style="list-style-type: none"> Incomplete pathway. 	<ul style="list-style-type: none"> Incomplete pathway. 	<ul style="list-style-type: none"> Incomplete pathway. 	<ul style="list-style-type: none"> None. 	<ul style="list-style-type: none"> None

Table 2 (Continued)
MEC and MC Exposure Pathway Analysis

Range Area & Type	MMRP Concern	Potential Contaminant of Concern (PCOCs)	Affected Media Potential Contaminant Sources/Fate and Transport	Exposure Routes and Potential Receptors			Data Gaps	Activities to Address Data Gaps (i.e., Sampling)
				Site Workers/ Contractor Personnel	Residents/ General Public	Ecological (Biota)		
Transition Range 1	MEC	MEC in the form of unfired small arms rounds are a potential hazard; low explosive hazard.	Surface Soil <ul style="list-style-type: none"> MEC (unfired ammunition) are a hazard. No MEC found. 	<ul style="list-style-type: none"> Incomplete pathway. 	<ul style="list-style-type: none"> Incomplete pathway. 	<ul style="list-style-type: none"> Incomplete pathway. 	<ul style="list-style-type: none"> None 	<ul style="list-style-type: none"> Visual reconnaissance to verify current site conditions; very low likelihood of finding MEC after 50 years of heavy use.
			Subsurface Soil <ul style="list-style-type: none"> None 	<ul style="list-style-type: none"> Incomplete pathway. 	<ul style="list-style-type: none"> Incomplete pathway. 	<ul style="list-style-type: none"> Not applicable. 	<ul style="list-style-type: none"> None; subsurface burial not documented. 	<ul style="list-style-type: none"> Historical documents do not indicate ranges have buried MEC.
	MC	Lead.	Soil <ul style="list-style-type: none"> Directly affected media. Potential lead from bullets. Fate & Transport: Secondary source of potential surface water, sediment, and air contamination. 	<ul style="list-style-type: none"> Potentially complete pathway. Exposure routes: <ul style="list-style-type: none"> Incidental ingestion, Dermal contact, and Inhalation of soil particulates during intrusive work. 	<ul style="list-style-type: none"> Potentially complete pathway. Exposure routes: <ul style="list-style-type: none"> Incidental ingestion, Dermal contact, and Inhalation of soil particulates during intrusive work. 	<ul style="list-style-type: none"> Potentially complete pathway. Exposure routes: <ul style="list-style-type: none"> Ingestion, and Direct contact by area fauna. 	<ul style="list-style-type: none"> Analytical data for lead in soil do not exist. 	<ul style="list-style-type: none"> Collect two soil samples from location of backstop berm and analyze for lead only.
			Sediment/Surface Water <ul style="list-style-type: none"> Potentially affected media – ponds. Potential lead contamination. Fate & Transport: Via surface runoff from impacted soil. 	<ul style="list-style-type: none"> Potentially complete pathway. Exposure routes: <ul style="list-style-type: none"> Incidental ingestion, Dermal contact, and Inhalation of surface water. 	<ul style="list-style-type: none"> Potentially complete pathway. Exposure routes: <ul style="list-style-type: none"> Incidental ingestion, Dermal contact, and Inhalation of surface water. 	<ul style="list-style-type: none"> Potentially complete pathway. Exposure routes: <ul style="list-style-type: none"> Ingestion, Direct contact by area fauna and aquatic organisms. 	<ul style="list-style-type: none"> Analytical data for lead in sediment/surface water do not exist. 	<ul style="list-style-type: none"> Collect one sediment sample from water collection area and analyze for lead only.
			Groundwater <ul style="list-style-type: none"> Potentially affected media. Potential metals and explosives contamination. Fate & Transport: Migration of metals directly to groundwater is unlikely because of relatively low mobility of metals lead in soil. 	<ul style="list-style-type: none"> Incomplete pathway. <ul style="list-style-type: none"> No local wells. 	<ul style="list-style-type: none"> Incomplete pathway. <ul style="list-style-type: none"> No local wells. 	<ul style="list-style-type: none"> Incomplete pathway. <ul style="list-style-type: none"> No local wells. 	<ul style="list-style-type: none"> No groundwater analytical data exist for metals. 	<ul style="list-style-type: none"> No groundwater samples will be collected.
			Air <ul style="list-style-type: none"> Not an affected media under current land use. 	<ul style="list-style-type: none"> Incomplete pathway. 	<ul style="list-style-type: none"> Incomplete pathway. 	<ul style="list-style-type: none"> Incomplete pathway. 	<ul style="list-style-type: none"> None. 	<ul style="list-style-type: none"> None

Table 2 (Continued)
MEC and MC Exposure Pathway Analysis

Range Area & Type	MMRP Concern	Potential Contaminant of Concern (PCOCs)	Affected Media Potential Contaminant Sources/Fate and Transport	Exposure Routes and Potential Receptors			Data Gaps	Activities to Address Data Gaps (i.e., Sampling)
				Site Workers/ Contractor Personnel	Residents/ General Public	Ecological (Biota)		
Transition Range 2	MEC	MEC in the form of unfired small arms rounds are a potential hazard; low explosive hazard.	Surface Soil <ul style="list-style-type: none"> MEC (unfired ammunition) are a hazard. No MEC found. 	<ul style="list-style-type: none"> Incomplete pathway. 	<ul style="list-style-type: none"> Incomplete pathway. 	<ul style="list-style-type: none"> Incomplete pathway. 	<ul style="list-style-type: none"> None 	<ul style="list-style-type: none"> Visual reconnaissance to verify current site conditions; very low likelihood of finding MEC after 50 years of heavy use.
			Subsurface Soil <ul style="list-style-type: none"> None 	<ul style="list-style-type: none"> Incomplete pathway. 	<ul style="list-style-type: none"> Incomplete pathway. 	<ul style="list-style-type: none"> Not applicable. 	<ul style="list-style-type: none"> None; subsurface burial not documented. 	<ul style="list-style-type: none"> Historical documents do not indicate ranges have buried MEC.
	MC	Lead.	Soil <ul style="list-style-type: none"> Directly affected media. Potential lead from bullets. Fate & Transport: Secondary source of potential surface water, sediment, and air contamination. 	<ul style="list-style-type: none"> Potentially complete pathway. Exposure routes: <ul style="list-style-type: none"> Incidental ingestion, Dermal contact, and Inhalation of soil particulates during intrusive work. 	<ul style="list-style-type: none"> Potentially complete pathway. Exposure routes: <ul style="list-style-type: none"> Incidental ingestion, Dermal contact, and Inhalation of soil particulates during intrusive work. 	<ul style="list-style-type: none"> Potentially complete pathway. Exposure routes: <ul style="list-style-type: none"> Ingestion, and Direct contact by area fauna. 	<ul style="list-style-type: none"> Analytical data for lead in soil do not exist. 	<ul style="list-style-type: none"> Collect two soil samples from location of backstop berm and analyze for lead only.
			Sediment/Surface Water <ul style="list-style-type: none"> Potentially affected media – ponds. Potential lead contamination. Fate & Transport: Via surface runoff from impacted soil. 	<ul style="list-style-type: none"> Potentially complete pathway. Exposure routes: <ul style="list-style-type: none"> Incidental ingestion, Dermal contact, and Inhalation of surface water. 	<ul style="list-style-type: none"> Potentially complete pathway. Exposure routes: <ul style="list-style-type: none"> Incidental ingestion, Dermal contact, and Inhalation of surface water. 	<ul style="list-style-type: none"> Potentially complete pathway. Exposure routes: <ul style="list-style-type: none"> Ingestion, Direct contact by area fauna and aquatic organisms. 	<ul style="list-style-type: none"> Analytical data for lead in sediment/surface water do not exist. 	<ul style="list-style-type: none"> Collect one sediment sample from water collection area and analyze for lead only.
			Groundwater <ul style="list-style-type: none"> Potentially affected media. Potential metals and explosives contamination. Fate & Transport: Migration of metals directly to groundwater is unlikely because of relatively low mobility of metals lead in soil. 	<ul style="list-style-type: none"> Incomplete pathway. <ul style="list-style-type: none"> No local wells. 	<ul style="list-style-type: none"> Incomplete pathway. <ul style="list-style-type: none"> No local wells. 	<ul style="list-style-type: none"> Incomplete pathway. <ul style="list-style-type: none"> No local wells. 	<ul style="list-style-type: none"> No groundwater analytical data exist for metals. 	<ul style="list-style-type: none"> No groundwater samples will be collected.
			Air <ul style="list-style-type: none"> Not an affected media under current land use. 	<ul style="list-style-type: none"> Incomplete pathway. 	<ul style="list-style-type: none"> Incomplete pathway. 	<ul style="list-style-type: none"> Incomplete pathway. 	<ul style="list-style-type: none"> None. 	<ul style="list-style-type: none"> None

Table 2 (Continued)
MEC and MC Exposure Pathway Analysis

Range Area & Type	MMRP Concern	Potential Contaminant of Concern (PCOCs)	Affected Media Potential Contaminant Sources/Fate and Transport	Exposure Routes and Potential Receptors			Data Gaps	Activities to Address Data Gaps (i.e., Sampling)
				Site Workers/ Contractor Personnel	Residents/ General Public	Ecological (Biota)		
Gas Chamber	MEC	MEC not anticipated (riot control gas hand grenades).	Surface Soil <ul style="list-style-type: none"> • MEC - none. • No MEC found. 	• Incomplete pathway.	• Incomplete pathway.	• Incomplete pathway.	• None	• Visual reconnaissance to verify current site conditions.
			Subsurface Soil <ul style="list-style-type: none"> • None 	• Incomplete pathway.	• Incomplete pathway.	• Not applicable.	• None	• None.
	MC	Riot Gas (CN-1).	Soil <ul style="list-style-type: none"> • Directly affected media. • Potential CN-1 residue; however, CN-1 not expected to persist over 50 years in soil • Fate & Transport: Secondary source of potential surface water, sediment, and air contamination. 	• Incomplete pathway.	• Incomplete pathway.	• Incomplete pathway.	• None	• None.
			Sediment/Surface Water <ul style="list-style-type: none"> • Potentially affected media – ponds. • Potential CN-1 residue; however, CN-1 not expected to persist over 50 years. • Fate & Transport: Via surface runoff from impacted soil. 	• Incomplete pathway.	• Incomplete pathway.	• Incomplete pathway.	• None	• None.
			Groundwater <ul style="list-style-type: none"> • Potentially affected media. • Potential CN-1 residue; however, CN-1 not expected to persist for over 50 years. • Fate & Transport: Migration of metals directly to groundwater is unlikely because of relatively low mobility of metals lead in soil 	• Incomplete pathway. - No local wells.	• Incomplete pathway. - No local wells.	• Incomplete pathway. - No local wells.	• No groundwater analytical data exist for metals.	• No groundwater samples will be collected.
			Air <ul style="list-style-type: none"> • Not an affected media under current land use. 	• Incomplete pathway.	• Incomplete pathway.	• Incomplete pathway.	• None.	• None

Table 2 (Continued)
MEC and MC Exposure Pathway Analysis

Range Area & Type	MMRP Concern	Potential Contaminant of Concern (PCOCs)	Affected Media Potential Contaminant Sources/Fate and Transport	Exposure Routes and Potential Receptors			Data Gaps	Activities to Address Data Gaps (i.e., Sampling)
				Site Workers/ Contractor Personnel	Residents/ General Public	Ecological (Biota)		
Rifle Grenade/ Anti-Tank Rocket Range	MEC	MEC in the form of 2.36-inch and 3.5-inch rockets, hand grenades, land mines are a potential hazard.	Surface Soil <ul style="list-style-type: none"> MEC in the form of unexploded rockets, hand grenades, and land mines are a hazard. MEC found historically, cleanup in 1992, may still be MEC in unsurveyed areas. 	<ul style="list-style-type: none"> Complete pathway. Exposure routes <ul style="list-style-type: none"> Vehicle and foot traffic. 	<ul style="list-style-type: none"> Complete pathway. <ul style="list-style-type: none"> Exposure routes <ul style="list-style-type: none"> Foot traffic. 	<ul style="list-style-type: none"> Complete pathway. Exposure routes <ul style="list-style-type: none"> Foot traffic. 	<ul style="list-style-type: none"> Occurrence of MEC in area south of Fire Break Road in eastern AOC is unknown. 	<ul style="list-style-type: none"> Visual reconnaissance with magnetometer will be conducted to: <ul style="list-style-type: none"> Assess MEC occurrence. Practice MEC avoidance.
			Subsurface Soil <ul style="list-style-type: none"> MEC in the form of unexploded rockets, hand grenades, and land mines are a hazard. MEC found historically, cleanup in 1992, may still be MEC in unsurveyed areas. 	<ul style="list-style-type: none"> Potentially complete pathway. Exposure routes <ul style="list-style-type: none"> Intrusive activities. Geologic instability. 	<ul style="list-style-type: none"> Potentially complete pathway. Exposure routes <ul style="list-style-type: none"> Intrusive activities. Geologic instability. 	<ul style="list-style-type: none"> Potentially complete pathway. Exposure routes <ul style="list-style-type: none"> Intrusive activities. Geologic instability. 	<ul style="list-style-type: none"> Occurrence of MEC in area south of Fire Break Road in eastern AOC is unknown. 	<ul style="list-style-type: none"> No subsurface survey will be performed.
	MC	Select metals, explosives (nitrocellulose, NG, RDX, PETN, TNT), perchlorate.	Soil <ul style="list-style-type: none"> Directly affected media. Potential metals and explosives contamination. Fate & Transport: Secondary source of potential surface water, sediment, and air contamination. 	<ul style="list-style-type: none"> Potentially complete pathway. Exposure routes: <ul style="list-style-type: none"> Incidental ingestion, Dermal contact, and Inhalation of soil particulates during intrusive work. 	<ul style="list-style-type: none"> Potentially complete pathway. Exposure routes: <ul style="list-style-type: none"> Incidental ingestion, Dermal contact, and Inhalation of soil particulates during intrusive work. 	<ul style="list-style-type: none"> Potentially complete pathway. Exposure routes: <ul style="list-style-type: none"> Ingestion, and Direct contact by area fauna. 	<ul style="list-style-type: none"> Analytical data for metals and explosives in soil do not exist. 	<ul style="list-style-type: none"> Collect three soil samples. Two at documented MEC locations from 1992 clearance and one from a location in eastern portion of clearance area. Analyze samples for select metals (aluminum, chromium, copper, iron, lead, manganese, molybdenum, and nickel) and explosives, including NG and PETN.
			Sediment/Surface Water <ul style="list-style-type: none"> Potentially affected media – ponds. Potential metal and explosive contamination. Fate & Transport: Via surface runoff from impacted soil. 	<ul style="list-style-type: none"> Potentially complete pathway. Exposure routes: <ul style="list-style-type: none"> Incidental ingestion, Dermal contact, and Inhalation of surface water. 	<ul style="list-style-type: none"> Potentially complete pathway. Exposure routes: <ul style="list-style-type: none"> Incidental ingestion, Dermal contact, and Inhalation of surface water. 	<ul style="list-style-type: none"> Potentially complete pathway. Exposure routes: <ul style="list-style-type: none"> Ingestion, Direct contact by area fauna and aquatic organisms. 	<ul style="list-style-type: none"> Analytical data for metals in sediment/surface water do not exist. 	<ul style="list-style-type: none"> Collect one sediment sample from water collection area. Analyze samples for select metals (aluminum, chromium, copper, iron, lead, manganese, molybdenum, and nickel) and explosives, including NG and PETN.
			Groundwater <ul style="list-style-type: none"> Potentially affected media. Potential metals and explosives contamination. Fate & Transport: Migration of metals directly to groundwater is unlikely because of relatively low mobility of metals lead in soil 	<ul style="list-style-type: none"> Incomplete pathway. <ul style="list-style-type: none"> No local wells. 	<ul style="list-style-type: none"> Incomplete pathway. <ul style="list-style-type: none"> No local wells. 	<ul style="list-style-type: none"> Incomplete pathway. <ul style="list-style-type: none"> No local wells. 	<ul style="list-style-type: none"> No groundwater analytical data exist for metals. 	<ul style="list-style-type: none"> No groundwater samples will be collected.
			Air <ul style="list-style-type: none"> Not an affected media under current land use. 	<ul style="list-style-type: none"> Incomplete pathway. 	<ul style="list-style-type: none"> Incomplete pathway. 	<ul style="list-style-type: none"> Incomplete pathway. 	<ul style="list-style-type: none"> None. 	<ul style="list-style-type: none"> None

Table 2 (Continued)
MEC and MC Exposure Pathway Analysis

Range Area & Type	MMRP Concern	Potential Contaminant of Concern (PCOCs)	Affected Media Potential Contaminant Sources/Fate and Transport	Exposure Routes and Potential Receptors			Data Gaps	Activities to Address Data Gaps (i.e., Sampling)
				Site Workers/ Contractor Personnel	Residents/ General Public	Ecological (Biota)		
Live Grenade Court	MEC	MEC in the form of <i>unexploded</i> grenades used at this site.	Surface & Subsurface Soils <ul style="list-style-type: none"> Unexploded grenades are a hazard. 	<ul style="list-style-type: none"> Complete pathway (MEC found). Exposure routes: <ul style="list-style-type: none"> Foot traffic Intrusive activity Geologic instability 	<ul style="list-style-type: none"> Complete pathway. Exposure routes: <ul style="list-style-type: none"> Foot traffic Geologic instability 	<ul style="list-style-type: none"> Potentially complete pathway. Exposure routes: <ul style="list-style-type: none"> Foot traffic Burrowing Geologic instability 	<ul style="list-style-type: none"> Presence of MEC is unknown 	Visual reconnaissance aided by a magnetometer sweeps will be conducted to: <ul style="list-style-type: none"> Identify MEC or MEC debris Practice MEC avoidance, and
	MC	Select metals, explosives (TNT, older models used E.C. blank fire smokeless powder), perchlorate	Soil <ul style="list-style-type: none"> Incomplete detonation of explosive munitions 	<ul style="list-style-type: none"> Potentially complete pathway. Exposure routes (during intrusive work): <ul style="list-style-type: none"> incidental ingestion, dermal contact, and inhalation of soil particulates. 	<ul style="list-style-type: none"> Potentially complete pathway. Exposure routes: <ul style="list-style-type: none"> incidental ingestion, dermal contact, and inhalation of soil particulates. 	<ul style="list-style-type: none"> Potentially complete pathway. Exposure routes: <ul style="list-style-type: none"> ingestion, and direct contact by area fauna. 	<ul style="list-style-type: none"> Analytical data for metals or explosives do not exist. 	One composite soil sample AOC will be analyzed for select metals (aluminum, chromium, copper, iron, lead, manganese, molybdenum, and nickel) and explosives.
			Surface Water/Sediment <ul style="list-style-type: none"> Potentially affected media – ponds. Potential metal and explosive contamination. Fate & Transport: Via surface runoff from impacted soil. 	<ul style="list-style-type: none"> Potentially complete pathway. Exposure routes: <ul style="list-style-type: none"> incidental ingestion, dermal contact, and inhalation. 	<ul style="list-style-type: none"> Potentially complete pathway. Exposure routes: <ul style="list-style-type: none"> incidental ingestion, dermal contact, and inhalation. 	<ul style="list-style-type: none"> Potentially complete pathway. Exposure routes: <ul style="list-style-type: none"> ingestion, and direct contact by area fauna. 	<ul style="list-style-type: none"> Analytical data for metals and explosives do not exist. 	<ul style="list-style-type: none"> No sediment samples will be collected. Area is small and no water collection areas at AOC.
			Groundwater <ul style="list-style-type: none"> Potentially affected media. Potential metals and explosives contamination. Fate & Transport: Migration of metals directly to groundwater is unlikely because of relatively low mobility of metals lead in soil 	<ul style="list-style-type: none"> Incomplete pathway. <ul style="list-style-type: none"> No local wells. 	<ul style="list-style-type: none"> Incomplete pathway. <ul style="list-style-type: none"> No local wells. 	<ul style="list-style-type: none"> Incomplete pathway. <ul style="list-style-type: none"> No local wells. 	<ul style="list-style-type: none"> No groundwater analytical data exist for metals. 	<ul style="list-style-type: none"> No groundwater samples will be collected.
Air <ul style="list-style-type: none"> Not an affected media under current land use. 	<ul style="list-style-type: none"> Incomplete pathway. 	<ul style="list-style-type: none"> Incomplete pathway. 	<ul style="list-style-type: none"> Incomplete pathway. 	<ul style="list-style-type: none"> None. 	<ul style="list-style-type: none"> None 			

Table 2 (Continued)
MEC and MC Exposure Pathway Analysis

Range Area & Type	MMRP Concern	Potential Contaminant of Concern (PCOCs)	Affected Media Potential Contaminant Sources/Fate and Transport	Exposure Routes and Potential Receptors			Data Gaps	Activities to Address Data Gaps (i.e., Sampling)
				Site Workers/ Contractor Personnel	Residents/ General Public	Ecological		
Practice Grenade Court	MEC	No indication of munitions being used at this AOC other than spotting charge training grenades and practice grenades with small black powder charges.	Surface & Subsurface Soils • A mechanism by which explosive munitions would be present has not been identified.	• Incomplete pathway.	• Incomplete pathway.	• Incomplete pathway.	None	• Visual reconnaissance to verify site conditions.
	MC	No PCOCs in black powder.	Soil • Not Applicable	• Incomplete pathway.	• Incomplete pathway.	• Incomplete pathway.	• None.	• None
			Surface Water/Sediment • Not Applicable	• Incomplete pathway.	• Incomplete pathway.	• Incomplete pathway.	• None.	• None
			Air • Not Applicable	• Incomplete pathway.	• Incomplete pathway.	• Incomplete pathway.	• None.	• None

Table 2 (Continued)
MEC and MC Exposure Pathway Analysis

Range Area & Type	MMRP Concern	Potential Contaminant of Concern (PCOCs)	Affected Media Potential Contaminant Sources/Fate and Transport	Exposure Routes and Potential Receptors			Data Gaps	Activities to Address Data Gaps (i.e., Sampling)
				Site Workers/ Contractor Personnel	Residents/ General Public	Ecological (Biota)		
Rifle Range	MEC	MEC in the form of unfired small arms rounds are a potential hazard; low explosive hazard.	Surface Soil <ul style="list-style-type: none"> MEC (unfired ammunition) are a hazard. No MEC found. 	<ul style="list-style-type: none"> Incomplete pathway. 	<ul style="list-style-type: none"> Incomplete pathway. 	<ul style="list-style-type: none"> Incomplete pathway. 	<ul style="list-style-type: none"> None 	<ul style="list-style-type: none"> Visual reconnaissance to verify current site conditions; very low likelihood of finding MEC after 50 years of heavy use.
			Subsurface Soil <ul style="list-style-type: none"> None 	<ul style="list-style-type: none"> Incomplete pathway. 	<ul style="list-style-type: none"> Incomplete pathway. 	<ul style="list-style-type: none"> Not applicable. 	<ul style="list-style-type: none"> None; subsurface burial not documented. 	<ul style="list-style-type: none"> Historical documents does not indicate ranges have buried MEC.
	MC	Lead.	Soil <ul style="list-style-type: none"> Directly affected media. Potential lead from bullets. Fate & Transport: Secondary source of potential surface water, sediment, and air contamination. 	<ul style="list-style-type: none"> Potentially complete pathway. Exposure routes: <ul style="list-style-type: none"> Incidental ingestion, Dermal contact, and Inhalation of soil particulates during intrusive work. 	<ul style="list-style-type: none"> Potentially complete pathway. Exposure routes: <ul style="list-style-type: none"> Incidental ingestion, Dermal contact, and Inhalation of soil particulates during intrusive work. 	<ul style="list-style-type: none"> Potentially complete pathway. Exposure routes: <ul style="list-style-type: none"> Ingestion, and Direct contact by area fauna. 	<ul style="list-style-type: none"> Analytical data for lead in soil do not exist. 	<ul style="list-style-type: none"> Collect two soil samples from location of backstop berm and analyzed for lead only.
			Sediment/Surface Water <ul style="list-style-type: none"> Potentially affected media – ponds. Potential lead contamination. Fate & Transport: Via surface runoff from impacted soil. 	<ul style="list-style-type: none"> Potentially complete pathway. Exposure routes: <ul style="list-style-type: none"> Incidental ingestion, Dermal contact, and Inhalation of surface water. 	<ul style="list-style-type: none"> Potentially complete pathway. Exposure routes: <ul style="list-style-type: none"> Incidental ingestion, Dermal contact, and Inhalation of surface water. 	<ul style="list-style-type: none"> Potentially complete pathway. Exposure routes: <ul style="list-style-type: none"> Ingestion, Direct contact by area fauna and aquatic organisms. 	<ul style="list-style-type: none"> Analytical data for lead in sediment/surface water do not exist. 	<ul style="list-style-type: none"> Collect one sediment sample from water collection area and analyzed for lead only.
			Groundwater <ul style="list-style-type: none"> Potentially affected media. Potential metals and explosives contamination. Fate & Transport: Migration of metals directly to groundwater is unlikely because of relatively low mobility of metals lead in soil 	<ul style="list-style-type: none"> Incomplete pathway. <ul style="list-style-type: none"> No local wells. 	<ul style="list-style-type: none"> Incomplete pathway. <ul style="list-style-type: none"> No local wells. 	<ul style="list-style-type: none"> Incomplete pathway. <ul style="list-style-type: none"> No local wells. 	<ul style="list-style-type: none"> No groundwater analytical data exist for metals. 	<ul style="list-style-type: none"> No groundwater samples will be collected.
			Air <ul style="list-style-type: none"> Not an affected media under current land use. 	<ul style="list-style-type: none"> Incomplete pathway. 	<ul style="list-style-type: none"> Incomplete pathway. 	<ul style="list-style-type: none"> Incomplete pathway. 	<ul style="list-style-type: none"> None. 	<ul style="list-style-type: none"> None

Table 2 (Continued)
MEC and MC Exposure Pathway Analysis

Range Area & Type	MMRP Concern	Potential Contaminant of Concern (PCOCs)	Affected Media Potential Contaminant Sources/Fate and Transport	Exposure Routes and Potential Receptors			Data Gaps	Activities to Address Data Gaps (i.e., Sampling)
				Site Workers/ Contractor Personnel	Residents/ General Public	Ecological (Biota)		
Demolition Area	MEC	MEC in the form of 2.36-inch and 3.5-inch rockets, hand grenades, land mines; small arms are a potential hazard.	Surface Soil <ul style="list-style-type: none"> No MEC at surface, Site has been backfilled in the form of unexploded rockets, hand grenades, and land mines are a hazard. 	<ul style="list-style-type: none"> Complete pathway. Exposure routes <ul style="list-style-type: none"> Vehicle and foot traffic. 	<ul style="list-style-type: none"> Complete pathway. <ul style="list-style-type: none"> Exposure routes <ul style="list-style-type: none"> Foot traffic. 	<ul style="list-style-type: none"> Complete pathway. Exposure routes <ul style="list-style-type: none"> Foot traffic. 	<ul style="list-style-type: none"> None. 	<ul style="list-style-type: none"> Visual reconnaissance to verify current site conditions; the primary area that will be surveyed is the area along the beach and shoreline.
			Subsurface Soil <ul style="list-style-type: none"> MEC in the form of unexploded rockets, hand grenades, and land mines are a hazard 	<ul style="list-style-type: none"> Potentially complete pathway. Exposure routes <ul style="list-style-type: none"> Intrusive activities. Geologic instability. 	<ul style="list-style-type: none"> Potentially complete pathway. Exposure routes <ul style="list-style-type: none"> Intrusive activities. Geologic instability. 	<ul style="list-style-type: none"> Potentially complete pathway. Exposure routes <ul style="list-style-type: none"> Intrusive activities. Geologic instability. 	<ul style="list-style-type: none"> Occurrence of MEC in subsurface soil is unknown. 	<ul style="list-style-type: none"> None
	MC	Select metals explosives (nitrocellulose, NG, RDX, TNT), perchlorate.	Soil <ul style="list-style-type: none"> Directly affected media. Potential metals and explosives contamination. Fate & Transport: Secondary source of potential surface water, sediment, and air contamination. 	<ul style="list-style-type: none"> Potentially complete pathway. Exposure routes: <ul style="list-style-type: none"> Incidental ingestion, Dermal contact, and Inhalation of soil particulates during intrusive work. 	<ul style="list-style-type: none"> Potentially complete pathway. Exposure routes: <ul style="list-style-type: none"> Incidental ingestion, Dermal contact, and Inhalation of soil particulates during intrusive work. 	<ul style="list-style-type: none"> Potentially complete pathway. Exposure routes: <ul style="list-style-type: none"> Ingestion, and Direct contact by area fauna. 	<ul style="list-style-type: none"> None in surface soil 	<ul style="list-style-type: none"> None
			Sediment/Surface Water <ul style="list-style-type: none"> Potentially affected media – Puget Sound. Potential metal and explosive contamination. Fate & Transport: via tidal action in subsurface soil. 	<ul style="list-style-type: none"> Potentially complete pathway. Exposure routes: <ul style="list-style-type: none"> Incidental ingestion, Dermal contact, and Inhalation of Puget Sound water. 	<ul style="list-style-type: none"> Potentially complete pathway. Exposure routes: <ul style="list-style-type: none"> Incidental ingestion, Dermal contact, and Inhalation of surface water. 	<ul style="list-style-type: none"> Potentially complete pathway. Exposure routes: <ul style="list-style-type: none"> Ingestion, Direct contact by area fauna and aquatic organisms. 	<ul style="list-style-type: none"> Analytical data for metals or explosives in Puget Sound do not exist. 	<ul style="list-style-type: none"> None. Puget Sound is a large body of saline water any contamination resulting from the demolition area has been flushed out via tidal action.
			Groundwater <ul style="list-style-type: none"> Potentially affected media. Potential metals and explosives contamination. Fate & Transport: Migration of metals directly to groundwater is unlikely because of relatively low mobility of metals lead in soil 	<ul style="list-style-type: none"> Incomplete pathway. <ul style="list-style-type: none"> No local wells. 	<ul style="list-style-type: none"> Incomplete pathway. <ul style="list-style-type: none"> No local wells. 	<ul style="list-style-type: none"> Incomplete pathway. <ul style="list-style-type: none"> No local wells. 	<ul style="list-style-type: none"> No groundwater analytical data exist for metals. 	<ul style="list-style-type: none"> No groundwater samples will be collected.
			Air <ul style="list-style-type: none"> Not an affected media under current land use. 	<ul style="list-style-type: none"> Incomplete pathway. 	<ul style="list-style-type: none"> Incomplete pathway. 	<ul style="list-style-type: none"> Incomplete pathway. 	<ul style="list-style-type: none"> None. 	<ul style="list-style-type: none"> None

Table 2 (Continued)
MEC and MC Exposure Pathway Analysis

Range Area & Type	MMRP Concern	Potential Contaminant of Concern (PCOCs)	Affected Media Potential Contaminant Sources/Fate and Transport	Exposure Routes and Potential Receptors			Data Gaps	Activities to Address Data Gaps (i.e., Sampling)
				Site Workers/ Contractor Personnel	Residents/ General Public	Ecological (Biota)		
Quarter-master Wharf Disposal Site	MEC	MEC in the form of unfired small arms rounds a potential hazard; potential for other MEC.	Surface Soil <ul style="list-style-type: none"> MEC (unfired ammunition) are a hazard. Small arms rounds found. 	Potentially complete pathway <ul style="list-style-type: none"> Exposure routes: Foot traffic. 	Potentially complete pathway <ul style="list-style-type: none"> Exposure routes: Foot traffic. 	<ul style="list-style-type: none"> Incomplete pathway. 	<ul style="list-style-type: none"> Presence of MEC 	<ul style="list-style-type: none"> A visual reconnaissance will be performed along the beach.
			Subsurface Soil <ul style="list-style-type: none"> None 	<ul style="list-style-type: none"> Incomplete pathway. 	<ul style="list-style-type: none"> Incomplete pathway. 	<ul style="list-style-type: none"> Not applicable. 	<ul style="list-style-type: none"> None; subsurface burial not documented. 	<ul style="list-style-type: none"> Historical documents do not indicate ranges have buried MEC.
	MC	Lead.	Soil <ul style="list-style-type: none"> Directly affected media. Potential lead and other metals from munitions. Potential for explosives Fate & Transport: Secondary source of potential surface water and air contamination. 	<ul style="list-style-type: none"> Potentially complete pathway. Exposure routes: <ul style="list-style-type: none"> Incidental ingestion, Dermal contact, and Inhalation of soil particulates during intrusive work. 	<ul style="list-style-type: none"> Potentially complete pathway. Exposure routes: <ul style="list-style-type: none"> Incidental ingestion, Dermal contact, and Inhalation of soil particulates during intrusive work. 	<ul style="list-style-type: none"> Potentially complete pathway. Exposure routes: <ul style="list-style-type: none"> Ingestion, and Direct contact by area fauna. 	<ul style="list-style-type: none"> Analytical data for metals and explosives in soil do not exist. 	<ul style="list-style-type: none"> Collect one soil sample from near the wharf sample will be analyzed for explosives only. Because the site was used for disposal of non-MEC related items differentiation between metals from MEC and refuse is not possible.
			Sediment/Surface Water <ul style="list-style-type: none"> No sediment occurrence, site is a beach. 	<ul style="list-style-type: none"> Incomplete Pathway. 	<ul style="list-style-type: none"> Incomplete Pathway. 	<ul style="list-style-type: none"> Incomplete Pathway. 	<ul style="list-style-type: none"> None 	<ul style="list-style-type: none"> None
			Groundwater <ul style="list-style-type: none"> Potentially affected media. Potential metals and explosives contamination. Fate & Transport: Migration of metals directly to groundwater is unlikely because of relatively low mobility of metals lead in soil 	<ul style="list-style-type: none"> Incomplete pathway. <ul style="list-style-type: none"> No local wells. 	<ul style="list-style-type: none"> Incomplete pathway. <ul style="list-style-type: none"> No local wells. 	<ul style="list-style-type: none"> Incomplete pathway. <ul style="list-style-type: none"> No local wells. 	<ul style="list-style-type: none"> No groundwater analytical data exist for metals. 	<ul style="list-style-type: none"> No groundwater samples will be collected.
			Air <ul style="list-style-type: none"> Not an affected media under current land use. 	<ul style="list-style-type: none"> Incomplete pathway. 	<ul style="list-style-type: none"> Incomplete pathway. 	<ul style="list-style-type: none"> Incomplete pathway. 	<ul style="list-style-type: none"> None. 	<ul style="list-style-type: none"> None

**Table 3
Proposed Sampling Approach
Ft. Flagler Military Reservation**

Area of Concern	Media	Samples	Contaminants of Concern ^a						
			Lead	Select Metals ^b	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 Disposal Area	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
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

**Table 3
Proposed Sampling Approach
Ft. Flagler Military Reservation**

QC Required Samples ^c	Media	Samples	Contaminants of Concern ^a						
			Lead	Select Metals ^b	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:

^a 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).

^b Select metals are aluminum, chromium, copper, iron, lead, manganese, molybdenum, and nickel.

^c 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 4
Human Health Soil and Sediment Screening Criteria and Selected Values for Potential Contaminants of Concern
Ft. Flagler Military Reservation

Analyte	USEPA Region 9 ^a			Washington Department of Ecology - Soil Cleanup Levels ^b					Proposed Screening Value
	Residential PRGs (mg/kg)	Region 9 Residential PRGs - Adjusted ^b (ug/L)	Industrial PRGs (mg/kg)	Method B Level - Unrestricted ^c (mg/kg)	Leaching - Phase 3 Model - Unrestricted ^d (mg/kg)	Method B Level - Industrial ^e (mg/kg)	Leaching - Phase 3 Model - Industrial ^f (mg/kg)	Natural Background Level ^g (mg/kg)	
Explosives									
1,3,5-Trinitrobenzene	1,800	180	18,000						1,800
1,3-Dinitrobenzene	6.1	0.61	62						6.1
2,4,6-Trinitrotoluene	16	16	57						16
2,4-Dinitrotoluene ^h	0.72	0.72	2.5						0.72
2,6-Dinitrotoluene ^h	0.72	0.72	2.5						0.72
2-Amino-4,6-dinitrotoluene	12	1.2	120						12
2-Nitrotoluene	0.88	0.88	2.2						0.88
3-Nitrotoluene	730	73	1,000						730
4-Amino-2,6-dinitrotoluene	12	1.2	120						12
4-Nitrotoluene	12	12	30						12
HMX	3,100	310	31,000						3,100
NG	35	35	120						35
Nitrobenzene	20	2	100						20
PETN	0.50								0.50
RDX	4.4	4.4	16						4.4
Tetryl	610	61	6,200						610
Metals									
Aluminum	76,000	7,600	100,000					32,600	76,000
Chromium	210		450					48	210
Copper	3,100	310	41,000					36	3,100
Iron	23,000	2,300	100,000					58,700	23,000
Lead	400	400	800		3,000		3,000	24	400
Manganese	1,800	180	19,000					1,200	1,800
Molybdenum	390	39	5,100						390
Nickel	1,600	160	20,000					48	1,600

Acronyms and Abbreviations:

C = Value for carcinogen

CLARC = Cleanup Level and Risk Calculation

mg/kg = milligrams per kilogram

N = Value for noncarcinogen

WAC = Washington Administrative Code

Notes:

Table 4
Human Health Soil and Sediment Screening Criteria and Selected Values for Potential Contaminants of Concern
Ft. Flagler Military Reservation

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

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

^c 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 Calculations for Carcinogens for Soil Ingestion Plus Dermal Contact. Based on unrestricted land use. From CLARC Notes updated on November 23, 2004.

^d 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.

^{fe} 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 Ingestion Plus Dermal Contact and Table 6: Method C Industrial Calculations for Carcinogens for Soil Ingestion Plus Dermal Contact. Based on industrial land use. From CLARC Notes updated on November 23, 2004.

^f 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.

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

^h Carcinogenic DNT mixture values used if more conservative than noncarcinogenic isomer-specific values.

Table 5
Ecological Soil Screening Criteria and Selected Values for Potential Contaminants of Concern
Ft. Flagler Military Reservation

Analyte	Washington Dept of Ecology Lowest Value for Plants/Soil Biota/ Wildlife ^a (mg/kg)	Proposed Benchmarks							Other Values: Talmage et al. (1999) ^f or LANL (2005) ^g (mg/kg)	Potential Bioaccumulative Constituent? ^h	Final Proposed Ecological Screening Value Soil ⁱ (mg/kg)	
		USEPA Region 5 ESLs ^b (2003) (mg/kg)	USEPA Region 7 ^c (mg/kg)	USEPA Region 8 ^d (mg/kg)	USEPA Region 10 ^e (mg/kg)	EPA-R4	EPA-R4	EPA-R4				
Explosives												
1,3,5-Trinitrobenzene	NVA	0.376	0.376	EPA-R4		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	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	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	NVA		0.73	LANL		0.73
4-Nitrotoluene	NVA	NVA	NVA		NVA	NVA			4.4	LANL		4.4
HMX	NVA	NVA	NVA		NVA	NVA	NVA		27	LANL		27
Nitrobenzene	8	1.31	1.31	EPA-R4	NVA	1.31		EPA-R4	2.2	LANL		8
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
Metals												
Aluminum	50	NVA	50	EPA-R4	NVA	50		EPA-R4	5.5	LANL		50
Chromium (total)	0.4	0.4	26	SSL	26	SSL	26		2.3	LANL	Yes	0.4
Copper	50	5.4	60	ORNL	190	Dutch	60		10	LANL	Yes	50
Iron	10 mg/L	NVA	200	EPA-R4	NVA	200	200		NVA	LANL		200
Lead	16	0.0537	11	SSL	11	SSL	11		14	LANL	Yes	16
Manganese	100	NVA	100	EPA-R4	NVA	100		EPA-R4	50	LANL		100
Molybdenum	2	NVA	2	ORNL	2	ORNL	2	2	NVA	LANL		2
Nickel	30	13.6	30	ORNL	30	ORNL	30		20	LANL	Yes	30
Perchlorate	NVA	NVA	NVA		NVA	NVA		NVA	NVA			NVA

Acronyms and Abbreviations:

EPA-R4 = USEPA Region 4

Dutch = Dutch Intervention Values

LANL = Los Alamos National Laboratory

mg/kg = milligrams per kilogram

NVA: No value available

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

SSL = USEPA Eco Soil Screening Levels

Notes:

^a 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).

^b Ecological Screening Levels (ESLs), USEPA Region V, August 2003.

^b Texas Commission on Environmental Quality (TCEQ), 2005, *Guidance for Conducting Ecological Risk Assessments at Remediation Sites in Texas*, RG-263 (Revised).

^c 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.

^d U.S. Environmental Protection Agency (EPA), 2003, *U.S. EPA Region 5 RCRA Ecological Screening Levels (ESL)*, Website version last updated August 22, 2003: <http://www.epa.gov/reg5rcra/ca/edql.htm>.

^e U.S. Environmental Protection Agency (EPA), 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>.

^f 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, *Rev. Environ. Contam. Toxicol.* 161:1-156, Springer-Verlag. Screening concentration used is the lowest of the Plant and Soil Invertebrate concentrations. Wildlife (shrew) values were not included as candidates for screening values. This is consistent with TCEQ's method of only using the Plant and Earthworm values to select their screening values.

^g Earthworm and plant soil benchmark values in TCEQ 2005 were transposed, the values were corrected to reflect the Eco-SSLs (2005). *Personal Communication* with Vickie Reat, TCEQ, 12/06/05.

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

^e 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.

^f 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 5
Ecological Soil Screening Criteria and Selected Values for Potential Contaminants of Concern
Ft. Flagler Military Reservation

Analyte	Washington Dept of Ecology Lowest Value for Plants/Soil Biota/ Wildlife ^a (mg/kg)	Proposed Benchmarks							Other Values: Talmage et al. (1999) ^f or LANL (2005) ^g (mg/kg)	Potential Bioaccumulative Constituent? ^h	Final Proposed Ecological Screening Value Soil ⁱ (mg/kg)	
		USEPA Region 5 ESLs ^b (2003) (mg/kg)	USEPA Region 7 ^c (mg/kg)	USEPA Region 8 ^d (mg/kg)	USEPA Region 10 ^e (mg/kg)	EPA-R4	EPA-R4	EPA-R4				
Explosives												
1,3,5-Trinitrobenzene	NVA	0.376	0.376	EPA-R4		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	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	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	NVA		0.73	LANL		0.73
4-Nitrotoluene	NVA	NVA	NVA		NVA	NVA			4.4	LANL		4.4
HMX	NVA	NVA	NVA		NVA	NVA	NVA		27	LANL		27
Nitrobenzene	8	1.31	1.31	EPA-R4	NVA	1.31		EPA-R4	2.2	LANL		8
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
Metals												
Aluminum	50	NVA	50	EPA-R4	NVA	50		EPA-R4	5.5	LANL		50
Chromium (total)	0.4	0.4	26	SSL	26	SSL	26		2.3	LANL	Yes	0.4
Copper	50	5.4	60	ORNL	190	Dutch	60		10	LANL	Yes	50
Iron	10 mg/L	NVA	200	EPA-R4	NVA	200	200		NVA	LANL		200
Lead	16	0.0537	11	SSL	11	SSL	11		14	LANL	Yes	16
Manganese	100	NVA	100	EPA-R4	NVA	100		EPA-R4	50	LANL		100
Molybdenum	2	NVA	2	ORNL	2	ORNL	2	2	NVA	LANL		2
Nickel	30	13.6	30	ORNL	30	ORNL	30		20	LANL	Yes	30
Perchlorate	NVA	NVA	NVA		NVA	NVA	NVA	NVA	NVA	LANL		NVA

Acronyms and Abbreviations:

EPA-R4 = USEPA Region 4

Dutch = Dutch Intervention Values

LANL = Los Alamos National Laboratory

mg/kg = milligrams per kilogram

NVA: No value available

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

SSL = USEPA Eco Soil Screening Levels

Notes:

^a 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).

^b Ecological Screening Levels (ESLs), USEPA Region V, August 2003.

^b Texas Commission on Environmental Quality (TCEQ), 2005, *Guidance for Conducting Ecological Risk Assessments at Remediation Sites in Texas*, RG-263 (Revised).

^c 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.

^d U.S. Environmental Protection Agency (EPA), 2003, *U.S. EPA Region 5 RCRA Ecological Screening Levels (ESL)*, Website version last updated August 22, 2003: <http://www.epa.gov/reg5rcra/ca/edql.htm>.

^e U.S. Environmental Protection Agency (EPA), 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>.

^f 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, *Rev. Environ. Contam. Toxicol.* 161:1-156, Springer-Verlag. Screening concentration used is the lowest of the Plant and Soil Invertebrate concentrations. Wildlife (shrew) values were not included as candidates for screening values. This is consistent with TCEQ's method of only using the Plant and Earthworm values to select their screening values.

^g Earthworm and plant soil benchmark values in TCEQ 2005 were transposed, the values were corrected to reflect the Eco-SSLs (2005). *Personal Communication* with Vickie Reat, TCEQ, 12/06/05.

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

^e 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.

^f 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 5
Ecological Soil Screening Criteria and Selected Values for Potential Contaminants of Concern
Ft. Flagler Military Reservation

Rev. Environ. Contam. Toxicol.

^g Los Alamos National Laboratory (LANL), Eco Risk Database, Release 2.2, September 2005.

^h 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).

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_12000.pdf and Annex A:

Target Values, Soil Remediation Intervention Values and Indicative Levels for Serious Contamination http://www2.minvrom.nl/Docs/internationaal/annexS_12000.pdf were also consulted.

Table 6
Ecological Sediment Screening Criteria and Selected Values for Potential Contaminants of Concern
Ft. Flager Military Reservation

Analyte	Washington Dept. of Ecology Screening Level Values Freshwater ^a (mg/kg) Freshwater	USEPA Region 5 Ecological Screening Levels ^b (mg/kg)	USEPA Region 7 ^c (mg/kg)	USEPA Region 8 ^d (mg/kg)	USEPA Region 10 ^e (mg/kg)	Other Ecological Screening Levels ^f (mg/kg)	Potential Bioaccumulative Constituent? ^g	Final Ecological Screening Value Sediment ^h (mg/kg)				
Explosives												
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-TNT	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-Dinitrotoluene	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-Dinitrotoluene	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				
Metals												
Aluminum	NVA	NVA	NVA	NVA	NVA	2.80E+02	LANL	2.80E+02				
Chromium	3.70E+01	4.34E+01	4.34E+01	MAC	4.34E+01	MAC	4.34E+01	MAC	5.60E+01	LANL	Yes	3.70E+01
Copper	1.00E+01	3.16E+01	3.16E+01	MAC	3.16E+01	MAC	3.16E+01	MAC	1.70E+01	LANL	Yes	1.00E+01
Iron	NVA	NVA	NVA	NVA	NVA	NVA	NVA	NVA	2.00E+01	LANL		2.00E+01
Lead	3.50E+01	3.58E+01	3.58E+01	MAC	3.58E+01	MAC	3.58E+01	MAC	2.70E+01	LANL	Yes	3.50E+01
Manganese	1.10E+03	NVA	NVA	NVA	NVA	NVA	NVA	NVA	7.20E+02	LANL		1.10E+03
Molybdenum	NVA	NVA	NVA	NVA	NVA	NVA	NVA	NVA	NVA			NVA
Nickel	1.80E+01	2.27E+01	2.27E+01	MAC	2.27E+01	MAC	2.27E+01	MAC	3.90E+01	LANL	Yes	1.80E+01
Perchlorate	NVA	NVA	NVA	NVA	NVA	NVA	NVA	NVA	NVA			NVA

Acronyms and Abbreviations:

EPRGs = Oak Ridge National Laboratory Ecological PRGs

ISQGs = Canadian Interim Sediment Quality Guidelines

LANL = Los Alamos National Laboratory

MAC = MacDonald Consensus Values

NVA = No Value Available

TAL = Talmage et al (1999)

Notes:

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

^b Ecological Screening Levels (ESLs), USEPA Region V, August 2003.

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

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

^e 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.

^f 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.

^g 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).

^h Final Screening Value selected using the following hierarchy:

1. State Value (Washington)

Table 6
Ecological Sediment Screening Criteria and Selected Values for Potential Contaminants of Concern
Ft. Flagler Military Reservation

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

Other References:

Efroymson, 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.

Draft Worksheets

Site Information Worksheet ***MRSPP Data Gaps*** ***HRS Data Gaps***

Site Inspection
Ft. Flagler Military Reservation

Technical Project Planning Meeting
July 24, 2006

Site Information Worksheet

Site: Range Complex, Ammunition Bunker, Transition Ranges 1 & 2, Gas Chamber, Rifle Grenade/Anti-Tank Rocket Range, Live and Practice Grenade Courts, Rifle Range, Demolition Area, Quartermaster Wharf Area

Project: Ft. Flagler Military Reservation

	Site Information Needed^a	Suggested Means to Obtain Site Information	Potential Source(s) of Site Information	Responsible for Obtaining	Deadline for Obtaining Site Information
1	Background metals data	Sampling	Add background sampling	Shaw	For inclusion in TPP Memo
2	Locate MEC at Rocket Range	Site recon	Historical aerial photos/review historical documents	Shaw	For inclusion in Site Specific Work Plan
3	Schedule for sampling Washington sites	Consultation	Washington State Parks	Shaw	Prior to field work
4	Additional historical information	Records review	USACE Seattle District	Shaw	For inclusion in Site Specific Work Plan
5	Washington HH Screening Standards	WDOE regulations	WDOE	Shaw	For inclusion in TPP Memo
6	Washington Ecological Screening Standards	WDOE regulations	WDOE	Shaw	For inclusion in TPP Memo
7	Point of contact for community	Not applicable	USACE Seattle District	USACE	Before start of field work
8	Access agreements	Letters, call, or visit stakeholders	Letters/conversations with stakeholders	USACE	Before start of field work
9	Conceptual site model	Report review	CSMs prepared for AOCs	Shaw	For inclusion in TPP Memo
10	Threatened or endangered species within AOC	Phone	WA Fish and Wildlife U.S. Fish and Wildlife	Shaw	For inclusion in SSWP
11	Areas of cultural significance within AOC	SHPO	Phone SHPO	Shaw	For inclusion in SSWP

^a Refer to EM 200-1-2, Paragraphs 1.1.3 and 2.2.

**Munitions Response Site Prioritization Protocol (MRSPP) Data Gaps
32 CFR Part 179**

Installation: Ft. Flagler Military Reservation
AOC: Range Complex
RMIS Range ID: F10WA0316

Module	Table No.	Table Description	Data Gap	Potential Source of Information to Fill Data Gap	No Data Gap	Description of Known Data
Explosive Hazard Evaluation (EHE)	1	Munitions Type			x	Propellant
	2	Source of Hazard			x	Former ground to sea and air to air artillery batteries
	3	Location of Munitions			x	No munitions reported from this MRA
	4	Ease of Access			x	No barrier
	5	Status of Property			x	Non-DoD control
	6	Population Density			x	< 100 persons per square mile
	7	Population Near Hazard			x	26 or more structure
	8	Activities/Structures			x	Parks and recreational areas
	9	Ecological and/or Cultural Resources	x	U.S. Fish and Wildlife, SHPO		
	10	EHE Module Score				60 to 70 EHE Rating D (Preliminary)
Chemical Warfare Materiel (CWM) Hazard Evaluation (CHE)	11	CWM Configuration			x	Historical evidence indicates that CWM are not present
	12	Sources of CWM			x	Historical evidence indicates that CWM are not present
	13	Location of CWM			x	Historical evidence indicates that CWM are not present
	14	Ease of Access			x	No barrier
	15	Status of Property			x	Non-DoD control
	16	Population Density			x	< 100 persons per square mile
	17	Population Near Hazard			x	0 inhabited structures w/in 2 miles
	18	Activities/Structures			x	Agricultural - livestock grazing
	19	Ecological and/or Cultural Resources			x	Ecological resources present
	20	CHE Module Score				< 38 CHE Rating G (Preliminary)
Health Hazard Evaluation (HHE)	21	Groundwater Data Element			x	Groundwater not a pathway
	22	Surface Water (Human Endpoint) Data Element			x	Surface Water not a pathway
	23	Sediment (Human Endpoint) Data Element Table	x	Evaluation Pending		
	24	Surface Water (Ecological Endpoint) Data Element	x	Evaluation Pending		
	25	Sediment (Ecological Endpoint) Data Element	x	Evaluation Pending		
	26	Surface Soil Data Element	x	Evaluation Pending		
	27	Supplemental Contaminant Hazard Factor	x	Evaluation Pending		
	28	HHE Module Score	x	Module Score Pending		
MRS Priority	29	MRS Priority (Based on Highest Hazard Evaluation Module Rating)	x	Final Score Pending		
	A	MRS Background Information	x	Pending		

**Munitions Response Site Prioritization Protocol (MRSPP) Data Gaps
32 CFR Part 179**

Installation: Ft. Flagler Military Reservation
AOC: Ammunition Bunker
RMIS Range ID: F10WA0316

Module	Table No.	Table Description	Data Gap	Potential Source of Information to Fill Data Gap	No Data Gap	Description of Known Data
Explosive Hazard Evaluation (EHE)	1	Munitions Type			x	Small Arms, 2.36-in and 3.5 inch Anti-tank rockets, inert AT/AV mines, Hand Grenades
	2	Source of Hazard			x	Ammunition bunker
	3	Location of Munitions			x	No munitions reported from this MRA
	4	Ease of Access			x	No barrier
	5	Status of Property			x	Non-DoD control
	6	Population Density			x	< 100 persons per square mile
	7	Population Near Hazard			x	26 or more structure
	8	Activities/Structures			x	Parks and recreational areas
	9	Ecological and/or Cultural Resources	x	U.S. Fish and Wildlife, SHPO		
	10	EHE Module Score				60 to 70 EHE Rating D (Preliminary)
Chemical Warfare Material (CWM) Hazard Evaluation (CHE)	11	CWM Configuration			x	Historical evidence indicates that CWM are not present
	12	Sources of CWM			x	Historical evidence indicates that CWM are not present
	13	Location of CWM			x	Historical evidence indicates that CWM are not present
	14	Ease of Access			x	No barrier
	15	Status of Property			x	Non-DoD control
	16	Population Density			x	< 100 persons per square mile
	17	Population Near Hazard			x	0 inhabited structures w/in 2 miles
	18	Activities/Structures			x	Agricultural - livestock grazing
	19	Ecological and/or Cultural Resources			x	Ecological resources present
	20	CHE Module Score				< 38 CHE Rating G (Preliminary)
Health Hazard Evaluation (HHE)	21	Groundwater Data Element			x	Groundwater not a pathway
	22	Surface Water (Human Endpoint) Data Element			x	Surface Water not a pathway
	23	Sediment (Human Endpoint) Data Element Table	x	Evaluation Pending		
	24	Surface Water (Ecological Endpoint) Data Element	x	Evaluation Pending		
	25	Sediment (Ecological Endpoint) Data Element	x	Evaluation Pending		
	26	Surface Soil Data Element	x	Evaluation Pending		
	27	Supplemental Contaminant Hazard Factor	x	Evaluation Pending		
	28	HHE Module Score	x	Module Score Pending		
MRS Priority	29	MRS Priority (Based on Highest Hazard Evaluation Module Rating)	x	Final Score Pending		
	A	MRS Background Information	x	Pending		

**Munitions Response Site Prioritization Protocol (MRSPP) Data Gaps
32 CFR Part 179**

Installation: Ft. Flagler Military Reservation
AOC: Transition Range 1
RMIS Range ID: F10WA0316

Module	Table No.	Table Description	Data Gap	Potential Source of Information to Fill Data Gap	No Data Gap	Description of Known Data
Explosive Hazard Evaluation (EHE)	1	Munitions Type			x	Small Arms
	2	Source of Hazard			x	Transition Range - small arms
	3	Location of Munitions			x	No munitions reported from this MRA
	4	Ease of Access			x	No barrier
	5	Status of Property			x	Non-DoD control
	6	Population Density			x	< 100 persons per square mile
	7	Population Near Hazard			x	26 or more structure
	8	Activities/Structures			x	Parks and recreational areas
	9	Ecological and/or Cultural Resources	x	U.S. Fish and Wildlife, SHPO		
	10	EHE Module Score				60 to 70 EHE Rating D (Preliminary)
Chemical Warfare Materiel (CWM) Hazard Evaluation (CHE)	11	CWM Configuration			x	Historical evidence indicates that CWM are not present
	12	Sources of CWM			x	Historical evidence indicates that CWM are not present
	13	Location of CWM			x	Historical evidence indicates that CWM are not present
	14	Ease of Access			x	No barrier
	15	Status of Property			x	Non-DoD control
	16	Population Density			x	< 100 persons per square mile
	17	Population Near Hazard			x	0 inhabited structures w/in 2 miles
	18	Activities/Structures			x	Agricultural - livestock grazing
	19	Ecological and/or Cultural Resources			x	Ecological resources present
	20	CHE Module Score				< 38 CHE Rating G (Preliminary)
Health Hazard Evaluation (HHE)	21	Groundwater Data Element			x	Groundwater not a pathway
	22	Surface Water (Human Endpoint) Data Element			x	Surface Water not a pathway
	23	Sediment (Human Endpoint) Data Element Table	x	Evaluation Pending		
	24	Surface Water (Ecological Endpoint) Data Element	x	Evaluation Pending		
	25	Sediment (Ecological Endpoint) Data Element	x	Evaluation Pending		
	26	Surface Soil Data Element	x	Evaluation Pending		
	27	Supplemental Contaminant Hazard Factor	x	Evaluation Pending		
	28	HHE Module Score	x	Module Score Pending		
MRS Priority	29	MRS Priority (Based on Highest Hazard Evaluation Module Rating)	x	Final Score Pending		
	A	MRS Background Information	x	Pending		

**Munitions Response Site Prioritization Protocol (MRSPP) Data Gaps
32 CFR Part 179**

Installation: Ft. Flagler Military Reservation
AOC: Transition Range 2
RMIS Range ID: F10WA0316

Module	Table No.	Table Description	Data Gap	Potential Source of Information to Fill Data Gap	No Data Gap	Description of Known Data
Explosive Hazard Evaluation (EHE)	1	Munitions Type			x	Small Arms
	2	Source of Hazard			x	Transition Range - small arms
	3	Location of Munitions			x	No munitions reported from this MRA
	4	Ease of Access			x	No barrier
	5	Status of Property			x	Non-DoD control
	6	Population Density			x	< 100 persons per square mile
	7	Population Near Hazard			x	26 or more structure
	8	Activities/Structures			x	Parks and recreational areas
	9	Ecological and/or Cultural Resources	x	U.S. Fish and Wildlife, SHPO		
	10	EHE Module Score				60 to 70 EHE Rating D (Preliminary)
Chemical Warfare Materiel (CWM) Hazard Evaluation (CHE)	11	CWM Configuration			x	Historical evidence indicates that CWM are not present
	12	Sources of CWM			x	Historical evidence indicates that CWM are not present
	13	Location of CWM			x	Historical evidence indicates that CWM are not present
	14	Ease of Access			x	No barrier
	15	Status of Property			x	Non-DoD control
	16	Population Density			x	< 100 persons per square mile
	17	Population Near Hazard			x	0 inhabited structures w/in 2 miles
	18	Activities/Structures			x	Agricultural - livestock grazing
	19	Ecological and/or Cultural Resources			x	Ecological resources present
	20	CHE Module Score				< 38 CHE Rating G (Preliminary)
Health Hazard Evaluation (HHE)	21	Groundwater Data Element			x	Groundwater not a pathway
	22	Surface Water (Human Endpoint) Data Element			x	Surface Water not a pathway
	23	Sediment (Human Endpoint) Data Element Table	x	Evaluation Pending		
	24	Surface Water (Ecological Endpoint) Data Element	x	Evaluation Pending		
	25	Sediment (Ecological Endpoint) Data Element	x	Evaluation Pending		
	26	Surface Soil Data Element	x	Evaluation Pending		
	27	Supplemental Contaminant Hazard Factor	x	Evaluation Pending		
	28	HHE Module Score	x	Module Score Pending		
MRS Priority	29	MRS Priority (Based on Highest Hazard Evaluation Module Rating)	x	Final Score Pending		
	A	MRS Background Information	x	Pending		

**Munitions Response Site Prioritization Protocol (MRSPP) Data Gaps
32 CFR Part 179**

Installation: Ft. Flagler Military Reservation
 AOC: Gas Chamber
 RMIS Range ID: F10WA0316

Module	Table No.	Table Description	Data Gap	Potential Source of Information to Fill Data Gap	No Data Gap	Description of Known Data
Explosive Hazard Evaluation (EHE)	1	Munitions Type			x	Riot Control
	2	Source of Hazard			x	Evidence of no munitions
	3	Location of Munitions			x	No munitions reported from this MRA
	4	Ease of Access			x	No barrier
	5	Status of Property			x	Non-DoD control
	6	Population Density			x	< 100 persons per square mile
	7	Population Near Hazard			x	26 or more structure
	8	Activities/Structures			x	Parks and recreational areas
	9	Ecological and/or Cultural Resources	x	U.S. Fish and Wildlife, SHPO		
	10	EHE Module Score				60 to 70 EHE Rating D (Preliminary)
Chemical Warfare Materiel (CWM) Hazard Evaluation (CHE)	11	CWM Configuration			x	Evidence of no CWM, CN gas only
	12	Sources of CWM			x	Former Training facility
	13	Location of CWM			x	Historical evidence indicates that CWM are not present
	14	Ease of Access			x	No barrier
	15	Status of Property			x	Non-DoD control
	16	Population Density			x	< 100 persons per square mile
	17	Population Near Hazard			x	26 or more structure
	18	Activities/Structures			x	Parks and recreational areas
	19	Ecological and/or Cultural Resources	x	Ecological resources present		
	20	CHE Module Score				< 38 CHE Rating G (Preliminary)
Health Hazard Evaluation (HHE)	21	Groundwater Data Element			x	Groundwater not a pathway
	22	Surface Water (Human Endpoint) Data Element			x	Surface Water not a pathway
	23	Sediment (Human Endpoint) Data Element Table			x	Sediment not a pathway
	24	Surface Water (Ecological Endpoint) Data Element			x	Surface Water not a pathway
	25	Sediment (Ecological Endpoint) Data Element			x	Sediment not a pathway
	26	Surface Soil Data Element			x	Soil not a pathway
	27	Supplemental Contaminant Hazard Factor			x	No complete pathways
	28	HHE Module Score	x	Module Score Pending		
MRS Priority	29	MRS Priority (Based on Highest Hazard Evaluation Module Rating)	x	Final Score Pending		
	A	MRS Background Information	x	Pending		

**Munitions Response Site Prioritization Protocol (MRSPP) Data Gaps
32 CFR Part 179**

Installation: Ft. Flagler Military Reservation
AOC: Rifle Grenade/Anti-Tank Rocket Range
RMIS Range ID: F10WA0316

Module	Table No.	Table Description	Data Gap	Potential Source of Information to Fill Data Gap	No Data Gap	Description of Known Data
Explosive Hazard Evaluation (EHE)	1	Munitions Type			x	High Explosive, propellant
	2	Source of Hazard			x	Former Range
	3	Location of Munitions			x	Suspected (historical evidence)
	4	Ease of Access			x	No barrier
	5	Status of Property			x	Non-DoD control
	6	Population Density			x	< 100 persons per square mile
	7	Population Near Hazard			x	26 or more structure
	8	Activities/Structures			x	Parks and recreational areas
	9	Ecological and/or Cultural Resources	x	U.S. Fish and Wildlife, SHPO		
	10	EHE Module Score				
Chemical Warfare Materiel (CWM) Hazard Evaluation (CHE)	11	CWM Configuration			x	Historical evidence indicates that CWM are not present
	12	Sources of CWM			x	Historical evidence indicates that CWM are not present
	13	Location of CWM			x	Historical evidence indicates that CWM are not present
	14	Ease of Access			x	No barrier
	15	Status of Property			x	Non-DoD control
	16	Population Density			x	< 100 persons per square mile
	17	Population Near Hazard			x	0 inhabited structures w/in 2 miles
	18	Activities/Structures			x	Agricultural - livestock grazing
	19	Ecological and/or Cultural Resources			x	Ecological resources present
	20	CHE Module Score				
Health Hazard Evaluation (HHE)	21	Groundwater Data Element			x	Groundwater not a pathway
	22	Surface Water (Human Endpoint) Data Element			x	Surface Water not a pathway
	23	Sediment (Human Endpoint) Data Element Table	x	Evaluation Pending		
	24	Surface Water (Ecological Endpoint) Data Element			x	Surface Water not a pathway
	25	Sediment (Ecological Endpoint) Data Element	x	Evaluation Pending		
	26	Surface Soil Data Element	x	Evaluation Pending		
	27	Supplemental Contaminant Hazard Factor	x	Evaluation Pending		
	28	HHE Module Score	x	Module Score Pending		
MRS Priority	29	MRS Priority (Based on Highest Hazard Evaluation Module Rating)	x	Final Score Pending		
	A	MRS Background Information	x	Pending		

**Munitions Response Site Prioritization Protocol (MRSPP) Data Gaps
32 CFR Part 179**

Installation: Ft. Flagler Military Reservation
AOC: Live Grenade Court
RMIS Range ID: F10WA0316

Module	Table No.	Table Description	Data Gap	Potential Source of Information to Fill Data Gap	No Data Gap	Description of Known Data
Explosive Hazard Evaluation (EHE)	1	Munitions Type			x	Hand Grenades
	2	Source of Hazard			x	Former Grenade Court
	3	Location of Munitions	x			No munitions reported from this MRA
	4	Ease of Access			x	No barrier
	5	Status of Property			x	Non-DoD control
	6	Population Density			x	< 100 persons per square mile
	7	Population Near Hazard			x	26 or more structure
	8	Activities/Structures			x	Parks and recreational areas
	9	Ecological and/or Cultural Resources	x	U.S. Fish and Wildlife, SHPO		
	10	EHE Module Score				60 to 70 EHE Rating D (Preliminary)
Chemical Warfare Materiel (CWM) Hazard Evaluation (CHE)	11	CWM Configuration			x	Historical evidence indicates that CWM are not present
	12	Sources of CWM			x	Historical evidence indicates that CWM are not present
	13	Location of CWM			x	Historical evidence indicates that CWM are not present
	14	Ease of Access			x	No barrier
	15	Status of Property			x	Non-DoD control
	16	Population Density			x	< 100 persons per square mile
	17	Population Near Hazard			x	0 inhabited structures w/in 2 miles
	18	Activities/Structures			x	Agricultural - livestock grazing
	19	Ecological and/or Cultural Resources			x	Ecological resources present
	20	CHE Module Score				< 38 CHE Rating G (Preliminary)
Health Hazard Evaluation (HHE)	21	Groundwater Data Element			x	Groundwater not a pathway
	22	Surface Water (Human Endpoint) Data Element			x	Surface Water not a pathway
	23	Sediment (Human Endpoint) Data Element Table	x	Evaluation Pending		
	24	Surface Water (Ecological Endpoint) Data Element	x	Evaluation Pending		
	25	Sediment (Ecological Endpoint) Data Element	x	Evaluation Pending		
	26	Surface Soil Data Element	x	Evaluation Pending		
	27	Supplemental Contaminant Hazard Factor	x	Evaluation Pending		
	28	HHE Module Score	x	Module Score Pending		
MRS Priority	29	MRS Priority (Based on Highest Hazard Evaluation Module Rating)	x	Final Score Pending		
	A	MRS Background Information	x	Pending		

**Munitions Response Site Prioritization Protocol (MRSPP) Data Gaps
32 CFR Part 179**

Installation: Ft. Flagler Military Reservation
AOC: Practice Grenade Court
RMIS Range ID: F10WA0316

Module	Table No.	Table Description	Data Gap	Potential Source of Information to Fill Data Gap	No Data Gap	Description of Known Data
Explosive Hazard Evaluation (EHE)	1	Munitions Type			x	Practice Hand Grenade
	2	Source of Hazard			x	Former practice grenade court
	3	Location of Munitions			x	No munitions reported from this MRA
	4	Ease of Access			x	No barrier
	5	Status of Property			x	Non-DoD control
	6	Population Density			x	< 100 persons per square mile
	7	Population Near Hazard			x	26 or more structure
	8	Activities/Structures			x	Parks and recreational areas
	9	Ecological and/or Cultural Resources	x	U.S. Fish and Wildlife, SHPO		
	10	EHE Module Score				60 to 70 EHE Rating D (Preliminary)
Chemical Warfare Materiel (CWM) Hazard Evaluation (CHE)	11	CWM Configuration			x	Historical evidence indicates that CWM are not present
	12	Sources of CWM			x	Historical evidence indicates that CWM are not present
	13	Location of CWM			x	Historical evidence indicates that CWM are not present
	14	Ease of Access			x	No barrier
	15	Status of Property			x	Non-DoD control
	16	Population Density			x	< 100 persons per square mile
	17	Population Near Hazard			x	0 inhabited structures w/in 2 miles
	18	Activities/Structures			x	Agricultural - livestock grazing
	19	Ecological and/or Cultural Resources			x	Ecological resources present
	20	CHE Module Score				< 38 CHE Rating G (Preliminary)
Health Hazard Evaluation (HHE)	21	Groundwater Data Element			x	Groundwater not a pathway
	22	Surface Water (Human Endpoint) Data Element			x	Surface Water not a pathway
	23	Sediment (Human Endpoint) Data Element Table			x	No known or suspected MC hazard
	24	Surface Water (Ecological Endpoint) Data Element			x	No known or suspected MC hazard
	25	Sediment (Ecological Endpoint) Data Element			x	No known or suspected MC hazard
	26	Surface Soil Data Element			x	No known or suspected MC hazard
	27	Supplemental Contaminant Hazard Factor			x	No known or suspected MC hazard
	28	HHE Module Score	x	Module Score Pending		
MRS Priority	29	MRS Priority (Based on Highest Hazard Evaluation Module Rating)	x	Final Score Pending		
	A	MRS Background Information	x	Pending		

**Munitions Response Site Prioritization Protocol (MRSPP) Data Gaps
32 CFR Part 179**

Installation: Ft. Flagler Military Reservation
AOC: Rifle Range
RMIS Range ID: F10WA0316

Module	Table No.	Table Description	Data Gap	Potential Source of Information to Fill Data Gap	No Data Gap	Description of Known Data
Explosive Hazard Evaluation (EHE)	1	Munitions Type			x	Small Arms
	2	Source of Hazard			x	Former small arms range
	3	Location of Munitions			x	No munitions reported from this MRA
	4	Ease of Access			x	No barrier
	5	Status of Property			x	Non-DoD control
	6	Population Density			x	< 100 persons per square mile
	7	Population Near Hazard			x	26 or more structure
	8	Activities/Structures			x	Parks and recreational areas
	9	Ecological and/or Cultural Resources	x	U.S. Fish and Wildlife, SHPO		
	10	EHE Module Score				60 to 70 EHE Rating D (Preliminary)
Chemical Warfare Materiel (CWM) Hazard Evaluation (CHE)	11	CWM Configuration			x	Historical evidence indicates that CWM are not present
	12	Sources of CWM			x	Historical evidence indicates that CWM are not present
	13	Location of CWM			x	Historical evidence indicates that CWM are not present
	14	Ease of Access			x	No barrier
	15	Status of Property			x	Non-DoD control
	16	Population Density			x	< 100 persons per square mile
	17	Population Near Hazard			x	0 inhabited structures w/in 2 miles
	18	Activities/Structures			x	Agricultural - livestock grazing
	19	Ecological and/or Cultural Resources			x	Ecological resources present
	20	CHE Module Score				< 38 CHE Rating G (Preliminary)
Health Hazard Evaluation (HHE)	21	Groundwater Data Element			x	Groundwater not a pathway
	22	Surface Water (Human Endpoint) Data Element			x	Surface Water not a pathway, due to large water body
	23	Sediment (Human Endpoint) Data Element Table	x	Evaluation Pending		
	24	Surface Water (Ecological Endpoint) Data Element				Surface Water not a pathway, due to large water body
	25	Sediment (Ecological Endpoint) Data Element	x	Evaluation Pending		
	26	Surface Soil Data Element	x	Evaluation Pending		
	27	Supplemental Contaminant Hazard Factor	x	Evaluation Pending		
	28	HHE Module Score	x	Module Score Pending		
MRS Priority	29	MRS Priority (Based on Highest Hazard Evaluation Module Rating)	x	Final Score Pending		
	A	MRS Background Information	x	Pending		

**Munitions Response Site Prioritization Protocol (MRSPP) Data Gaps
32 CFR Part 179**

Installation: Ft. Flagler Military Reservation
AOC: Demolition Area
RMIS Range ID: F10WA0316

Module	Table No.	Table Description	Data Gap	Potential Source of Information to Fill Data Gap	No Data Gap	Description of Known Data
Explosive Hazard Evaluation (EHE)	1	Munitions Type			x	small arms, rifle grenade/anti-tank rockets, hand grenades
	2	Source of Hazard			x	OB/OD area
	3	Location of Munitions			x	No munitions reported from this MRA
	4	Ease of Access			x	Buried under as much as 10 ft of soil
	5	Status of Property			x	Non-DoD control
	6	Population Density			x	< 100 persons per square mile
	7	Population Near Hazard			x	26 or more structure
	8	Activities/Structures			x	Parks and recreational areas
	9	Ecological and/or Cultural Resources	x	U.S. Fish and Wildlife, SHPO		
	10	EHE Module Score				60 to 70 EHE Rating D (Preliminary)
Chemical Warfare Materiel (CWM) Hazard Evaluation (CHE)	11	CWM Configuration			x	Historical evidence indicates that CWM are not present
	12	Sources of CWM			x	Historical evidence indicates that CWM are not present
	13	Location of CWM			x	Historical evidence indicates that CWM are not present
	14	Ease of Access			x	No barrier
	15	Status of Property			x	Non-DoD control
	16	Population Density			x	< 100 persons per square mile
	17	Population Near Hazard			x	0 inhabited structures w/in 2 miles
	18	Activities/Structures			x	Agricultural - livestock grazing
	19	Ecological and/or Cultural Resources			x	Ecological resources present
	20	CHE Module Score				< 38 CHE Rating G (Preliminary)
Health Hazard Evaluation (HHE)	21	Groundwater Data Element			x	Groundwater not a pathway
	22	Surface Water (Human Endpoint) Data Element			x	Surface Water not a pathway, due to large water body
	23	Sediment (Human Endpoint) Data Element Table			x	Sediment not a pathway
	24	Surface Water (Ecological Endpoint) Data Element			x	Surface Water not a pathway, due to large water body
	25	Sediment (Ecological Endpoint) Data Element			x	Sediment not a pathway
	26	Surface Soil Data Element			x	Surface soil not a complete pathway
	27	Supplemental Contaminant Hazard Factor	x	Evaluation Pending		
	28	HHE Module Score	x	Module Score Pending		
MRS Priority	29	MRS Priority (Based on Highest Hazard Evaluation Module Rating)	x	Final Score Pending		
	A	MRS Background Information	x	Pending		

**Munitions Response Site Prioritization Protocol (MRSPP) Data Gaps
32 CFR Part 179**

Installation: Ft. Flagler Military Reservation
AOC: Quartermaster Wharf Disposal Area
RMIS Range ID: F10WA0316

Module	Table No.	Table Description	Data Gap	Potential Source of Information to Fill Data Gap	No Data Gap	Description of Known Data
Explosive Hazard Evaluation (EHE)	1	Munitions Type			x	small arms
	2	Source of Hazard			x	Disposal Area
	3	Location of Munitions			x	Only small arms reported
	4	Ease of Access			x	unrestricted
	5	Status of Property			x	Non-DoD control
	6	Population Density			x	< 100 persons per square mile
	7	Population Near Hazard			x	26 or more structure
	8	Activities/Structures			x	Parks and recreational areas
	9	Ecological and/or Cultural Resources	x	U.S. Fish and Wildlife, SHPO		
	10	EHE Module Score				60 to 70 EHE Rating D (Preliminary)
Chemical Warfare Materiel (CWM) Hazard Evaluation (CHE)	11	CWM Configuration			x	Historical evidence indicates that CWM are not present
	12	Sources of CWM			x	Historical evidence indicates that CWM are not present
	13	Location of CWM			x	Historical evidence indicates that CWM are not present
	14	Ease of Access			x	No barrier
	15	Status of Property			x	Non-DoD control
	16	Population Density			x	< 100 persons per square mile
	17	Population Near Hazard			x	0 inhabited structures w/in 2 miles
	18	Activities/Structures			x	Agricultural - livestock grazing
	19	Ecological and/or Cultural Resources			x	Ecological resources present
	20	CHE Module Score				< 38 CHE Rating G (Preliminary)
Health Hazard Evaluation (HHE)	21	Groundwater Data Element			x	Groundwater not a pathway
	22	Surface Water (Human Endpoint) Data Element			x	Surface Water not a pathway, due to large water body
	23	Sediment (Human Endpoint) Data Element Table			x	Sediment not a pathway
	24	Surface Water (Ecological Endpoint) Data Element			x	Surface Water not a pathway, due to large water body
	25	Sediment (Ecological Endpoint) Data Element			x	Sediment not a pathway
	26	Surface Soil Data Element	x	Evaluation Pending		
	27	Supplemental Contaminant Hazard Factor	x	Evaluation Pending		
	28	HHE Module Score	x	Module Score Pending		
MRS Priority	29	MRS Priority (Based on Highest Hazard Evaluation Module Rating)	x	Final Score Pending		
	A	MRS Background Information	x	Pending		

Fort Flagler Military Reservation HRS Data Gaps

Information required to complete the MEC-HRS data collection form:

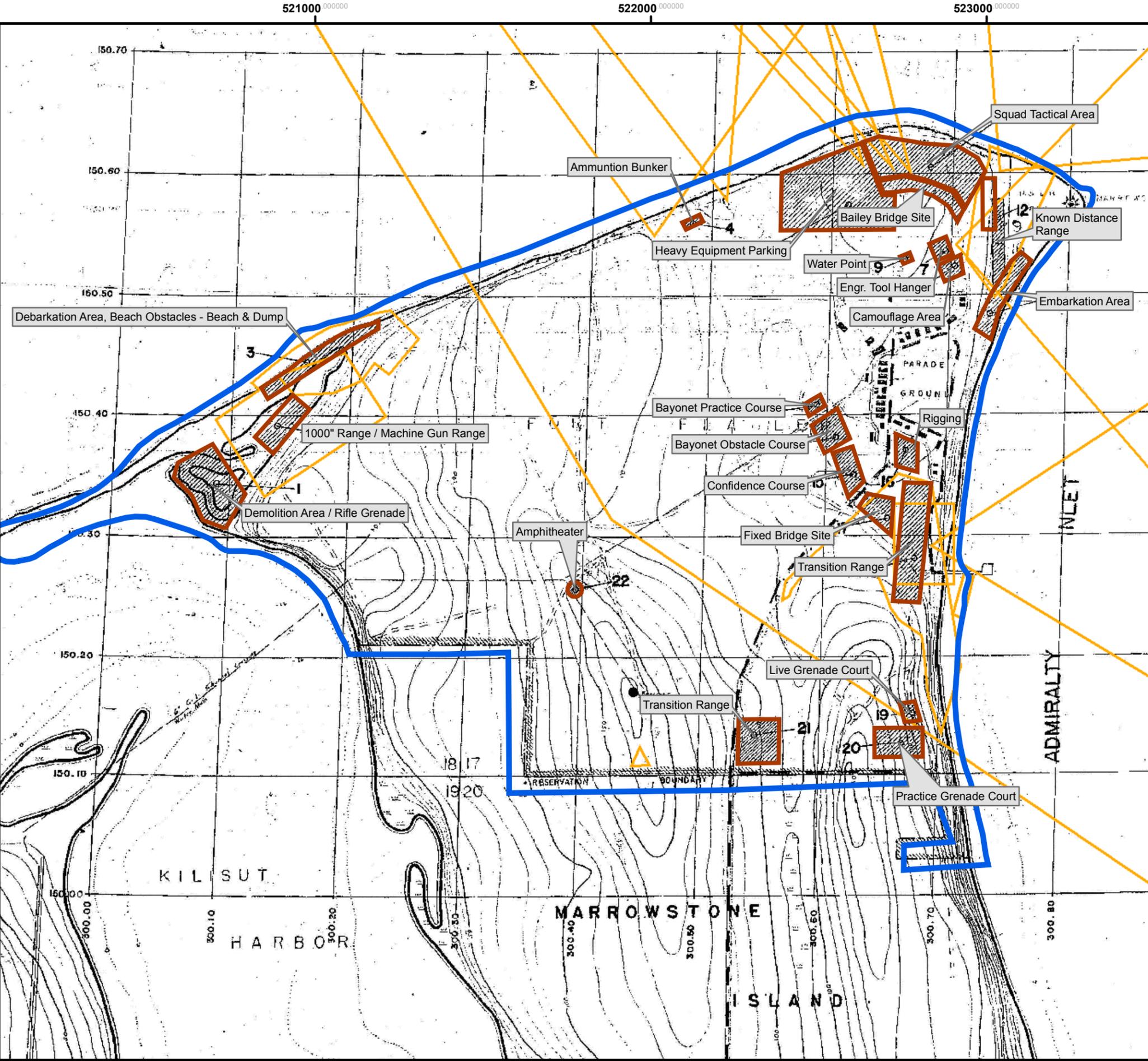
Item	Number	Comment – Missing Data Element
1	1.8	Confirm the latitude / longitude of potential source(s) and the accuracy of the information (in meters)
2		Source scale (i.e., 1:24,000, etc.)
3	1.12	Site Permits
4	6	Water use (GW within 4 miles, SW within 15 miles)
5	6.1	Total drinking water population served
6	6.2	Type of drinking water supply system (GW or SW?)
7	6.3	Other water uses of GW within 4 miles
8	6.4	Depth to Aquifer
9	6.5	Other surface water uses
10	7.1	Existence of sensitive or potentially vulnerable environment

Attachment A

***Site Inspection
Ft. Flagler Military Reservation***

***Technical Project Planning Meeting
July 24, 2006***

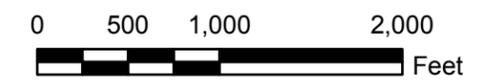
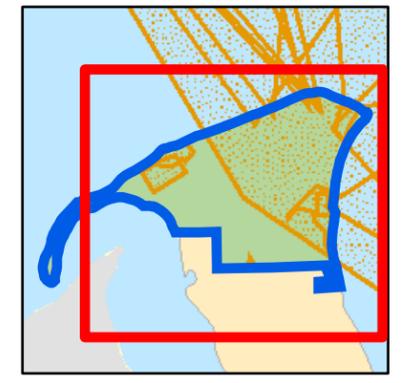
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 DRAWN BY: K. Masterson
 DATE: 10/06/06
 OFFICE: MNRVL



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



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