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**FINAL  
PRELIMINARY ASSESSMENT  
NAVAL AIR STATION BRUNSWICK, MAINE**

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**February 2006**

Prepared for:

**Naval Facilities Engineering Command  
Engineering Field Activity, Northeast**  
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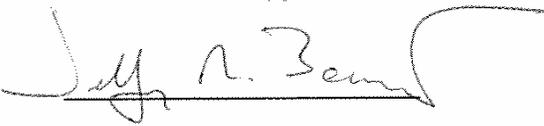
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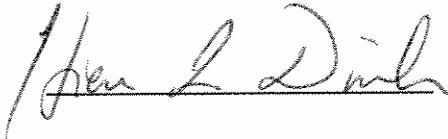
**FINAL  
PRELIMINARY ASSESSMENT  
NAVAL AIR STATION BRUNSWICK, MAINE**

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**February 2006**

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## ACRONYMS

BRAC	Base Realignment and Closure
CD	Compact Disc
CDR	Commander
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
CSM	Conceptual Site Model
DERP	Defense Environmental Restoration Program
DMM	Discarded Military Munitions
DoD	Department of Defense
EFANE	Engineering Field Activity, Northeast
EO	Explosive Ordnance
EOD	Explosive Ordnance Disposal
F	Degrees Fahrenheit
FUDS	Formerly Used Defense Site
FY	Fiscal Year
GIS	Geographical Information System
GOCO	Government-Owned, Contractor Operated
IRP	Installation Restoration Program
ITRC	Interstate Technology Regulatory Council
LANTDIV	Atlantic Division
LCDR	Lieutenant Commander
MEC	Munitions and Explosives of Concern
MC	Munitions Constituents
MRP	Munitions Response Program
NASB	Naval Air Station Brunswick
NAVFAC	Naval Facilities Engineering Command
NCDC	National Climatic Data Center
NCP	National Contingency Plan
OE	Ordnance and Explosives
PA	Preliminary Assessment

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PAH	Polycyclic Aromatic Hydrocarbon
PAO	Public Affairs Office
POC	Point of Contact
RG	Record Groups
RPM	Remedial Project Manager
SARA	Superfund Amendment and Reauthorization Act
U.S.	United States
U.S.C.	United States Code
USACE	U.S. Army Corps of Engineers
USEPA	U.S. Environmental Protection Agency
UXO	Unexploded Ordnance
XO	Executive Officer

## GLOSSARY OF TERMS

**Base Realignment and Closure (BRAC)** – A Department of Defense (DoD) program that focuses on compliance and cleanup efforts at military installations undergoing closure or re-alignment, as authorized by Congress in four rounds of base closures for 1988, 1991, 1993, and 1995. (DERP Management Guidance, September, 2001)

**Closed Range** – A range that has been taken out of service as a range and that either has been put to new uses that are incompatible with range activities or is not considered by the military to be a potential range area. A closed range is still under the control of a DoD component. (DERP Management Guidance, September, 2001)

**Defense Site** – All locations that are or were owned by, leased to, or otherwise possessed or used by the DoD. The term does not include any operational range, operating storage or manufacturing facility, or facility that is used or was permitted for the treatment or disposal of military munitions. (10 U.S.C. 2710(e)(1))

**Discarded Military Munitions** – Military munitions that have been abandoned without proper disposal or removed from storage in a military magazine or other storage area for the purpose of disposal. The term does not include unexploded ordnance, military munitions that are being held for future use or planned disposal, or military munitions that have been properly disposed consistent with applicable environmental laws and regulations. (10 U.S.C. 2710(e)(2))

**Explosive Ordnance Disposal (EOD)** – The detection, identification, field evaluation, rendering-safe, recovery, and final disposal of unexploded explosive ordnance (UXO). It may also include the rendering-safe and/or disposal of EO (explosive ordnance) which has become hazardous by damage or deterioration, when disposal of such EO requires techniques, procedures, or equipment which exceed the normal requirements for routine disposal. (OPNAVINST 8027.1G, 14 Feb 92)

**Explosives Safety** – A condition where operational capability and readiness, personnel, property, and the environment are protected from the unacceptable effects of an ammunition or explosives mishap. (DoD Directive 6055.9, July, 1996)

**Formerly Used Defense Site (FUDS)** – Real property that was formerly owned by, leased by, possessed by, or otherwise under the jurisdiction of the Secretary of Defense or the Components (including governmental entities that are the legal predecessors of DoD or the Components) and those real properties where accountability rested with DoD, but where activities at the property were conducted by contractors (i.e., government-owned, contractor-operated (GOCO) properties) that were transferred from DoD control prior to October 17, 1986. The status of a site as a FUDS is irrespective of current ownership or current responsibility within the federal government. (DERP Management Guidance, September, 2001)

**Munitions Constituents (MC)** – Any materials originating from unexploded ordnance, discarded military munitions or other military munitions, including explosive and non-explosive materials, and emission, degradation, or breakdown elements of such ordnance or munitions. (10 U.S.C. 2710 (e)(3))

**Munitions and Explosives of Concern (MEC)** – This term, which distinguishes specific categories of military munitions that may pose unique explosives safety risks, means unexploded ordnance, discarded military munitions, or munitions constituents (e.g., TNT, RDX) present in high enough concentrations to pose an explosive hazard. (OUSD (AT&L), 18 December 2003)

**Operational Range** – A range that is under the jurisdiction, custody, or control of the Secretary of Defense and that is used for range activities, or, although not currently being used for range activities, that is still considered by the Secretary to be a range and has not been put to a new use that is incompatible with range activities. (10 U.S.C. 101 (e)(3))

**Other than Operational Range** – This term encompasses closed, transferred, and transferring ranges.

**Range** – A designated land or water area set aside, managed, and used for range activities of the DoD. Ranges include firing lines and positions, maneuver areas, firing lanes, test pads, detonation pads, impact areas, electronic scoring sites, buffer zones with restricted access and exclusionary areas, and airspace areas designated for military use in accordance with regulations and procedures prescribed by the Administrator of the Federal Aviation Administration. (10 U.S.C. 101(e)(3))

**Transferred Range** – A property formerly used as a military range that is no longer under military control and had been leased by the DoD, transferred, or returned from the DoD to another entity, including federal entities. This includes a range that is no longer under military control but was used under the terms of a withdrawal, executive order, special-use permit or authorization, right-of-way, public land order, or other instrument issued by the federal land manager. (DERP Management Guidance, September, 2001)

**Transferring Range** – A range that is proposed to be transferred or returned from the DoD to another entity, including federal entities. This includes a range that is used under the terms of a withdrawal, executive order, act of Congress, special-use permit or authorization, right-of-way, public land order, or other instrument issued by the federal land manager or property owner. An operational or closed range will not be considered a “transferring range” until the transfer is imminent. (DERP Management Guidance, September, 2001)

**Unexploded Ordnance** – Military munitions that have been primed, fused, armed, or otherwise prepared for action; have been fired, dropped, launched, projected, or placed in such a manner as to constitute a hazard to operations, installations, personnel, or material; and remain unexploded either by malfunction, design, or any other cause. (10 U.S.C. 101(e)(5)).

## **EXECUTIVE SUMMARY**

The Department of Defense (DoD) has established the Military Munitions Response Program under the Defense Environmental Restoration Program (DERP) to address munitions and explosives of concern (MEC) (including unexploded ordnance (UXO) and discarded military munitions (DMM)) and munitions constituents (MC) at other than operational military ranges and other sites. Closed, transferred, and transferring military ranges and sites not located on an operational range are considered other than operational. This report addresses other than operational ranges and sites at an active installation. It may include transferring and/or transferred ranges and munition disposal sites associated with an active installation if they are not included in the Base Realignment and Closure (BRAC) or Formerly Used Defense Sites (FUDS) programs.

This report represents a Preliminary Assessment (PA) for the Naval Air Station Brunswick (NASB), located in Cumberland County, Maine. The DoD, United States Navy (Navy), and United States Environmental Protection Agency (USEPA) guidance for conducting and documenting PAs was followed and tailored, where appropriate, to address the unique aspects of MEC and MC.

The Former Munitions Bunker West Area occupied approximately 29 acres and was located west of the runways at the NASB. The undeveloped and relatively open area that serves as a buffer area for the runways was used sporadically in the 1980s to 2000 for munitions-related security training. Blank small arms ammunition, practice grenades, and limited pyrotechnics (simulators and smoke devices) were used during the training. The entire Former Munitions Bunker West Area is a suspected MEC area. However, installation personnel indicated that a procedure was in place to remove debris from the area including munitions related debris (e.g. expended smoke grenade bodies) after the training was conducted. Documentation of this procedure or a listing of munitions related debris removed from the area after training exercises was not available. No MEC or related debris was observed during the site survey. Therefore the potential for MEC at the site is considered extremely low. There is also a low potential for MC (e.g., phosphorus, metals, perchlorate) to remain at the site. However, considering the known frequency of usage,

types of munitions used, and likely volume of items deployed, heavy deposition of MC contamination is not expected.

The former Machine Gun Bore Sight Range was located in the southeast portion of the facility where the current Building 55 (former Recycling Facility) is situated, and extended to a partly open, partly wooded, undeveloped area behind the building. The total area, used to test the accuracy of fixed aircraft guns is approximately 0.3 acres. Part of the range is now covered with a paved road, a paved parking lot, Building 55, and a fenced-in storage area. On several historical maps, the range was labeled as a pistol range. It was not uncommon for machine gun ranges to double as pistol ranges since the infrastructure (e.g. firing line, targets) was already established. Expended machine gun and pistol ammunition is not considered MEC (no explosives safety hazard); however, there is the potential for MC. The primary MC of concern is lead. Other associated MC (less likely to be of concern) may include: antimony, arsenic, nickel, and lead azide. The amount of lead fired into the berm over the period of time the range was active is estimated to be 43 tons. It is unknown if NASB had any procedures in place to remove and dispose of lead as it accumulated on the range when it was active or when the range was abandoned. The ultimate disposition of the berm is unknown. Sampling data was not available to determine if lead is present at the site.

The former Skeet Range occupies approximately 73.2 acres (as shown on historic maps and aerial photos) and was located in an open field, approximately 75 meters north and 100 meters east of Building 55. Lead shot from expended shot gun ammunition is not considered MEC (no explosives safety hazard); however, there is the potential for MC at the site. The primary MC of concern associated with the Skeet Range is lead. Other associated MC (less likely to be of concern) may include: antimony, arsenic, nickel, and lead azide. Sampling data for metals and inorganics in ground water and soil was not available.

## 1. INTRODUCTION

The Department of Defense (DoD) has established the Military Munitions Response Program under the Defense Environmental Restoration Program (DERP) to address munitions and explosives of concern (MEC) (including unexploded ordnance (UXO) and discarded military munitions (DMM)) and munitions constituents (MC) at other than operational military ranges and other sites. Closed, transferred, and transferring military ranges and sites not located on an operational range are considered other than operational. This report addresses other than operational ranges and sites at an active installation. It may include transferring and/or transferred ranges and munition disposal sites associated with an active installation if they are not included in the Base Realignment and Closure (BRAC) or Formerly Used Defense Sites (FUDS) programs.

The DoD and the United States Navy (Navy) are currently establishing policy and guidance for munitions response actions under the Navy Munitions Response Program (MRP). However, key program drivers developed to date conclude that munitions response actions will be conducted under the process outlined in the National Contingency Plan (NCP) [40 Code of Federal Regulations (CFR) 300], as authorized by the Comprehensive Environmental Response, Compensation, and Liability Act of 1980, 42 United States Code (U.S.C.) 9605, and amended by the Superfund Amendments and Reauthorization Act of 1986 (SARA), Pub. L. 99-499, (hereinafter CERCLA). This report represents a Preliminary Assessment (PA) for the Naval Air Station Brunswick (NASB), located in Cumberland County, Maine. The DoD, Navy, and United States Environmental Protection Agency (USEPA) guidance for conducting and documenting PAs were followed and tailored, where appropriate, to address the unique aspects of MEC and MC.

This PA Report is organized into the following sections:

- [Section 1 – Introduction](#)
- [Section 2 – Installation Background](#)
- [Section 3 – Physical and Environmental Characteristics](#)
- [Section 4 – Summary of Data Collection Effort](#)
- [Section 5 – Site Characteristics](#)

The following supporting information is appended to this PA Report:

- References ([Appendix A](#))
- Project Source Data – General ([Appendix B](#))
- Project Source Data – Site Specific ([Appendix C](#))
- Ordnance Technical Data Sheets ([Appendix D](#))

Two interactive compact discs (CDs) are included with the final version of this report. The first CD includes electronic files of the report text, tables, and figures; appendices; and project source data. The second CD includes interactive Geographical Information System (GIS) maps of the installation and sites.

### **1.1. Purpose**

This PA summarizes the history of munitions use for the following former ranges at the NASB: the Former Munitions Bunker West Area, Machine Gun Bore Sight Range, and Skeet Range. The PA provides an assessment of the current conditions with respect to MEC and MC. The PA provides the necessary information for Navy and regulatory decision-makers to: 1) eliminate from further consideration those MEC sites that pose minimal or no threat to public health or the environment; 2) differentiate MEC sites that may not require further munitions response actions from those that will require further investigation and/or munitions response actions; and 3) determine if an imminent explosives safety hazard from MEC is present that warrants an accelerated response action.

### **1.2. Programmatic Framework**

The regulatory structure for managing Navy MRP sites is guided by a complex mixture of federal, state, and local laws, as well as DoD and Navy regulations and guidance, and provides the necessary information for Navy decision makers. The key legislation, policy, and guidance directing the program includes, but is not limited to, the following:

**Defense Environmental Restoration Program (DERP) Management Guidance (September 2001)**

The DERP Management Guidance establishes a MRP element for MEC and MC defense sites. The history of DERP dates back to the SARA of 1986<sup>1</sup>. The scope of the DERP is defined in 10 U.S.C. §2701(b), which states that the: “Goals of the program shall include the following: ... (1) The identification, investigation, research and development, and cleanup of contamination from hazardous substances, and pollutants and contaminants. (2) Correction of other environmental damage (such as detection and disposal of unexploded ordnance) which creates an imminent and substantial endangerment to the public health or welfare or to the environment ...”

**Draft DoD Directive Military Munitions Response Policy on Other Than Operational Ranges**

The Draft DoD Directive 4715.MRP (September 2003 version) states that munitions response will be conducted “in accordance with CERCLA and the National Oil and Hazardous Substances Pollution Contingency Plan (NCP)”.

**National Defense Authorization Act (FY02) (Sections 311-312)**

Sections 311-312 of the National Defense Authorization Act of FY02 reinforced the DoD’s 2001 DERP Management Guidance by tasking the DoD to develop and maintain an inventory of defense sites that are known or suspected to contain MEC and MC. Section 311 requires the DoD to develop a protocol for prioritizing defense sites for response activities in consultation with the states and tribes. Section 312 requires the DoD to create a separate program element to ensure that the DoD can identify and track munitions response funding.

The September 2001 Management Guidance for the DERP and the 2002 National Defense Authorization Act, described above, established the MRP. The DoD provides program guidance and methods for conducting a baseline inventory of defense sites containing, or potentially containing, MEC and/or MC. The Navy baseline inventory of sites was completed in FY 2002 and was used to establish the sites where PAs are needed to further evaluate the potential for MEC and MC.

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<sup>1</sup> SARA was signed into law on October 17, 1986 and amended the CERCLA of 1980, 42 U.S.C. §9601 et seq. Related sections in Title 10 of the U.S.C. (10 U.S.C. §§2702-2710 and §§2810-2811) further define the program.

### **1.3. Project Management**

This PA has been coordinated and managed by the Navy Engineering Field Activity Northeast (EFANE), a component of Naval Facilities Engineering Command (NAVFAC) Atlantic Division. The EFANE performs engineering functions for Navy installations throughout the northeast U.S. and is the Program Manager for this PA. Malcolm Pirnie, Inc. has been contracted to prepare this PA. The division of NAVFAC provides technical guidance and management for environmental projects at (NASB). The Navy Remedial Project Manager (RPM) and the installation point of contact (POC) for NASB provided valuable information and assistance throughout the PA data collection process.

### **1.4. Preliminary Assessment Approach**

The CERCLA implementing guidance, which was prepared for sites contaminated with hazardous substances, describes the PA as a limited-scope investigation based upon existing and available data. However, the guidance also states that the PA process developed under CERCLA is not equally applicable to all sites and all contaminants and that variation from the guidance may be necessary. Sites containing MEC are prime examples of sites where the generic CERCLA process is incomplete. Unique explosives safety issues associated with MEC cannot be assessed solely with the parameters developed for chemical and hazardous waste contaminants. While this PA generally follows CERCLA guidance, certain elements of the report have been tailored to address the unique explosives safety aspects of MEC.

The PA process for each of the sites involves collecting and reviewing existing and available information about the site. Data collection activities included off-site and on-site research and interviews. It also included a visual survey to assess physical evidence that might indicate the presence of MEC (e.g., discarded munitions items, ordnance penetration holes, and/or scarred trees) and MC (e.g.; ground scarring, stressed vegetation, and/or chemical residue) at the site. The Malcolm Pirnie data collection team conducted the on-site portion of the data collection and visual survey in January 2003. However, due to significant snow cover, the visual survey of the three areas was not conducted until May 2003.

This PA is inclusive and makes use of all available data relating to munitions use at the NASB, including historical records, field data, anecdotal evidence, interviews with site personnel, and professional knowledge and experience. It is based, in part, on information provided in

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documents referenced in [Appendix A](#) and is subject to the limitations and qualifications presented in the referenced documents.

## 2. INSTALLATION BACKGROUND

The NASB sits on approximately 3,200 acres in Brunswick, Cumberland County, Maine. It is the last active duty DoD airfield remaining in the northeastern U.S. The NASB is home to three active duty and two reserve squadrons and 29 tenant commands. The installation is one of Maine's largest employers with over 4,800 military and civilian personnel. Reserve Navy air units bring many more sailors to the station during the summer annual cruise months. The NASB also provides support for other Navy units in Maine, including the Navy ships at Bath, the Navy Security Group at Winter Harbor, the U.S. Naval Radio Station at Cutler, the U.S. Naval Survival School at Rangeley, and the Department of Naval Sciences at the Maine Maritime Academy at Castine. An aerial view of NAS Brunswick is shown in [Figure 2.1-1](#).

The following sections provide general information about NASB, including its location and setting; a brief history of the installation; its missions over time; and a history of munitions related training, storage, and usage.

### 2.1. Location and Setting

The NASB is located in Brunswick, approximately 25 miles northeast of Portland, Maine. The installation is located just south of U.S. Route 1, approximately two miles east of Brunswick's main business district five miles inland from the Atlantic Ocean (see [Figure 2.1-2](#)). This proximity to the ocean is a major influence on the climate and ecology at the NASB.



**Figure 2.1-1: Aerial view of NAS Brunswick**

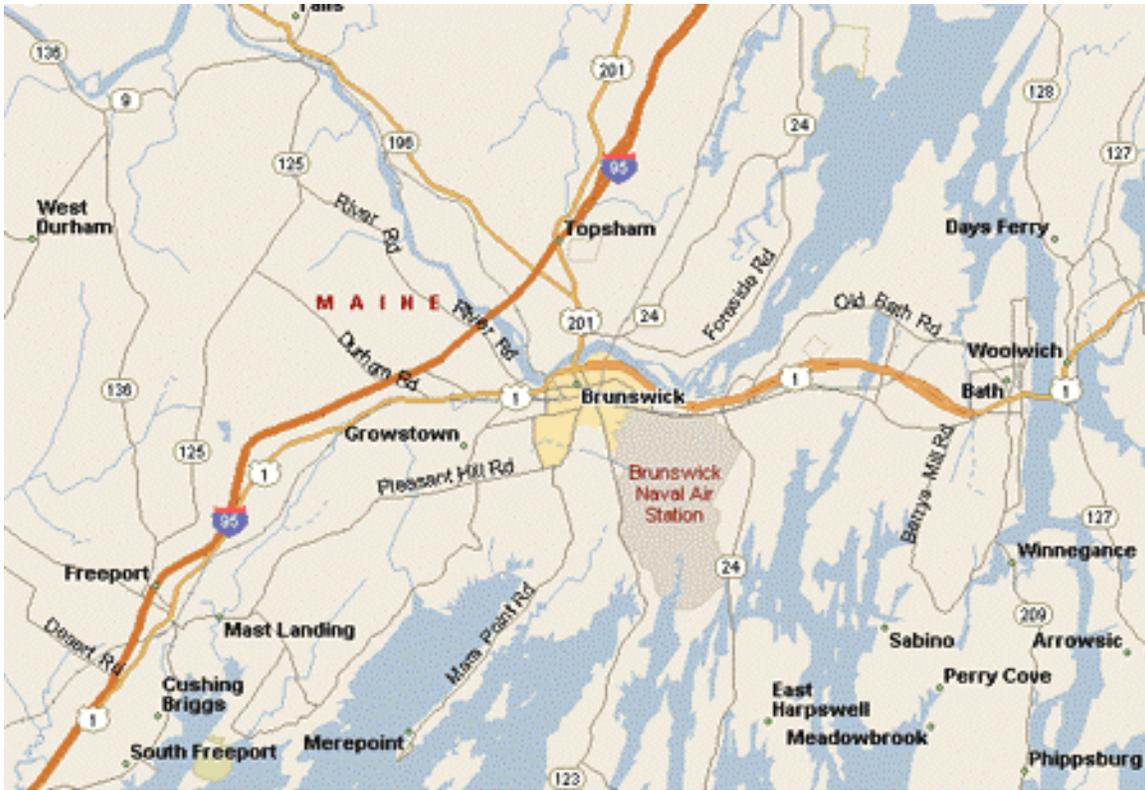


Figure 2.1-2: General Location of NAS Brunswick

[Map 2.1-1](#) provides a topographic map that shows the general layout of the installation, as well as the locations of the sites discussed in this PA report.

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**MALCOLM  
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**Map 2.1-1  
Area Location Map**

**Legend**

-  Installation Boundary
-  Ranges



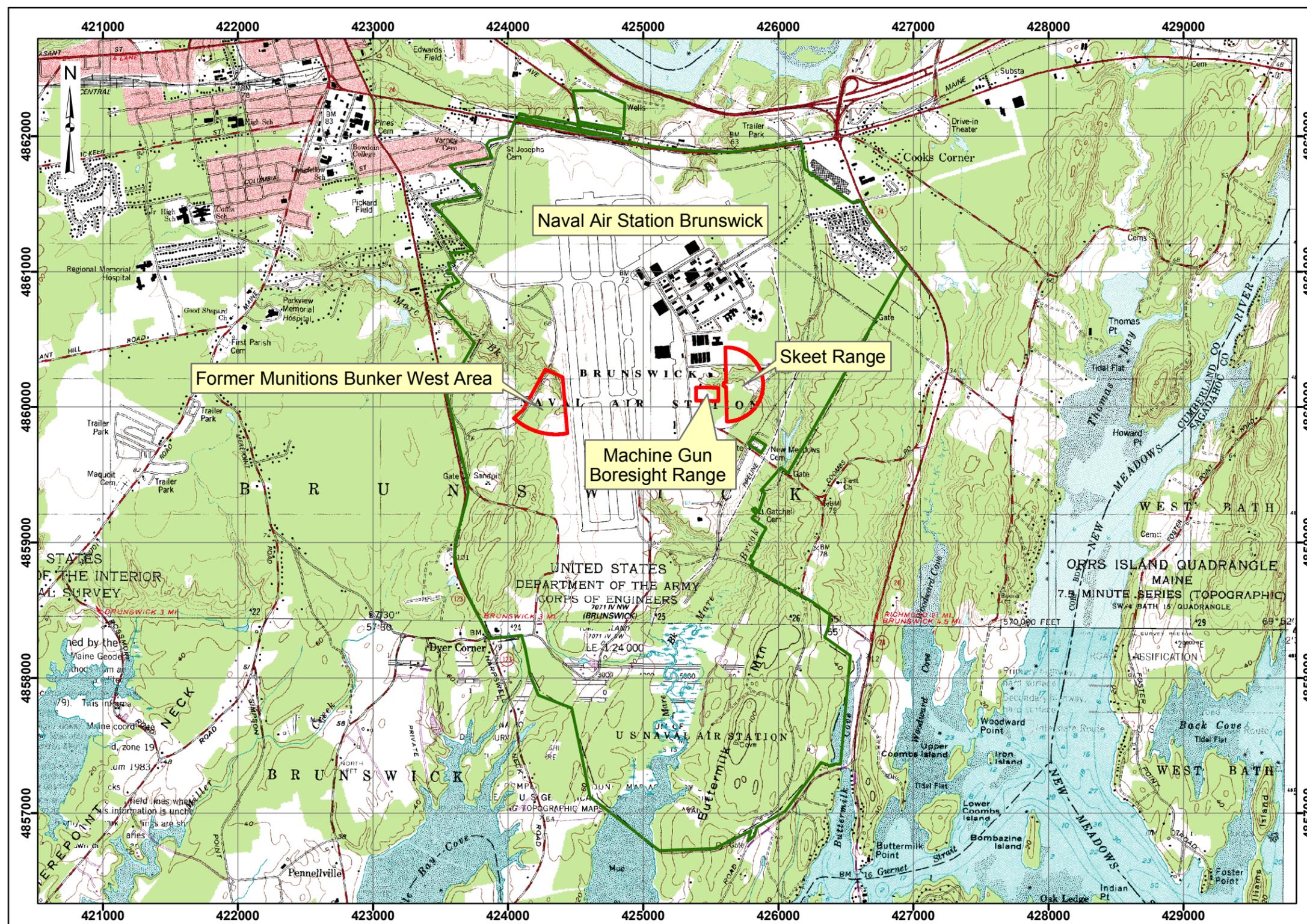
Data Source: USGS 7.5 Minute Series  
Topographic Survey Map  
Brunswick, ME, 1980  
Orrs Island, ME, 1978

Coordinate System: UTM Zone 19N  
Datum: NAD 83  
Units: Meters

Contract: N62472-02-D-1300  
Edition: Final Preliminary Assessment  
Date: February 2006

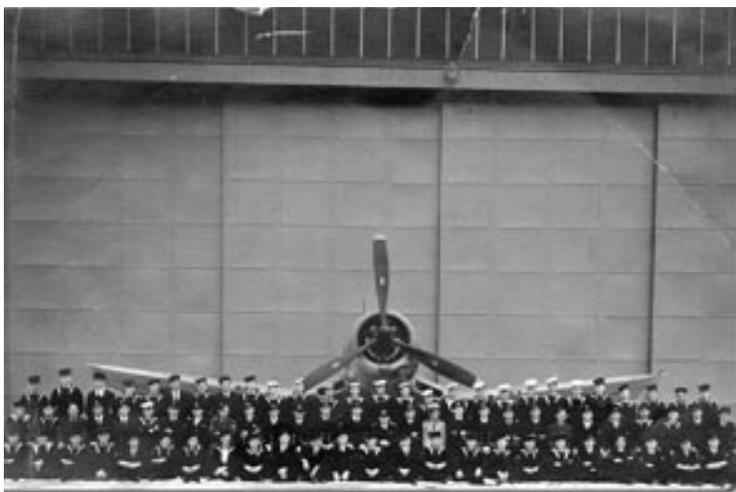


Naval Air Station Brunswick, Maine



## 2.2. Installation History

The installation, which encompasses 1,487 acres, was originally constructed and occupied in March 1943 with the primary mission of training British Naval Command (Royal Canadian Air Force) pilots. The station carried out a secondary mission of anti-submarine warfare during World War II.



**Figure 2.2-1: Chance Vought F4U-1 Corsair**

The first U.S. squadron to arrive at the NASB was an air scouting

squadron. When the squadron began operations, the station consisted of only a half-mile of runway, and had no hangars or operations tower. When the Royal Canadian Air Force crews arrived, construction was still underway on the runways and various other parts of the station. Over the next few years, the station experienced tremendous growth and expansion of available facilities and infrastructure. An early squadron pictured with a Chance-Vought F4U-1 Corsair is shown in [Figure 2.2-1](#). At the height of its wartime operations, the station was supporting three auxiliary landing fields: one at Sanford, one at Lewiston, and one at Rockland, Maine.

In October 1946 the installation was deactivated and the land and buildings were leased jointly to the University of Maine and Bowdoin College as annexes to ease the over-crowded conditions caused by the G.I. Bill student influx.

The University of Maine and Bowdoin College terminated their leases in 1949, and the station was taken over by the Brunswick Flying Service. At this time, the buildings that had housed military personnel and equipment were put to other uses. Hanger one was converted to a skating rink; hanger two and the operations tower were used for a civilian flying school; hanger three housed automobiles; ammunition magazines became mushroom farms; and shrubbery nurseries graced the northern boundaries of the station.

## FINAL PRELIMINARY ASSESSMENT

Following this period of caretaker status, the station was selected by the Navy as a prime center for development. During the development period, the U.S. Air Force reached an agreement with the Navy authorizing the construction of an Air Force Control and Warning Facility on the station, as a part of the continental circumferential radar screen.

The station was re-commissioned in March 1951 as a Naval Air Facility with the mission of supporting three land-plane patrol squadrons and one fleet aircraft service squadron, and a planned future mission as a master jet base. The station retained the mission of anti-submarine warfare. In December 1950, The Navy requested funds from Congress to be used for this master jet project. Such a base required dual 8,000-foot runways and two outlying fields: one for gunnery and one for carrier practice landings. In addition, the Secretary of Defense submitted a request to Congress for approximately \$20,000,000 in June 1951. This money was to be used for additional barracks, officers' quarters, and enlisted men's clubs; control tower, storage, and communication buildings; and new galleys and mess facilities. The new buildings and facilities would make the station a permanent installation in Brunswick.

Following the reactivation period, several new permanent facilities were erected to replace the World War II "temporary" buildings. New facilities included a modern operations tower, three-deck barracks, and a large mess hall. In addition to these facilities, a new enlisted men's club, Navy Exchange, and Bachelor Officers' Quarters were constructed.

In December 1951 the Naval Air Facility was officially changed to the designation of Naval Air Station and the Arctic Survival Training School was established in September 1956 for members deploying to the Arctic in north country survival.

In order to practice rocket and bombing training, the Navy acquired by condemnation Seal Island in 1958. Bombing and rocket training continued through the early 1960s along with anti-submarine warfare training. Units trained at the NASB served in action during the Lebanon crises in the Fall of 1958, when squadrons of Fleet Air Wing Three provided anti-submarine protection for the Sixth Fleet, then operating in the Mediterranean Sea. Also in 1958, a small detachment of U.S. Marines of the 2nd Marine Division from Camp Lejeune, North Carolina was assigned to the NASB.

In March 1959, the U.S. Marine detachment became the Marine Barracks of the NASB. The Marine Barracks eventually assumed full surveillance of the entrances from the civilian security police.

The Navy declared Seal Island excess property in 1965 and began to transfer the island to the National Park Service (Department of Interior) through the General Services Administration. The transfer was completed sometime after 1972. Today, Seal Island is in the FUDS program managed by the U.S. Army Corps of Engineers (USACE).

In the late 1990s the base consolidation efforts caused the demolition of over 40-year old surplus buildings around the installation. For over 40 years, six squadrons (Patrol Squadron 8, 10, 11, 23, 26, and 44) were based at the NASB. The BRAC process instigated the decommissioning of three squadrons (Patroller Squadron 11, 23, and 44) and reserve squadrons VP-92 and VR-62 moved up from NAS South Weymouth.

<b>Table 2.2-1: Historical Summary of NASB</b>	
1943	The installation is constructed and occupied with its primary mission to train the British Naval Command pilots.
1946	The installation is deactivated and leased by the University of Maine and Bowdoin College.
1949	The installation is taken over by the Brunswick Flying Service.
1951	The installation is recommissioned and officially designated as the Naval Air Station Brunswick.
1956	The Artic Survival Training School is established at NASB.
1958	The Navy acquires Seal Island for use in bombing, rocket, and anti-submarine warfare training.
1972	Seal Island is declared excess property (1965) and transferred to the National Park Service (Department of Interior)

### **2.3. Munitions Related Training / Storage / Usage**

Throughout its history, NASB stored, trained with, and used all types of Naval munitions including aircraft cannon, depth charges, bombs, rockets, hand grenades, torpedoes, sea mines, small arms, and pyrotechnics. Archival records from 1943 list the explosives magazine storage requirements for the NASB as follows:

- 10 High explosive magazines – 20’ x 50’ each
- 1 Incendiary magazine – 20’ x 50’

- 3 Fuze and detonator magazines – 10’ x 10’ each
- 2 Small arms magazines – 20’ x 50’ each
- 1 Pyrotechnic magazine – 20’ x 20’
- 6 Inert magazines – 40’ x 100’ each
- 1 Torpedo magazine – 25’ x 50’

The magazines were capable of holding thousands of pounds of explosives. Over the years, the magazines were relocated due to explosives safety requirements associated with their close proximity to the runways.

**Table 2.3-1** below lists the types of munitions stored at NASB from 1943 to 1946.

Table 2.3-1: Munitions Types Historically Stored at NASB	
Aircraft Cannon Ammunition	20 mm tracer and practice
Depth Charges	Mark (Mk) 3 Mk 24 Mk 33 Mk 37 Mk 38 Mk 49 Mk 54
Bombs	Army Navy (AN) – Mk1 AN-Mk12 Mod 2 Mk 17 (325 lbs) Mk 23 (miniature practice) AN-Mk 35 AN-Mk 41 (325 lbs) AN-Mk 47 (350 lbs) AN-M 30 AN-Mk 64 Mk-65 (practice) 500 lbs water filled
Rockets (2.25-inch)	Mk 11 Mod 0 Mk 11 Mod 1 Mk 7 Mk 2 Mod 3
Hand Grenades	AN-Mk 8 (HC – smoke) Mk 1 Mod 0 smoke grenades
Small Arms	.22 caliber .30 caliber .38 caliber .45 caliber .50 caliber 12 gauge shot gun
Miscellaneous Smoke and Pyrotechnics	Mk 1 smoke pots

Table 2.3-1: Munitions Types Historically Stored at NASB	
	FS smoke drums Float light – Mk 5 Mod 1 Float light – Mk 6 Mod 2 Distress signal AN-M75 (red)
Signal Aircraft Cartridges	Mk 1 Mod 0 Mk 2 (red and green star) Mk 4 Mk-AN-M30 Mk 3 Mod 3 Mk-AN-37 Mk-AN-M38 Mk-AN-M39 Mk-AN-M40 Mk-AN-M41 Mk-AN-M42

This PA focuses on three former ranges in the Navy’s MMRP associated with the history of the NASB. A short description of each range is provided below.

Former Munitions Bunker West Area – This range occupied approximately 29 acres and was located west of the runways at the NASB. The undeveloped and relatively open area that serves as a buffer area for the runways was used sporadically in the 1980s to 2000 for munitions-related security training. Blank small arms ammunition, practice grenades, and limited pyrotechnics (simulators and smoke devices) were used during the training. This area is addressed further in [Section 5.1](#) of this report.

Machine Gun Bore Sight Range – The former Machine Gun Bore Sight Range was located in the southeast portion of the facility where the current Building 55 (former Recycling Facility) is situated (just off Orion Street), and extending to a partly open, partly wooded undeveloped area behind the building. The former range encompasses approximately 0.3 acres from the firing line to the berm with a safety danger zone (SDZ) of 1029.4 acres and was used as a Bore Sight range during the 1950s. Part of the range is now covered with a paved road, a paved parking lot, Building 55, and a fenced-in storage area. This range is addressed further in [Section 5.2](#) of this report.

Skeet Range – The former Skeet Range occupied approximately 73.2 acres and is located in an open field approximately 75 meters north and 100 meters east of Building 55. This range is addressed further in [Section 5.3](#) of this report.

### 3. PHYSICAL AND ENVIRONMENTAL CHARACTERISTICS

The following sections provide general information for NASB, including its climate, topography, geology, soil and vegetation types, hydrology, hydrogeology, cultural and natural resources, and endangered species.

#### 3.1. Climate

The State of Maine is divided into three major climatic divisions. The NASB is located in the Coastal Division, which is strongly influenced by its proximity to the Atlantic Ocean to the east and the White Mountains to the northwest. The Atlantic Ocean moderates extremes in temperature and increases the amount of precipitation received by the area. The White Mountains keep considerable snow from reaching the area from the northwest and also moderate the temperature. Information obtained from the National Climatic Data Center (NCDC) station in Portland, Maine (approximately 25 miles southwest of Brunswick) provides representative climatic data for the area in which NASB is located.

Average temperatures range from 20.8 degrees Fahrenheit (F) in January to 68.6 F in July, with an annual average of 45.4 F. Mean daily maximum and minimum temperatures of 78.8 F in July and 12.4 F in January, respectively, have been recorded. In January, the mean daily maximum is 30.6 F. During extreme conditions, a daily maximum of 99 F in July and a daily minimum of -26 F in January have been recorded. There are, on average, 13 days of zero or subzero temperatures a year.

The annual average precipitation recorded is 44.34 inches, with monthly average peaks as high as 5.17 inches in the fall and as low as 2.87 inches in the summer. The annual average relative humidity ranges between 65 and 77 percent. The mean seasonal snowfall is 70.9 inches. Because of the proximity to the Atlantic Ocean, winter precipitation in southern mid-coastal Maine is often in the form of rain or wet snow. Fog occurs frequently along the Maine coast at all times during the year except in winter. On average, there are 57 days with heavy fog, defined as visibility less than one-fourth of a mile. Possible sunshine ranges from 48 percent in November to 64 percent in August; the yearly percent of possible sunshine is 57 percent.

Prevailing winds are from the south from April to September, from the north in November and December, and from the west to northwest for the remainder of the year. The annual average wind speed is approximately 9 miles per hour (mph), with monthly average wind speeds not varying considerably (7.7 mph in the summer to 10.1 mph in the spring). Strong winds in the winter, generated by coastal storms, can produce abnormally high wind-driven tides. Regional diurnal and seasonal variations may moderately influence the wind directions and wind speeds at the site.

### **3.2. Topography**

In the developed portion of the installation, the topography has been altered so that the area is relatively level. Elevations in this area range from 60 to 75 feet above mean sea level. In the undeveloped portions of the NASB, the slopes vary between 0 and 15 percent. Slopes between zero and three percent are typical for most of the installation. Slopes between three and eight percent are common in the southern and western margins of the installation. The steeper slopes occur primarily along stream banks and are isolated occurrences on hills that generally have more gentle slopes. The highest elevations at NASB occur in the southeast and southwest portions of the installation. A northeast trending ridge with an elevation of approximately 120 feet occurs near Dyer Corner. A more extensive ridge, Buttermilk Mountain, occurs northeast of Harpswell Cove. At the southern boundary of the installation at the Harpswell Cove shoreline, the elevation is at sea level. However, elevations rise rapidly to 60 feet. Elevations on most of the installation range between 40 and 80 feet above mean sea level.

### **3.3. Geology**

The geology of the area around NASB is characterized by two primary components: unconsolidated sediments and Paleozoic bedrock. The surficial unconsolidated sediments are mapped as the Presumpscot Formation, which is composed of sediments that washed out of the Late Wisconsinian glacier. Relatively flat to gently sloping topography with a branching network of steep-walled stream gullies are characteristic of areas underlain by this formation. As a result of glacial recession and sea level advances and retreats, the Pleistocene sediments of the area are extremely variable. The Presumpscot Formation is composed of silt, clay, and sand, and is fossiliferous at some locations. The unit found at NASB is largely sand that may be underlain by silt and clay in some locations.

The predominant bedrock type at NASB is the Cape Elizabeth Formation. This formation underlies all but the northwestern third of the facility. The other bedrock type found at NASB is the Cushing Formation, which is the base unit in the Casco Bay Group. Both bedrock formations at the installation are characterized by very limited primary porosity, generally in the saprolite or weathered zone. Secondary porosity results from structurally controlled fractures and foliations or planes of schistosity. The principle direction of such structures at the installation is a northeast strike and a southeast dip.

### **3.4. Soil and Vegetation Types**

The U.S. Department of Agriculture, Soil Conservation Service soil survey for Cumberland County, Maine (SCS, 1974) shows soils in the vicinity of the NASB as belonging to the Windsor-Hinckley-Deerfield Association. These soils are described as deep, excessively drained to moderately well drained, nearly level to steep, and course textured. They occur on bottomlands, glacial terraces, outwash plains, and a few hills and ridges. The major soils in the association are rapidly permeable with a seasonal high water table.

Terrestrial vegetation in the underdeveloped sections of NASB consists predominately of woodland species. The individual stand compositions are the result of a combination of natural seeding, forest management, and planting. Because the NASB's forest management program established timber stands suited to conditions at the installation, the forest contains the species typical of the New England coastal area. Differences in species composition generally coincide with differences in soil and physiographic conditions. The majority of NASB's trees are conifers (white pine, pitch pine, hemlock, spruce, and fir) with lesser numbers of hardwoods (oak, maple, ash, poplar, and birch).

### **3.5. Hydrology**

Surface water from NASB ultimately flows to nearby wetlands or to Mere Brook. Due to the developed nature of the operations, cantonment, and housing areas at the installation, most of the natural drainage is directed to the storm sewer system.

The NASB is included in four major drainage basins: the Androscoggin River, Mere Brook, Middle Bay Cove, and Buttermilk Cove. Approximately 74 percent of NASB is in the Mere Brook–Harpwell Cove watershed. Mere Brook enters NASB at the northwestern boundary and

flows in its natural stream bed for approximately one-half mile. Mere Brook flows under the runways and through the weapons area. Mere Brook joins a number of other very small, intermittent streams to form Merriconeag Stream, which is the stream entering Harpswell Cove at the head of the cove. Merriconeag Stream is tidal and its channel is wide and bordered by extensive tidal flats. The stream is tidally influenced.

The Androscoggin River is the major surface water body in the Brunswick area. It is one of the three major rivers that empty into the Atlantic Ocean on the Maine coast; the Kennebec River and the Penobscot River are the others. Portions of Brunswick are located in the lower Androscoggin River Basin. The Androscoggin River flows to the east along the northern boundary of Brunswick and forms the boundary between Cumberland and Sagadahoc Counties. At the closest point, the Androscoggin River is approximately 3,000 feet from the northern boundary of NASB. Approximately 13 percent of NASB is in the Androscoggin watershed. The Middle Bay Cove watershed includes about 4 percent of NASB. Middle Bay Cove is separated from Harpswell Cove by a northeast-trending ridge. Approximately 9 percent of NASB is in the Buttermilk Cove watershed.

### **3.6. Hydrogeology**

Groundwater in the Brunswick area occurs both in unconsolidated sediments and in underlying bedrock. Groundwater is used as the municipal water supply in the residential area north of NASB and also supplies those areas not connected to public water. The most productive aquifers in the area are the unconsolidated sand and gravel aquifers. The specific units are discontinuous and are obscured by development in some areas. However, it appears that glacial outwash sands are the most common unconsolidated material. Drillers' logs for test borings and water wells on and near NASB show that the most common sequence encountered includes glacial outwash of variable (5 to 90 feet) thickness overlying marine clays (Presumpscot Formation). Well information indicates that the bedrock beneath NASB produces limited quantities of groundwater. The yield of bedrock wells in the vicinity of NASB ranges from less than 10 gallons per minute (gpm) to over 50 gpm. Most of the wells in the vicinity are between 101 and 300 feet deep.

### **3.7. Cultural and Natural Resources**

The area in which NASB is located falls under the protection of the Maine Department of the Environment's Coastal Zone Management Program which incorporates regulations regarding

development and use of the coastal zone (i.e., point-source discharges, land use, solid waste management, air quality, stream alteration, and spill prevention and control).

**3.8. Endangered and Special Status Species**

Protected species that are known to, or have the potential to, inhabit NASB are listed in the following table:

Table 3.8-1: Summary of Known or Potential Protected Species	
Ecological Receptors	Species
Federal Endangered	None listed
Federal Threatened	<i>Haliaeetus leucocephalus</i> (Bald eagle)
State Endangered	<i>Carex vestita</i> (Clothed sedge) <i>Ammodramus savannarum</i> (Grasshopper sparrow)
State Threatened	<i>Bartramia longicauda</i> (Upland sandpiper) <i>Haliaeetus leucocephalus</i> (Bald eagle)

One State endangered bird species, the grasshopper sparrow (*Ammodramus savannarum*), and one State threatened bird species, the upland sandpiper (*Bartramia longicauda*), may exist in the grassland habitat on NASB. The grasshopper sparrow is a small, chunky sparrow that inhabits open grassy and weedy meadows, pastures, and plains. The upland sandpiper is a pigeon-sized bird that inhabits open grassland, prairies, and hayfields in breeding season and open country during migration. The State and Federally listed (threatened) bald eagle (*Haliaeetus leucocephalus*) may inhabit the area around the lakes, rivers, marshes, and seacoasts. They may occasionally be found over-wintering in the vicinity of the NASB. As documented in the *Integrated Natural Resources Management Plan*, one State endangered plant species, the clothed sedge (*Carex vestita*), may occur on the installation. The clothed sedge exists in dry, semi-open conditions and may exist in the grassland habitat at the site. It is a low-growing, herbaceous, grass-like plant. Artificial areas that are routinely cut, such as under electric power lines, often provide suitable habitat. Persistence of the clothed sedge can be compatible with such maintenance, but maintenance activities require planning with the species in mind.

## 4. SUMMARY OF DATA COLLECTION EFFORT

Five primary sources of information were researched as part of the data collection effort for this PA. The sources of data included:

- 1) Historical archives;
- 2) Personal interviews;
- 3) Installation data repositories;
- 4) Visual survey observations; and
- 5) Off-site data sources and repositories, such as local libraries and museums.

These five sources of data are discussed below, along with their relative application to this PA.

### 4.1. Historical Archive Repositories (off-site)

The data collection team reviewed archival records located at the National Archives in College Park, Maryland and Washington, DC, as well as records located at the Naval Historical Center in Washington, DC and regional archives at the National Archives in College Park, Maryland; and Suitland Park, Maryland.. The data collection team researched the following records and record groups (RG) for documents relating to munitions usage at NASB. An asterisk (\*) indicates the material was photocopied.

#### **Textual Records**

RG 71, Bureau of Yards and Docks

Naval Property Case Files, Boxes 511-519

RG 72, Bureau of Aeronautics: [NA116]

Entry 62-B, General Correspondence, 1943-1945, Boxes 2937, 2974, 2994, 2998, 3003, 3009, 3050, 3075, 3411

Entry 62-B, General Correspondence, 1946-1947

Entry 62-B, Unclassified General Correspondence, 1948-1949, Box 456

Entry 62-B, Unclassified General Correspondence, 1950, Box 231

Entry 62-B, Unclassified General Correspondence, 1951, Box 203

Entry 62-B, Unclassified General Correspondence, 1953, Box 281

Entry 62-B, Unclassified General Correspondence, 1954, Box 201

Entry 62-B, Unclassified General Correspondence, 1955, Box 200

Entry 62-B, Unclassified General Correspondence, 1956, Box 190

Entry 62-B, Unclassified General Correspondence, 1957, Box 196

Entry 62-B, Unclassified General Correspondence, 1958, Box 151

Entry 62-B, Unclassified General Correspondence, 1959, Box 142

RG 74, Bureau of Ordnance: [NA116]

General Correspondence, 1943--Restricted, Box 476

General Correspondence, 1944--Confidential, Box 507

General Correspondence, 1944--Restricted, Box 846

General Correspondence 1945, Box 1216

General Correspondence 1946, Box 263

### **Cartographic Records**

RG 71, Bureau of Yards and Docks

Maps for facility 123, codes 1, 2, 3, 15, 16, 32, 34, 42, 44-48

Series II Index

Series II Microfilm, Reels 110, 111, 1314

RG 385, Naval Facilities and Engineering Command, 1917-1989

Architectural and Engineering Plans, Boxes 237-239

### **Aerial Photos**

Can # ON 006229—IM 10199153

Can # ON 006230—IM 10199152

Can # ON 009065—IM 10197919

Can # ON 017355—IM 153922229

Can # ON 017439—IM 153922918

Range specific notes on the archives records search are described below:

Former Munitions Bunker West Area: The archive records listed above did not provide any information specifically associated with the munitions-related security training conducted at the Former Munitions Bunker West Area. National Archives records generally date from the 1920s through the 1960s. However, the Former Munitions Bunker West Area was actively used for munitions-related training after 1980. The archival data, however, does provide valuable information about the history of the site, including the layout of the area over time and the location and number of structures and improvements in the area, including the munitions storage bunkers that were abandoned.

Machine Gun Bore Sight Range: Several archive maps from the 1950s and an aerial photo from 1957 provided specific information on the location and layout of this range.

Skeet Range: Several archive maps from the 1950s and an aerial photo from 1957 provided specific information on the location and layout of this range.

## **4.2. Personal Interviews**

The data collection team visited the following offices located on the NASB to interview representatives and research records related to the munitions-related activities associated with the three former ranges covered in this report:

- Environmental Department
- Security Department
- Fire Department
- Safety Office
- U.S. Marine Corps Reserve Center
- Weapons
- Public Affairs Office

A summary of the personnel interviewed and general information obtained from each office is presented below.

**Environmental Department** – The Environmental Department manages environmental related studies and activities conducted on the installation. The data collection team interviewed the

Installation Restoration Program (IRP) manager, Mr. Anthony Williams. He provided the team access to various environmental documents and studies conducted throughout various areas of NASB. Mr. Williams was the primary POC for the Navy range inventory and the data collection portion of the PA. Mr. Williams provided the team with electronic map files for the NASB.

**Security Department** – The Security Department controls access to portions of the installation that are restricted, including the area of the Former Munitions Bunker West Area. The Security Department was contacted because of their experience with patrolling the area of the Former Munitions Bunker West Area. The data collection team interviewed the Deputy Security Officer, Lieutenant Commander (LCDR) Jo McCabe. LCDR McCabe had no specific knowledge or information relating to the former ranges. However, LCDR McCabe did indicate that the former Munitions Bunker West Area site was located in a controlled access area of the installation and was subject to 24 hour security patrols and that no munitions related finding or reports have been filed through the Security Office.

**Fire Department** – Fire Department personnel typically are the first responders to installation emergencies and should have records of munitions related emergencies (if any). The Fire Department personnel did not have any specific knowledge or information about any of the former ranges and did not have any records of munitions-related emergency responses conducted in the areas.

**Safety Office** – The Safety Office is responsible for explosives safety issues on the installation. They were contacted to see if any records existed about the three former ranges of interest. The data collection team interviewed the Explosive Safety Officer, Mr. Melvin Tardie. He did not have any knowledge or information about the former ranges.

**U.S. Marine Corps Reserve Center** – The Marine Corps Reserve Unit was the organization that conducted training exercises within the Former Munitions Bunker West Area. They were contacted regarding the types of training conducted on the installation. The data collection team interviewed Major Jason Climer, Gunnery Sergeant Masters, and Staff Sergeant Coleman. They provided specific information on the types of munitions-related security training conducted at the

Former Munitions Bunker West Area including the types of training, types of munitions used, and frequency of training.

**Weapons** – The data collection team interviewed the Weapons Officer, Lieutenant Tom Behne. He did not have any specific knowledge of munitions training on the former ranges.

**Public Affairs Office (PAO)** - The PAO typically has information and news regarding the history of an installation, including reports and stories released to the public. The data collection team interviewed the PAO Officer, Mr. John James, who also serves as the installation historian. He provided valuable information about the history of the NASB as well as historical documents and summaries and historical maps.

In addition to the offices listed above, the data collection team also interviewed two former Executive Officers (XO) of the NASB: Retired Commander (CDR) Bill Locke and retired CDR Donald McKissock. The retired XOs provided general information on the history of the installation but did not have specific knowledge of the former ranges covered in this PA. The team also contacted the Explosive Ordnance Disposal (EOD) Mobile Unit Two in Newport, Rhode Island for a phone interview to obtain information on EOD responses on the NASB. EOD Mobile Unit Two did not have any records of munitions responses associate with the former ranges.

### **4.3. On-Site Data Repositories**

The data collection team reviewed documents from the offices interviewed. There were no separate or range specific on-site data repositories for archival range records at the installation.

### **4.4. Visual Survey**

The data collection team conducted a visual survey of each site/range as part of the data collection effort for the PA. The purpose of the visual survey was to identify MEC and ordnance related materials (e.g., expended rounds, fragmentation, range debris, and/or old targets), evidence of MC (e.g., ground scarring, stressed vegetation, and/or chemical residue), and/or surface features (e.g., firing points, targets, and/or buildings) that could provide additional

information to aid in the characterization of the site. The visual survey was also used to enhance, augment, or confirm the archival data and, in some cases, provide new data to the team. A description of the areas surveyed and the results of the survey are provided in [Section 5](#).

#### **4.5. Off-Site Data Sources**

The data collection team visited the Curtis Memorial Library and the Pejepscot Historical Society Museum located in Brunswick, Maine to gather additional information. Neither repository had any information related to munitions training associated with the installation.

## 5. SITE CHARACTERISTICS

The following sections provide site-specific information about the three PA sites located at NASB, that are the focus of this PA report, including history and site description, land use, access controls and restrictions, visual survey observations and results, contaminant migration routes, and potential receptors.

### 5.1. FORMER MUNITIONS BUNKER WEST AREA

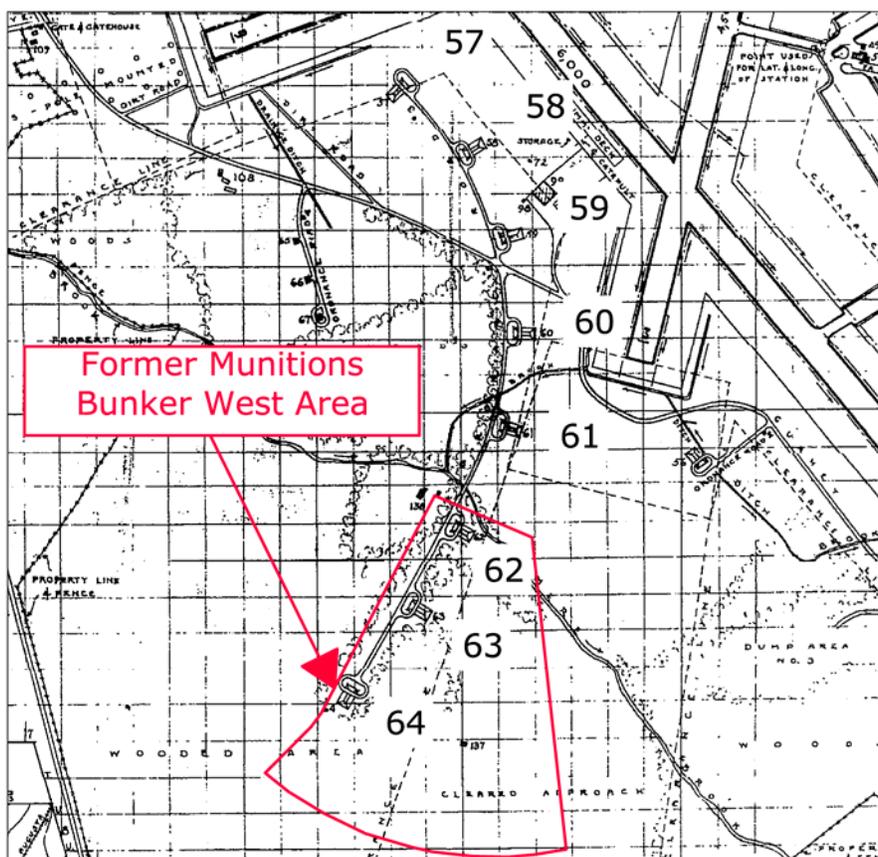
#### *5.1.1. History and Site Description*

Between 1980 and 2000, U.S. Marines stationed at the installation used the Former Munitions Bunker West Area sporadically to conduct munitions-related security training. Blank small arms ammunition, practice grenades, and limited pyrotechnics (simulators and smoke devices) were used during the training. Reportedly, sweeps of the areas where training took place were conducted following each training exercise. The types of munitions used during the training have quantity distance explosives safety separation distances in the range of a few meters and thereby would not pose an explosives safety hazard to runways operations, the current storage magazines south of the site, or the nearby local population. The site was never formally established as a range at the NASB; however, it was determined to be an MRP eligible site during the investigation phase of this PA.

The Former Munitions Bunker West Area was so named because former munitions bunkers were located on the site and because the area is located on the west side of the runways. The area used for munitions-related training is approximately 29 acres. As shown on [Map 5.1-1](#) (located at the end of Section 5.1), the area is roughly bordered by a section of the inner electronic deer fence that surrounds the runways to the east, Mere Brook to the north, the outer perimeter fence that follows along the installation boundary to the west, and the munitions bunkers road to the south. The site is accessible via a perimeter road located around the runways. A portion of the perimeter road, referred to as Ordnance Road, bisects the site.

The Former Munitions Bunker West Area has been part of the buffer area for the runways dating back to 1943 with only minimal other uses over the years. According to a 1946 historical map, eight storage bunkers were located along a perimeter road; however, only three of these bunkers

were located within the Former Munitions Bunker West Area ([Figure 5.1-1](#)). Two of these bunkers housed high explosives (numbers 62 and 63) and one housed incendiary materials (number 64). The remaining bunkers, numbers 57 through 61, lie north of the site and were historically used to house high explosives. According to a February 22, 1943 memo, the bunkers were earth-covered, corrugated steel, arc-type structures with concrete floors and each had a capacity of 115,000 pounds. When the installation went into caretaker status in 1946, the bunkers were emptied and abandoned in place. The area was then used by locals to farm mushrooms.



**Figure 5.1-1: Storage bunkers located near the Former Munitions Bunker West Area**

After the installation was re-commissioned in 1951, the bunkers were reused for explosives storage until the mid-1950s when they were abandoned in place a second time. New bunkers were built south of the area to provide a greater separation distance from the runways to meet the increased explosives safety distance requirements. In the late 1950's and early 1960's, bunkers 57 through 62 were demolished. Bunkers 63 and 64 (within the Former Munitions Bunker West Area) remain empty and abandoned.

Currently, the site remains a buffer area for the runways and also provides a buffer area for the current magazines. The close proximity to the runways, residential and commercial buildings, and the current magazines made the site impractical to use as a formal range for significant live-fire munitions training or related uses.

According to installation personnel, the area will continue to be used as a controlled access buffer area for the runways. Since 2000, munitions-related training has not been, and will no longer be, conducted at the site. The site remains undeveloped with the exception of a perimeter road, which goes through the general area. Installation personnel indicated that improvements planned for or near the site include a small communications or radar-type structure to support the runway operations. The tower will be located approximately ½-mile northwest of the Site.

#### **5.1.1.1. Topography**

The topography of the Former Munitions Bunker West Area is relatively flat to gently rolling. However, the northern border of the site (Mere Creek) has a relatively steep cut bank.

#### **5.1.1.2. Geology**

Site-specific geology of the former range area is unknown. There are no monitoring wells within the area; therefore, soil boring logs were not available. A general description of the geology associated with the area around NASB is included in [Section 3.3](#).

#### **5.1.1.3. Soil and Vegetation Types**

The soils associated with the Former Munitions Bunker West Area are from the Suffield-Buxton-Hollis Association. This association consists of deep to shallow, moderately well drained to somewhat poorly drained soils that are characterized by low permeability.

The vegetation of the area is characterized by both forested and marsh areas. Tree species include conifers (white pine, pitch pine, hemlock, spruce, and



**Figure 5.1-2: Former Munitions Bunker West Area**

fir) and to a lesser extent, hardwoods (oak, maple, ash, poplar, and birch). [Figure 5.1-2](#) shows some of the forested area of the Former Munitions Bunker West area.

#### **5.1.1.4. Hydrology**

The area where the Former Munitions Bunker West Area is located drains to the Mere Brook watershed.

#### **5.1.1.5. Hydrogeology**

Site specific hydrogeology for the area is not known (no wells are located within the area of concern). A general discussion of hydrogeology for the area around the NASB is included in [Section 3.6](#).

#### **5.1.1.6. Cultural and Natural Resources**

Based on information provided by NASB, no significant cultural resources have been identified in the area to date.

#### **5.1.1.7. Endangered and Special Status Species**

Threatened and endangered species data for the NASB are presented in [Section 3.8](#). No evidence was found indicating the presence of the species listed on the area of the Former Munitions Bunker West Area.

### ***5.1.2. Visual Survey Observations and Results***

The data collection team visually surveyed approximately 1/3 of the total area. The area surveyed included the area adjacent to Perimeter Road and the southwest portion of the range. The remaining area of the range was inaccessible due to the vegetation. The data collection team did not find any evidence of MEC (e.g. casings, expended flares) or evidence of MC (e.g. ground scarring, stained soils) during the visual site survey.

A visual depiction of the site reconnaissance is provided on [Map 5.1-1](#) located at the end of Section 5.1. Additional range/site details are illustrated on [Map 5.1-2](#), also located at the end of Section 5.1.

### ***5.1.3. Munitions and Munitions Related Materials Associated with the Site***

This section describes the munitions or munitions related materials known or suspected to be at the site, including the types and estimated maximum penetration depths. This includes both MEC and non-hazardous munitions related scrap (e.g., fragmentation, base plates, and/or inert mortar fins). Potential ordnance concentration areas are presented along with a discussion on the presence of special consideration ordnance.

According to available records and personnel interviews, the following munitions are known to have been used during munitions-related security training at the site:

- Grenade, Hand Smoke Red M18 with fuze M201A1
- Grenade, Hand Smoke Yellow M18 with fuze M201A1
- Signal Illumination, Ground Green Star cluster, hand held M125A1
- Flare, Surface Trip, M49A1
- Simulator Noise Cartridge Assault Rock trainer, MK 103 Mod 0
- Cartridge 7.62 Blank M82 Linked
- Cartridge 5.56 Blank M20 Linked and non-linked

Based on the information obtained during the data collection process, no special consideration munitions are known or suspected to have been used at the site; therefore, the Former Munitions Bunker West Area is not suspected to contain special consideration MEC.

### ***5.1.4. MEC Presence***

The entire site has been subdivided and categorized into one of three levels of MEC presence including: Known MEC Areas, Suspect MEC Areas, and Areas where No Evidence Exists to indicate that MEC is known or is suspected to be at the site. The MEC presence is discussed below.

[Map 5.1-3](#) illustrates the munitions characterization of the Former Munitions Bunker West Area and is provided at the end of Section 5.1.

#### **5.1.4.1. Known MEC Areas**

There were no known MEC areas associated with the Former Munitions Bunker West Area that were identified during the data collection process.

#### **5.1.4.2. Suspected MEC Areas**

The entire 29-acre Former Munitions Bunker West Area is considered a suspected MEC area for the purposes of this PA. However, Marines at NASB reported that sweeps of the area were conducted after each training exercise and all munitions debris were removed from the ground surface. Additionally, no MEC was observed during the visual site survey. Therefore, the potential for MEC at the Site is considered extremely low.

#### **5.1.4.3. Areas Not Suspected to Contain MEC**

There were no areas not suspected to contain MEC associated with the Former Munitions Bunker West Area that were identified during the data collection process.

### ***5.1.5. Ordnance Penetration Estimates***

The depth to which munitions penetrate below the ground surface depends on many factors, including the type of soil, the angle of impact, the size of the munition, the velocity at impact, and site-specific environmental conditions. Over the years, the DoD has studied and modeled munitions penetration depths and has issued various guidance and technical documents on the subject. For the purposes of this PA, maximum probable penetration depths are estimated following guidance listed in the latest draft (July 2002) of the DoD Directive on Explosives Safety issued by the DoD Explosives Safety Board [*DoD Directive 6055.9 (DoD Ammunition and Explosives Safety Standards)*]. The Directive refers to *TM 5.855.1* and *NAVFAC P-1080*.

All of the munitions listed above are deployed on the ground surface. They are not designed to penetrate the ground surface.

### **5.1.6. Munitions Constituents**

Contaminants potentially present at the site include phosphorous from the smoke-generating grenades, metals, perchlorate from the limited pyrotechnics used on-site, and explosive residuals. Based on the known frequency of usage, types of items, and likely volume of items deployed, heavy deposition of MC contamination is not expected. Actual concentrations (if any) of MC remaining at the site are not known.

### **5.1.7. Contaminant Migration Routes**

There are two primary routes for the migration of MC, if it exists: surface runoff to surface water bodies or infiltration to groundwater. The area where the Former Munitions Bunker West Area is located drains to the Mere Brook watershed. The potential for migration to groundwater may be enhanced by the presence of high permeability soils, coarse-grained glacial outwash, and shallow bedrock. At NASB, however, the glacial drift aquifer appears to be highly variable in thickness and permeability. Lateral movement of impacted groundwater over long distances would be dependent on the extent to which the various units are hydraulically connected. In addition, the vertical transfer of constituents to the bedrock groundwater system would be limited in those areas where low permeability marine clay is present. MC, if present, may be in the soil in and around the range; however, no sampling data was available to estimate the potential for constituents.

### **5.1.8. Receptors**

The area is not currently in use. Navy personnel and authorized visitors can access the site, but the area is not maintained on a regular basis. The area contains dense vegetation, which provides an additional deterrent to potential receptors. Navy personnel, maintenance workers, and contractors (e.g., construction workers) represent potential human receptors. If construction or grounds work is performed in the future, then construction or maintenance workers may access the site.

#### **5.1.8.1. Nearby Populations**

As Maine's second largest employer, the NASB employs more than 4,800 military and civilian personnel. Approximately 1,480 military personnel reside on the installation. The NASB is located approximately two miles east of the Brunswick's main business district. Residential

properties are located approximately one to two miles west, northwest, and southwest of the installation. Based on estimates from the 2000 U.S. Census, the population of Cumberland County is just over 265,600 and comprises approximately 20% of the State's population. The Town of Brunswick, including NASB, has an estimated population of approximately 16,000, which comprises approximately 6% of Cumberland County's population.

#### **5.1.8.2. Buildings Near/Within Site**

Buildings located within the Former Munitions Bunker West Area include two former munitions bunkers (Figure 5.1-3), which are currently empty. The bunkers are constructed primarily of steel with concrete floors. All of the former munitions bunkers outside of the site boundaries have been demolished. Other structures nearby include radio towers and runways.



**Figure 5.1-3: Former Munitions Bunker**

#### **5.1.8.3. Utilities On/Near Site**

Overhead utilities are not present at the Former Munitions Bunker West Area. Buried utilities, if present, would follow a utility corridor along the perimeter roadway.

#### **5.1.9. Land Use**

The area is mostly undeveloped as it serves as a buffer area for the runways. There are plans in the immediate future to cut most or all of the vegetation at the site to provide a line-of-sight to the runway from a new (not yet constructed) control tower, which will be located approximately ½-mile northwest of the Site. There are two bunkers on-site that remain empty and abandoned.

#### **5.1.10. Access Controls / Restrictions**

The Former Munitions Bunker West Area is within the boundaries of the NASB that is surrounded by a perimeter security fence. Access to the airfield via a manned security checkpoint

is required to access the Former Munitions Bunker West Area. Access is restricted to security patrols, authorized Navy personnel, and escorted contractors/visitors. There is no public access. Base security monitors all access to the area, and frequent motor vehicle patrols are conducted as part of the access control program. The access control program is in place to protect the runways and aircraft, not specifically for the former range area. The former range area is a buffer area for the runway and as such falls under the access control program.

**5.1.11. Conceptual Site Model**

This Conceptual Site Model (CSM) was developed following guidance documents issued by the USEPA for hazardous waste sites and the USACE for ordnance and explosives (OE) sites. Guidance documents included the USEPA’s Guidance for Conducting Remedial Investigations and Feasibility Studies under CERCLA (EPA/540/G-89/004) and the Final USACE CSM Guidance Development of Integrated Conceptual Site Models for Environmental Ordnance and Explosives Sites (USACE, 2003).

The CSM describes the site and its environmental setting. The CSM presents information regarding: 1) MEC and/or MC known or suspected to be at the site; 2) current and future reasonably anticipated or proposed uses of the real property; and 3) actual, potentially complete, or incomplete exposure pathways linking them. The CSM is the basis for the prioritization and remediation cost estimate.

The CSM is presented in a series of information profiles that provide information about the site. The information profiles are included in [Table 5.1-1](#) below.

<b>Table 5.1-1: Conceptual Site Model Information Profiles – Former Munitions Bunker West Area</b>		
<b>Profile Type</b>	<b>Information Needs</b>	<b>Preliminary Assessment Findings</b>
<b>Range/Site Profile</b>	Installation Name	Naval Air Station Brunswick
	Installation Location	Cumberland County, Maine
	Range/Site Name	Former Munitions Bunker West Area.
	Range/Site Location	Located west of the runways in the northwest portion of the installation.
	Range/Site History	From the 1980s to 2000, the range was used for training of installation security personnel.

<b>Table 5.1-1: Conceptual Site Model Information Profiles – Former Munitions Bunker West Area</b>		
<b>Profile Type</b>	<b>Information Needs</b>	<b>Preliminary Assessment Findings</b>
	Range/Site Area and Layout	Approximately 29 acres.
	Range/Site Structures	The range itself had no structures (e.g. firing points, targets); however, the site contains two-abandoned magazines (#63 and #64) dating back to the 1940s.
	Range/Site Boundaries	N: Undeveloped land. S: Undeveloped land. E: Outboard Runway. W: Perimeter Road
	Range/Site Security	The site is within the boundaries of the NASB that is surrounded by a perimeter fence. Access to the airfield via a manned security checkpoint is required to access the site. Access is restricted to security patrols, authorized Navy personnel, and escorted contractors/visitors.
<b>Munitions/ Release Profile</b>	Munitions Types	-Grenade, Hand Smoke Red M18 with fuze M201A1 -Grenade, Hand Smoke Yellow M18 with fuze M201A1 -Signal Illumination, Ground Green Star cluster, hand held M125A1 -Flare, Surface Trip, M49A1 -Simulator Noise Cartridge Assault Rock trainer, -MK 103 Mod 0 -Cartridge 7.62 Blank M82 Linked -Cartridge 5.56 Blank M20 Linked and non-linked
	Maximum Probability Penetration Depth	None of the munitions used during security training are expected to have penetrated the ground surface.
	MEC Density	No MEC were observed during the visual survey. The potential for MEC is low due in part to the types of training conducted at the range and the undocumented procedure in place to clear the area of debris after training activities.
	MEC Scrap/Fragments	No MEC scrap/fragments were found during the site visit.

<b>Table 5.1-1: Conceptual Site Model Information Profiles – Former Munitions Bunker West Area</b>		
<b>Profile Type</b>	<b>Information Needs</b>	<b>Preliminary Assessment Findings</b>
	Associated Munitions Constituents	Constituents associated with the munitions used at the site include phosphorus from the smoke generating items, metals, perchlorate, and explosive residuals.
	Migration Routes/Release Mechanisms	There are two primary routes for the migration of potential MC: surface runoff to surface water bodies or infiltration to groundwater.
<b>Physical Profile</b>	Climate	Continental climate with three well defined seasons. Highest temperatures occur in July (79 F or higher). Coldest temperatures occur in January (21 F or lower).
	Topography	Gently rolling to flat.
	Geology	Site specific geology is unknown (boring logs not available). However, the NASB is characterized by two primary components: unconsolidated sediments and Paleozoic bedrock
	Soil	Suffield-Buxton-Hollis Association. Deep to shallow, moderately well drained to somewhat poorly drained soils with low permeability.
	Hydrogeology	Site specific hydrogeology for the area is unknown (no wells within the area of concern).
	Hydrology	Surface water drains to Mere Brook watershed.
	Vegetation	The site contains both forested and marsh areas.
<b>Land Use and Exposure Profile</b>	Current Land Use	The area is mostly undeveloped as it serves as a buffer area for the runways.
	Current Human Receptors	Current human receptors include: Navy personnel, maintenance workers, and contractors.
	Current Activities (frequency, nature of activity)	Navy personnel and authorized visitors can access the site, but it is not likely. The area is not used on a regular basis and is inaccessible due to the dense vegetation
	Potential Future Land Use	No unforeseen changes in the use of the area however, plans are in place to construct a radio / radar tower near the former range area.
	Potential Future Human Receptors	Same as current.
	Potential Future Land Use-Related Activities:	Construction of radio/radar tower approximately ½ mile northeast of the site.
	Zoning/Land Use Restrictions	Use of the area is restricted by its proximity to the active runways.

<b>Table 5.1-1: Conceptual Site Model Information Profiles – Former Munitions Bunker West Area</b>		
<b>Profile Type</b>	<b>Information Needs</b>	<b>Preliminary Assessment Findings</b>
	Demographics/Zoning	Cumberland County population density is approximately 50,000 persons per square mile.
	Beneficial Resources	Groundwater from the deep aquifer is the source of the municipal water supply.
<b>Ecological Profile</b>	Habitat Type	Grassland and woodland area.
	Degree of Disturbance	Minimal to none.
	Ecological Receptors and Species of Special Concern	Potential ecological receptors include indigenous species. No species of special concern are known to be present at the site.
	Relationship of MEC/MC Sources to Habitat and Potential Receptors	When the new radio / radar tower is built, construction workers may come into contact with MEC / MC. Security personnel routinely patrol the area; however, most of the patrols are vehicle patrols along perimeter road thus minimal activity within the area of the former training area.

A key element of the CSM is the exposure pathway analysis. For MEC, a complete or potentially complete exposure pathway must include the following components: 1) a source (e.g., locations where MEC are expected to be found); 2) access (e.g., controlled or uncontrolled access, items on the surface or within the subsurface); 3) an activity (e.g., non-intrusive grounds maintenance or intrusive construction); and 4) receptors (e.g., Navy personnel, construction workers, recreational users, or authorized visitors). It is important to recognize that environmental mechanisms (e.g., erosion) and/or human intervention may result in the repositioning of MEC.

For MC, a complete or potentially complete exposure pathway must include the following components: 1) a source (e.g., locations where MC are expected to be found); 2) an exposure medium (e.g., surface soil); 3) an exposure route (e.g., dermal contact); and 4) receptors (e.g., Navy personnel, construction workers, recreational users, or authorized visitors). If the point of exposure is not at the same location as the source, the pathway may also include a release mechanism (e.g., erosion) and a transport medium (e.g., surface water).

The potential interactions between the source and receptors are assessed differently between MEC and MC. For MC, interaction between the source and receptors involves a release mechanism for the MC, an exposure medium that contains the MC, and an exposure route that

places the receptor into contact with the contaminated medium. For MEC, interaction between the potential receptors and an MEC source has two components. The receptor must have access to the source and must engage in some activity that results in contact with individual MEC items within the source area.

### **MEC Interactions and Pathway Analysis**

As discussed in [Section 5.1.4](#), the entire 29-acre Former Munitions Bunker West Area is a suspected MEC area. However, no MEC was observed during the site survey. Additionally, Marines at NASB reported that sweeps of the area were conducted after each training exercise and all munitions debris were removed from the ground surface. Therefore the potential for MEC at the site is considered extremely low. The MEC pathway analysis is shown in [Figure 5.1-4](#)

If activities, such as the construction of a new radio/radar tower, occur in the area, construction workers may come into contact with MEC. Therefore, the surface soil pathway is considered potentially complete for maintenance and construction personnel and the Navy personnel that would be supervising them. Biota is shown as potentially complete for MEC in surface.

All pathways are shown as incomplete for MEC in subsurface because MEC is not suspected to be in the subsurface. This is based upon the types of ordnance used at the site (all surface deployed items not designed to penetrate the ground) and that erosion is not considered to be a factor at the site.

### **MC Interactions and Pathway Analysis**

As discussed in [Section 5.1.6](#), the potential exists for surface MC at the Former Munitions Bunker West Area. The MC pathway analysis and the potential for exposure to MC are shown in [Figure 5.1-5](#). The area is not used on a regular basis by anyone; therefore exposure pathways for visitors are shown as incomplete. The rationale for identified exposure pathways is discussed as follows:

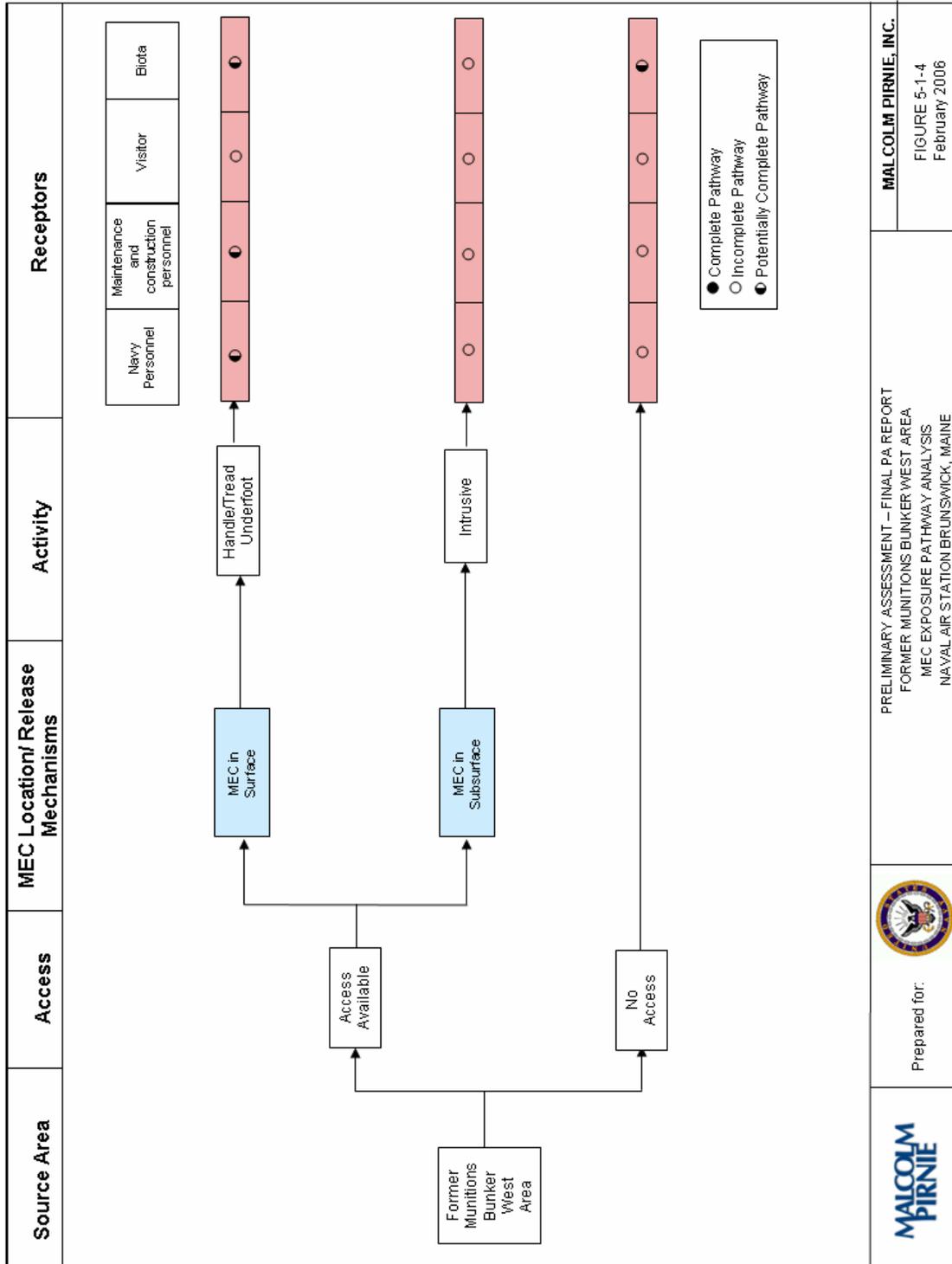
A minimal potential exists for MC in the surface soil. Contaminants potentially present at the site include phosphorous from the smoke-generating items, metals, and perchlorate from the limited pyrotechnics used on-site. Actual concentrations (if any) of MC remaining at the site are not known. If construction or grounds work is performed in the future, then construction or maintenance workers and the navy personnel that would be supervising them, may be exposed

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through dermal contact with or ingestion of surface water / sediments or surface soil. This pathway is shown as potentially complete.

Due to the lack of data regarding biota in the area, the exposure pathways are marked as potentially complete. MC, if present, have the potential to leach to shallow groundwater; however, groundwater wells around the installation are over 100 feet deep and impacts from MC are not expected. Therefore, the groundwater pathway is shown as incomplete for all receptors.

Figure 5.1-4: MEC Exposure Pathway Analysis



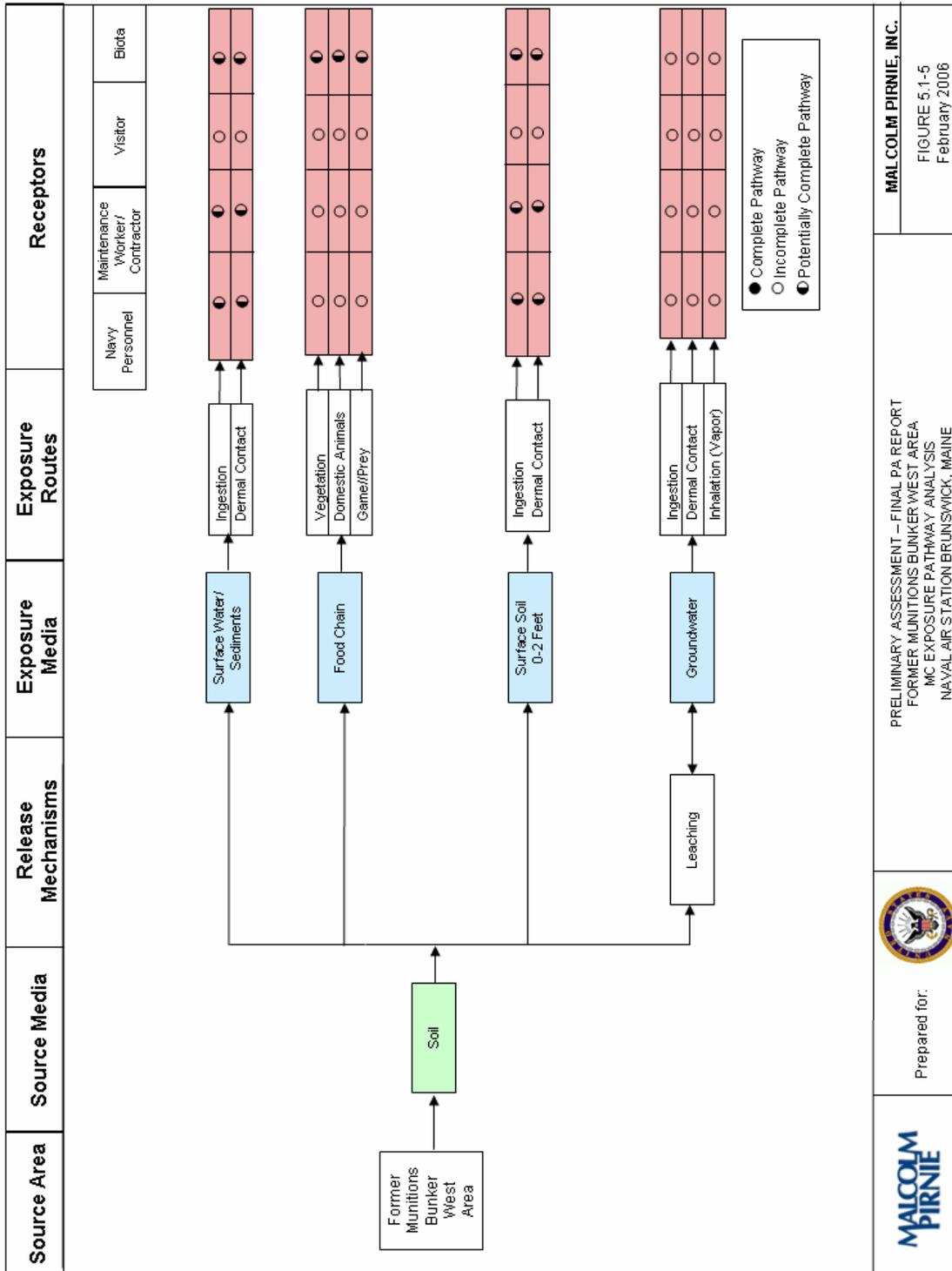
PRELIMINARY ASSESSMENT – FINAL PA REPORT  
 FORMER MUNITIONS BUNKER WEST AREA  
 MEC EXPOSURE PATHWAY ANALYSIS  
 NAVAL AIR STATION BRUNSWICK, MAINE

Prepared for:



MALCOLM PIRNIE, INC.  
 FIGURE 5-1-4  
 February 2006

Figure 5.1-5: MC Exposure Pathway Analysis



  
 Prepared for:  
 PRELIMINARY ASSESSMENT – FINAL PA REPORT  
 FORMER MUNITIONS BUNKER WEST AREA  
 MC EXPOSURE PATHWAY ANALYSIS  
 NAVAL AIR STATION BRUNSWICK, MAINE  
 MALCOLM PIRNIE, INC.  
 FIGURE 5.1-5  
 February 2006

***5.1.12. Summary***

Between 1980 and 2000, U.S. Marines stationed at the installation used the site sporadically to conduct munitions-related security training. Blank small arms ammunition, practice grenades, and limited pyrotechnics (simulators and smoke devices) were used during the training. The area is no longer used to conduct security training.

The Former Munitions Bunker West Area remains a buffer area for the runways and the new explosives magazine storage areas. There are plans in the immediate future to cut most or all of the vegetation at the site to provide a line-of-sight to the runway from a new (not yet constructed) control tower, which will be located approximately ½-mile northwest of the Site.

The entire Former Munitions Bunker West Area is a suspected MEC area. However, Marines at NASB reported that sweeps of the area were conducted after each training exercise and all munitions debris were removed from the ground surface. Additionally, no MEC was observed during the site survey. Therefore the potential for MEC at the Site is considered extremely low.

In addition, the potential exists for MC in the surface soil. Contaminants potentially present at the site include phosphorous from the smoke-generating grenades, metals, and other munitions-related constituents. Based on the known frequency of usage, types of items, and likely volume of items deployed, heavy deposition of MC contamination is not expected. Actual concentrations (if any) of MC remaining at the site are not known. If construction or grounds work is performed in the future, then construction or maintenance workers may be exposed through soil ingestion, dermal contact, or dust inhalation.

**Preliminary Assessment  
Naval Air Station Brunswick, Maine**



**MALCOLM  
PIRNIE**

**Map 5.1-1  
Visual Survey  
Former Munitions Bunker West Area**

**Legend**

-  Installation Boundary
-  Site Reconnaissance
-  Former Munitions Bunker West Area

Former Munitions Bunker West Area



Data Source: USGS 7.5 Minute Series  
Digital Ortho Photo Quadrangle  
Brunswick, ME, 1998

Coordinate System: UTM Zone 19N  
Datum: NAD 83  
Units: Meters

Contract: N62472-02-D-1300  
Edition: Final Preliminary Assessment  
Date: February 2006

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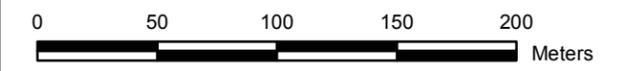


**MALCOLM  
PIRNIE**

**Map 5.1-2  
Range/Site Details  
Former Munitions Bunker West Area**

**Legend**

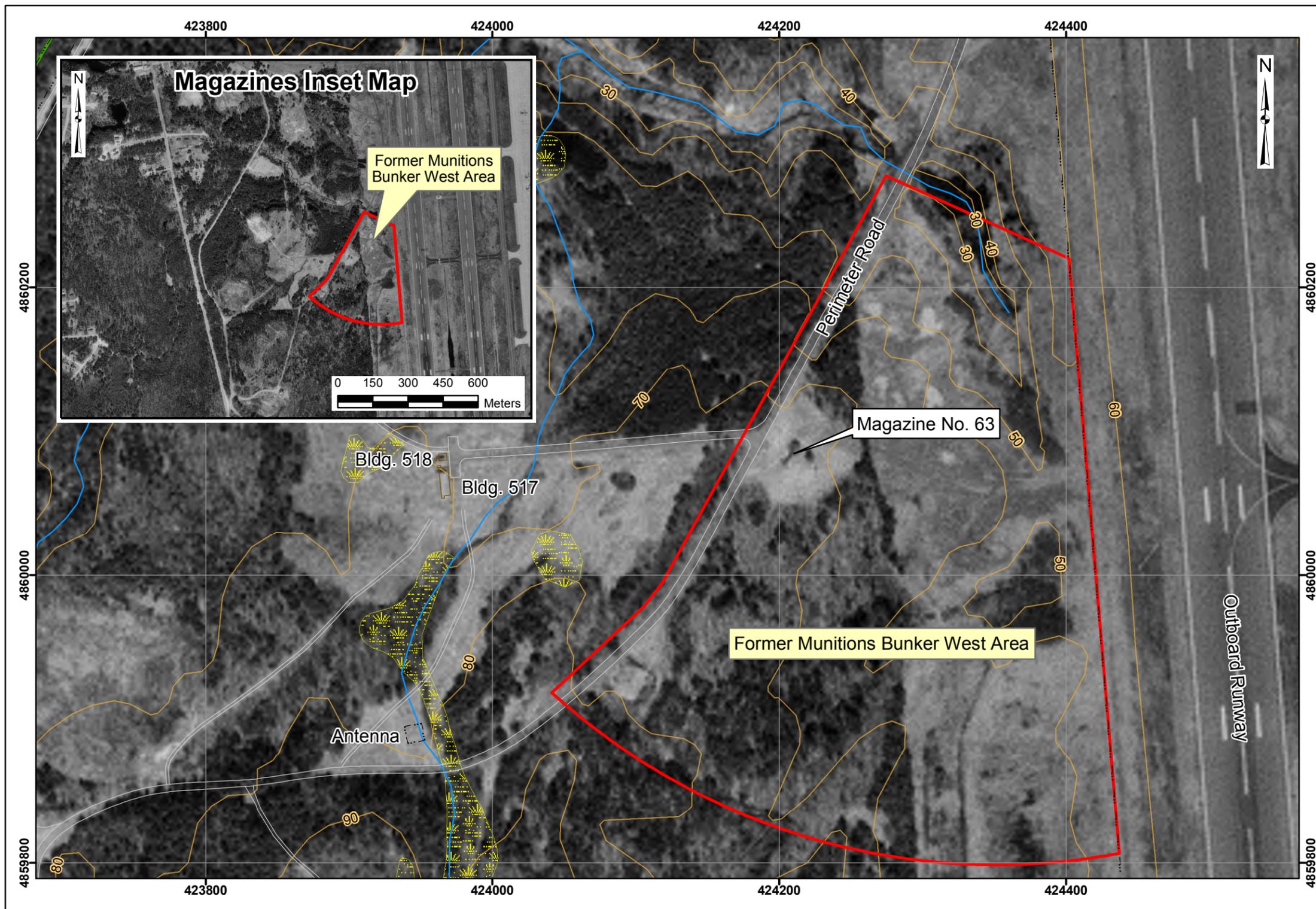
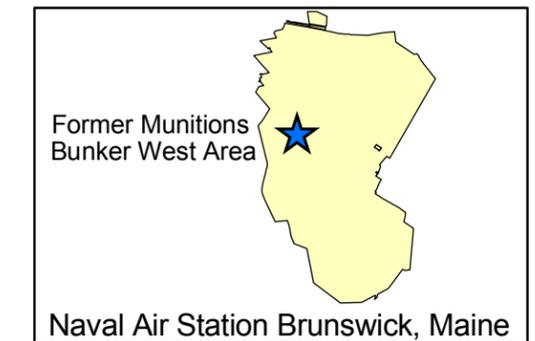
-  Installation Boundary
-  Structures
-  Roads
-  Fence Lines
-  Contours
-  Streams
-  Wetlands
-  Former Munitions Bunker West Area



Data Source: USGS 7.5 Minute Series  
Digital Ortho Photo Quadrangle  
Brunswick, ME, 1998

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**Preliminary Assessment  
Naval Air Station Brunswick, Maine**



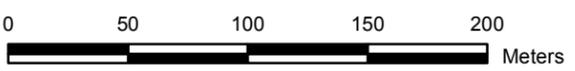
**MALCOLM  
PIRNIÉ**

**Map 5.1-3  
Munitions Characterization  
Former Munitions Bunker West Area**

**Legend**

-  Installation Boundary
-  Former Munitions Bunker West Area
- MEC Presence\***
-  Known
-  Suspect

\* MEC Presence was determined through review of historical documentation, interviews, and/or visual survey.



Data Source: USGS 7.5 Minute Series  
Digital Ortho Photo Quadrangle  
Brunswick, ME, 1998

Coordinate System: UTM Zone 19N  
Datum: NAD 83  
Units: Meters

Contract: N62472-02-D-1300  
Edition: Final Preliminary Assessment  
Date: February 2006



## 5.2. MACHINE GUN BORE SIGHT RANGE

### 5.2.1. *History and Site Description*

The Machine Gun Bore Sight Range was located in the eastern portion of the installation and was identified in the initial Navy Range Inventory. The Machine Gun Bore Sight Range encompasses approximately 0.3 acres, from the firing line to the berm, with an approximately 1029.4 acre SDZ. The Navy used the range as a Bore Sight range in the 1950s. The layout of the installation during the timeframe the Machine Gun Bore Sight Range was active was much different than its current layout. Over the years the footprint of the runways and the associated support buildings and structures nearby have changed. During the 1950s taxiways connected the runways to the area of the compass calibration pad and Machine Gun Bore Sight Range. Today the runways are segregated from the area of the range by a security fence, structures, and buildings.

The national archives and local repositories had limited information related to the specific history and use of the former Machine Gun Bore Sight Range. However, Navy facility guidance documents from the timeframe of when the range was operational provide some specific guidelines on the layout and use of Navy shore facilities, which would have included the NASB. The guidelines can be used to establish how the range was most likely setup and used. The guidelines are covered in the Bureau of Aeronautics published Programming Guide, entitled *U.S. Naval Aeronautical Shore Facilities* NAVAER 00-100-504, March 1958. NAVAER 00-100-504 prescribed guidelines for Military Construction of Naval aeronautical shore facilities. The Programming Guide provided general construction guidelines for just about every building, structure or improvement that was authorized on Naval shore facilities. The Programming Guide also included construction guidelines for ranges under Section 179 “Training Facilities Other Than Buildings” and for aircraft Bore Sight ranges in Section 211-80 – “Aircraft Bore Sight Range.”

The 1958 Programming Guide outlines the requirements for the alignment for aircraft mounted guns to be checked and for which installations had to have a Bore Sight range. The 1958 Programming Guide stated that “every aircraft with fixed guns must be Bore Sighted and test fired approximately once a month to maintain the guns in alignment and the accessory ordnance equipment in condition. Because of problems of logistics and timing, it is not desirable to fly aircraft to some central base for Bore Sighting; therefore, any naval air station serving as a base

for squadron using aircraft with fixed guns requires a Bore Sight range. One set of firing positions spaced at various distances from a single backstop will serve up to four air groups.”<sup>2</sup>

In addition to outlining the requirement for a Bore Sighting range, Section 211-80 also provided specific design criteria for each range. “An aircraft Bore Sight range consists of a set of Bore Sighting and firing positions connected by a tow-way, Bore Sight boards, a target, and a target backstop. The target backstop or firing-in butt is an earthen mound with flared concrete end walls and canopy. It is designed to stop projectiles fired at a specific distance of 1000 in., 2000 in., 500 ft., or 1,000 ft.”<sup>3</sup> “Because of the relatively uniform mounting height of fixed guns in modern naval aircraft, a single size backstop may be used on all ranges. The target consists of a wooden frame placed about 20 ft. in front of the backstop and covered with a paper or cloth cover. The Bore Sight board may be suspended from the same target. In locating the range, consideration must be given to the noise nuisance of firing aircraft guns at ground level.”<sup>4</sup>

Located on the taxiway from the runway to the Machine Gun Bore Sight Range was an aircraft compass calibration pad area. Section 166-20 “Aircraft Compass Calibration Pad” of the 1958 Programming Guide states “an aircraft compass calibration pad is a paved area in a magnetically quiet zone where the directions indicated by the compass are checked against known magnetic directions laid out on the pad so that the compass in the aircraft may be calibrated. A compass calibration pad shall be furnished for each air station.”<sup>5</sup> The compass calibration pad was commonly referred to as the compass rose as indicated on the NASB archive maps from the 1950s.

Based upon the requirements for pilots to check the accuracy of their compass and to align their aircraft mounted guns, the following scenario would typically take place during routine maintenance of aircraft. Pilots would taxi the aircraft a safe distance away from the runway to a position known as the compass rose (an example of a reconditioned compass rose based upon a 1950s type design - not on NASB - is shown in [Figure 5.2-1](#)), where pilots could adjust their

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<sup>2</sup> Bureau of Aeronautics, *U.S. Naval Aeronautical Shore Facilities Programming Guide NA/VAER 00-100-504*, March 1958, Section 211-80 page 200-9.

<sup>3</sup> Bureau of Aeronautics, page 200-9.

<sup>4</sup> Bureau of Aeronautics, page 200-9.

<sup>5</sup> Bureau of Aeronautics, page 100-6.

sighting and navigation aids by aligning with the magnetic headings for North, South, East and West indicated by the cardinal points.



**Figure 5.2-1: Typical Compass Rose**

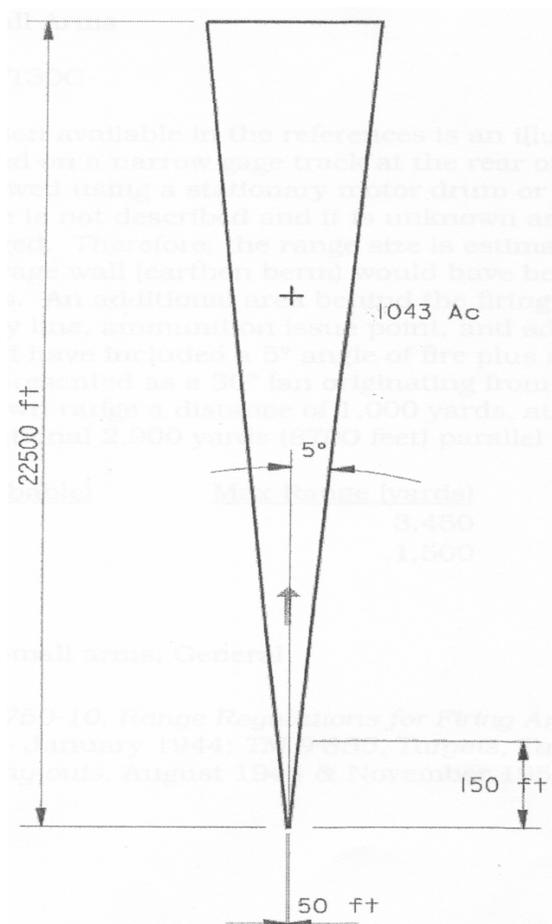
The pilots would then move the aircraft to a pre-designated Bore Sighting position to visually check weapons systems accuracy by aligning their weapons with a Bore Sight board. The aircraft would then taxi to the firing position to confirm accuracy by firing on a target. An earthen target backstop with flared concrete walls as outlined in the 1958 Programming Guide, or firing in-butt, would be positioned behind the target to stop the bullets. A berm structure for the Machine Gun Bore Sight Range appears on the 1957 aerial photograph ([Figure 5.2-2](#)).

The scenario above indicates that the most likely location of the firing line for the Machine Gun Bore Sight Range would correspond to the eastern edge of the compass rose. The width of the firing line was determined based upon the wingspan of the F4U-4 Corsair, the aircraft most likely tested at the Machine Gun Bore Sight Range. According to historical documents and the layout of the berm and firing line, the range was oriented for firing to the east.



Figure 5.2-2: Machine Gun Bore Sight Range on 1957 Aerial Photo

Naval aircraft of the 1950s would have fired machine gun (small arms) ammunition including .30 caliber and .50 caliber. According to the Army Technical Manuals on small arms ranges (AR 750-10, TM 9-855), the maximum range for .50-cal weapons is 7,500 feet with a muzzle velocity of 2,545 feet per second. The maximum range for .30-cal weapons is 3,450 feet with a muzzle velocity of 2,700 feet per second. The SDZ for a .50-cal Bore Sight range extends downrange from each end of each firing line at a 5° angle for 7,600 feet. An example of a typical SDZ for a Bore Sight range is provided in [Figure 5.2-3](#).



**Figure 5.2-3: SDZ of a typical .50-cal Bore Sight range**

Given the size of the range and the proximity of the range to the installation boundary (200 meters based on review of a 1952 map), rounds that may have missed the target could have had the potential to land outside the installation. At the time the range was active, the area east (direction of fire) of the range was undeveloped and wooded. The exact number of rounds fired

during the time the range was active will never be known however, for estimating purposes the following analysis is provided below.

**Estimate of Number of Machine Gun Rounds of Ammunition Fired at the Bore Sight Range:**

- Estimated No. of planes per Navy Squadron in the 1950s = (12 –25)
- Known No. of squadrons at NASB during the 1950s = 6
- Average number of guns per plane = 6 (based upon the F4U-4 Corsair)
- Estimated rounds fired during Bore Sight process = 20 rounds per gun
- Assuming the range was active for 10 years (120 months) and each plane was Bore Sighted once a month (Navy Programming Guide).

**Calculations:**

- Estimated No. of planes stationed during the 1950s at NASB = (average No. of planes per squadron) x (No. of squadrons) = 19 x 6 = 114 planes.
- Estimated No. of aircraft mounted machine guns = (No. of planes) x (Average No. of Guns) = 114 x 6 = 684 guns.
- Estimated rounds fired per month = (No. of guns) x (No. of rounds per Bore Sight exercise) = (684 guns) x (20 rounds per gun) = 13,680 rounds of ammunition per month.
- Assuming the range was active for 10 years and its use (on average) was consistent, the total number of machine gun rounds fired = 13,680 rounds per month x 120 months = 1,641,600 rounds.

The range can be seen on the 1957 aerial photo of the installation (See [Figure 5.2-2](#)). From the aerial photo the area of the compass rose is visible, as is the target area for the Machine Gun Bore Sight Range. Under magnification, a berm is visible on the aerial photo. Today however, there are no visible remnants of the former Machine Gun Bore Sight Range including the range berm or the compass rose.

An undated map believed to be from the late 1950s to early 1960s found at the National Archives had the range labeled as a pistol range. It would not be uncommon for Bore Sight ranges to double as pistol ranges since they already have a target and backstop or berm in place. The exact history or use of the range as a pistol range is unknown. What is known is that sometime after that timeframe, the layout of the installation changed and eventually the taxiways connecting the runways to the range area were removed and the range was abandoned. In addition to the changes in the taxiways, the names of the roads have changed. During the 1950s the Machine Gun Bore Sight Range was located just west of Range Road. Today the road is named Orion. According to a map from 1952, a “Ready Magazine” existed adjacent to the compass rose along the taxiway to the range. Today Building 55 sits on the approximate area of the compass rose and roughly ¼ of the former range area is paved over for the parking lot and storage area associated with Building 55. The ready magazine shown on the 1952 map is no longer standing. By design, the majority of the bullets fired at the range would have landed and accumulated in a berm. During the 1950s there were no official Navy clean up or disposal policies in place for soil potentially contaminated with lead. It is unknown what happened to the soil that made up the berm. It may have been removed or built over when the area was improved. The boundaries of the range area are shown on [Map 5.2-1](#) at the end of Section 5.2.

#### **5.2.1.1. Topography**

The topography of the former Machine Gun Bore Sight Range is flat.

#### **5.2.1.2. Geology**

Site-specific geology of the former range area is unknown. There are no monitoring wells within the area, so soil boring logs were not available. A general description of the geology associated with the area around the NASB is included in [Section 3.3](#).

#### **5.2.1.3. Soil and Vegetation Types**

The soils in the area of the former Machine Gun Bore Sight Range are from the Suffield-Buxton-Hollis Association. This association consists of deep to shallow, moderately well drained to somewhat poorly drained soils that are characterized by low permeability.

The undeveloped portion of the range is grassy with various species of trees as shown in [Figure 5.2-4](#). Tree species common to NASB include white pine, pitch pine, hemlock, spruce, and fir with lesser numbers of hardwoods (oak, maple, ash, poplar, and birch). However, most of the trees within the open area of the former range are pines.



**Figure 5.2-4: Trees at the area of the Former Range**

#### **5.2.1.4. Hydrology**

The area where the former Machine Gun Bore Sight Range is located drains to the Picnic Pond watershed.

#### **5.2.1.5. Hydrogeology**

Site specific hydrogeology for the area is unknown (no wells are within the area of concern). For a general discussion see [Section 3.6](#).

#### **5.2.1.6. Cultural and Natural Resources**

Based on information provided by NASB, no significant cultural resources have been identified in the area to date.

#### **5.2.1.7. Endangered and Special Status Species**

Threatened and endangered species data for NASB are presented in [Section 3.8](#). No evidence was found indicating the presence of the species listed in the area of the former Machine Gun Bore Sight Range.

### **5.2.2. Visual Survey Observations and Results**

The developed portion of the site is now Building 55 (See [Figure 5.2-5](#)). The west side of the site is bordered by a paved road (Orion Street) that runs roughly parallel to the runways. During the visual survey of the area, the data collection team did not locate any evidence of MEC on the area and there were no signs of the former range structures (e.g. firing position, berm) associated with the range.



**Figure 5.2-5: Building 55 (Former Recycling Facility)**

A visual depiction of the site reconnaissance is provided on [Map 5.2-1](#) located at the end of Section 5.2. Additional range/site details are illustrated on [Map 5.2-2](#), also located at the end of Section 5.2.

### **5.2.3. Munitions and Munitions Related Materials Associated with the Site**

This section describes the munitions or munitions related materials known or suspected to be at the site, including the types and estimated maximum penetration depths. This includes both MEC and non-hazardous munitions related scrap (e.g., fragmentation, base plates, and/or inert mortar fins). Potential ordnance concentrations areas are presented along with a discussion on the presence of special consideration ordnance.

The following list represents the types of munitions suspected to have been used at the range. Munitions listed include machine gun ammunition used in aircraft mounted guns and pistol ammunition from the 1950s.

- .30 caliber (machine gun ammunition)
- .50 caliber (machine gun ammunition)
- .22 caliber (pistol ammunition)
- .30 caliber (pistol ammunition)
- .38 caliber (pistol ammunition)

The list was pulled together based on common machine gun ammunition for aircraft mounted guns and from historic magazine storage records. The exact quantity of ammunition deployed or fired at the range is unknown. However, based upon the analysis presented in this section, it is estimated that 1.6 million rounds of machine gun ammunition (.50 caliber and .30 caliber) may have been fired on the range. An estimate for the amount of pistol ammunition fired is not provided because firing records were not available and there is no defensible method of determining the amount of pistol ammunition fired. No other munitions types are known or are suspected to have been used at the site.

Based on the information obtained during the data collection process, no special consideration munitions are known or suspected to have been used at the site; therefore, the Machine Gun Bore Sight Range is not suspected to contain special consideration MEC.

#### ***5.2.4. MEC Presence***

The entire site has been subdivided and categorized into one of three levels of MEC presence including: Known MEC Areas, Suspect MEC Areas, and Areas where No Evidence exists to indicate that MEC is known or is suspected to be at the site. The MEC presence is discussed below.

[Map 5.2-3](#) illustrates the munitions characterization of the Machine Gun Bore Sight Range and is provided at the end of Section 5.2.

##### **5.2.4.1. Known MEC Areas**

There are no known MEC areas associated with the former Machine Gun Bore Sight Range.

##### **5.2.4.2. Suspected MEC Areas**

There are no suspected MEC areas associated with the former Machine Gun Bore Sight Range.

##### **5.2.4.3. Areas Not Suspected to Contain MEC**

The entire former Machine Gun Bore Sight Range area is considered an area where no evidence exists to indicate or suggest that MEC is known or suspected to be at the site. Expended machine

gun and small arms ammunition are not considered an explosives safety issue. MC are a potential concern for area as discussed in [Section 5.2.6](#).

### **5.2.5. *Ordnance Penetration Estimates***

For small arms ranges, the Interstate Technology Regulatory Council (ITRC) has prepared a document titled, "Characterization and Remediation of Soils at Closed Small Arms Firing Ranges", dated January 2003, to provide information on the general layout of small arms ranges, as well as information on areas that may be impacted with MC and/or MEC as a result of range use and the characteristics of the munitions used. According to the ITRC guidance, the penetration depth of small arms on the range floor is one foot or less. The document states that rounds that impact the range floor are typically a flat trajectory that fell short of or missed the target or those resulting from ricochet, and these fragments are usually found within the top six inches of soil. Penetration depths within the side of the berm may vary depending on the soil type and other conditions, but are expected to be up to one foot or more. The berm no longer stands at the site; the date the berm was removed or where the soil was deposited to is also unknown.

### **5.2.6. *Munitions Constituents***

The primary MC of concern with machine gun and pistol ammunition used during the time that the range was active is lead. Other associated MC (less likely to be of concern) may include: antimony (increases hardness), arsenic (present in lead), nickel (coating on some shot), and lead azide (associated with gunpowder).

Using the estimated number of machine gun bullets fired at the range calculated in [Section 5.2.3](#) (rounded to 1.6 million), the amount of lead fired into the berm over the period of time the range was active can be estimated:

- The .30-caliber ammunition fired had (on average) .33 oz. of lead per bullet, and the .50-caliber ammunition had (on average) 1.42 oz. of lead per bullet.
- Therefore, the estimated amount of lead = [(no. of .30-caliber rounds) x (.33 oz./round)] + [(no. of .50-caliber rounds) x (1.42 oz./round)].

- Assuming that half of ammunition was .30-caliber and half was .50-caliber, the estimated amount of lead contained in the berm is  $[(.8 \text{ million rounds}) \times (.33 \text{ oz./round})] + [(.8 \text{ million rounds}) \times (1.42 \text{ oz./round})] = (264,000 \text{ oz.} + 1,136,000\text{oz.}) = 1,400,000 \text{ oz.} = 87,500 \text{ lbs.} \approx 43 \text{ tons.}$

It is unknown if NASB had any procedures in place to remove and dispose of lead as it accumulated on the range when it was active or when the range was closed. However, during the 1950s, lead was not considered to be an environmental issue or a health hazard. Therefore, it is not unusual that records were not kept of lead related activities.

The ultimate disposition of the berm is unknown. Sampling data was not available to estimate the potential for lead in the soil.

#### ***5.2.7. Contaminant Migration Routes***

There are two primary routes for the migration of MC, if it exists: surface runoff to surface water bodies or infiltration to groundwater. In the developed areas of the installation, surface runoff is directed to the storm sewer system. In the undeveloped portions of the installation, runoff flows via surface flow to streams and other water bodies. The area where the former Machine Gun Bore Sight Range is located drains to the Picnic Pond watershed. The potential for migration to groundwater may be reduced by the presence of low permeability soils, unconsolidated sediments, and deep to shallow bedrock. At NASB, however, the glacial drift aquifer appears to be highly variable in thickness and permeability. Lateral movement of impacted groundwater over long distances would be dependent on the extent to which the various units are hydraulically connected. In addition, the vertical transfer of constituents to the bedrock groundwater system would be limited in those areas where low permeability marine clay is present. MC, if present, may be in the soil in and around the range; however, no sampling data was available to estimate the potential for constituents to migrate.

#### ***5.2.8. Receptors***

The developed portion of the site contains Building 55 and associated storage and parking areas. The remaining area of the former range is undeveloped and not currently used. Navy personnel, authorized visitors, and maintenance workers/contractors represent potential human receptors.

### **5.2.8.1. Nearby Populations**

As Maine's second largest employer, NASB employs more than 4,800 military and civilian personnel. Approximately 1,480 military personnel reside on the installation. NASB is located approximately two miles east of the Brunswick's main business district. Residential properties are located approximately one to two miles west, northwest, and southwest of the installation. Based on estimates from the 2000 U.S. Census, the population of Cumberland County is just over 265,600 and comprises approximately 20% of the State's population. The Town of Brunswick, including NASB, has an estimated population of approximately 16,000, which comprises approximately 6% of Cumberland County's population.

### **5.2.8.2. Buildings Near/Within Site**

The only building located within the boundaries of the former Machine Gun Bore Sight Range site is Building 55. A water treatment plant is located near (approximately 160 yards to the southeast) of the former range area. Structures that existed when the range was active, such as trap houses, are no longer present at the site.

### **5.2.8.3. Utilities On/Near Site**

Overhead utilities (electric and telephone lines) are present at the former Machine Gun Bore Sight Range. There is water and sewer line that runs parallel to Building 55 just south of the paved parking area. This goes from Orion Street through the cleared area then swings south and serves the Ground Water Treatment Plant (Building 50). Nearby buildings and facilities have water, electric, and telephone utilities.

### **5.2.9. Land Use**

Only a small portion of the former Machine Gun Bore Sight Range is developed and used as a parking lot for Building 55. The remaining acreage is undeveloped and unused. Currently, according to the Environmental Department, there are no plans in place to alter the use or to develop the area behind Building 55. Therefore, the anticipated future land use is for the area to remain the same as the current use.

**5.2.10. Access Controls / Restrictions**

The former Machine Gun Bore Sight Range area within the boundaries of the NASB, which is surrounded by a perimeter security fence. There are no security or access restrictions to the site once on the installation.

**5.2.11. Conceptual Site Model**

This CSM was developed following guidance documents issued by the USEPA for hazardous waste sites and the USACE for OE sites. Guidance documents included the USEPA's Guidance for Conducting Remedial Investigations and Feasibility Studies under CERCLA (EPA/540/G-89/004) and the USACE CSM Guidance Development of Integrated Conceptual Site Models for Environmental Ordnance and Explosives Sites, finalized in February 2003.

The CSM describes the site and its environmental setting. The CSM presents information regarding: 1) MEC and/or MC known or suspected to be at the site; 2) current and future reasonably anticipated or proposed uses of the real property; and 3) actual, potentially complete, or incomplete exposure pathways linking them. The CSM is the basis for the risk evaluation, prioritization, and remediation cost estimate.

The CSM is presented in a series of information profiles that present information about the site. The information profiles are included in [Table 5.2-1](#) below.

Table 5.2-1: Conceptual Site Model Information Profiles – Machine Gun Bore Sight Range		
Profile Type	Information Needs	Preliminary Assessment Findings
Range/Site Profile	Installation Name	Naval Air Station Brunswick
	Installation Location	Cumberland County, Maine
	Range/Site Name	Machine Gun Bore Sight Range
	Range/Site Location	The site is located in the eastern portion of the facility adjacent to Building 55 and extends to an open field behind the building.
	Range/Site History	In the 1950s, pilots used the range to calibrate their aircraft mounted machine guns.
	Range/Site Area and Layout	Pilots fired toward the east into a berm after taxing down the runway to the compass rose. The range area encompassed 0.3 acres with an SDZ 1029.4 acres.
	Range/Site Structures	A berm appears on the 1957 aerial photograph of the installation. No other range related structures are discernable from the aerial. Based on the site walk, any structures that existed when the range was active are no longer present.
	Range/Site Boundaries	N: Building 55, Building 52, and containment pond. S: Building 50 E: Open field and forested area. W: Parking lot and Orion Street
	Range/Site Security	There are no security or access restrictions to the site once on the installation.
Munitions/Release Profile	Munitions Types	Machine gun (small arms) ammunition including .50 caliber and .30 caliber and pistol ammunition including .20 caliber, .22-caliber, and .38 caliber.
	Maximum Probability Penetration Depth	Small arms, less than one foot.
	MEC Density	Small arms, not applicable.
	MEC Scrap/Fragments	No MEC scrap/fragments were found during the visual survey.

Table 5.2-1: Conceptual Site Model Information Profiles – Machine Gun Bore Sight Range		
Profile Type	Information Needs	Preliminary Assessment Findings
	Associated Munitions Constituents	MC, including lead from the machine gun ammunition, could potentially be present at the site. Other associated MC (less likely to be of concern) may include: antimony (increases hardness), arsenic (present in lead), nickel (coating on some shot), and lead azide (associated with gunpowder). Sampling data was not available for the area to confirm lead or other potential MC concentrations at the site.
	Migration Routes/Release Mechanisms	Erosion – potential (in non-paved open area) Surface Water runoff – potential (in non-paved open area) Human Intervention – potential (in non-paved open area).
<b>Physical Profile</b>	Climate	Continental climate with three well-defined seasons. Highest temperatures occur in July (79 F or higher). Coldest temperatures occur in January (21 F or lower).
	Topography	The former Machine Gun Bore Sight Range is relatively flat.
	Geology	Characterized by two primary components: unconsolidated sediments and Paleozoic bedrock.
	Soil	Suffield-Buxton-Hollis Association. Deep to shallow, moderately well drained to somewhat poorly drained soils with low permeability.
	Hydrogeology	Groundwater is used as the municipal water supply in the residential area north of NASB. Most of the wells in the vicinity are between 101 and 300 feet deep. There are no wells within the boundary of the range.
	Hydrology	Surface water flows off the paved area away from Building 55.
	Vegetation	The undeveloped portion of the range is grassy with various tree species.
<b>Land Use and Exposure Profile</b>	Current Land Use	A small portion of the range is developed and used as a parking lot for Building 55. The remaining area is undeveloped and unused.
	Current Human Receptors	Current human receptors include: Navy personnel, authorized visitors, and maintenance workers/contractors.

Table 5.2-1: Conceptual Site Model Information Profiles – Machine Gun Bore Sight Range		
Profile Type	Information Needs	Preliminary Assessment Findings
	Current Activities (frequency, nature of activity)	Building 55 is located in the area. The remaining portion of the range is undeveloped and unused.
	Potential Future Land Use	Same as current.
	Potential Future Human Receptors	Same as current.
	Potential Future Land Use-Related Activities:	No foreseen change to current use.
	Zoning/Land Use Restrictions	No site specific restrictions or access controls.
	Demographics/Zoning	Cumberland County population density is approximately 50,000 persons per square mile.
	Beneficial Resources	Groundwater is a source of the municipal water supply.
<b>Ecological Profile</b>	Habitat Type	Open field and forested area behind Building 55.
	Degree of Disturbance	Limited to surface activities near Building 55.
	Ecological Receptors and Species of Special Concern	Potential ecological receptors include indigenous species. No species of special concern are known to be present at the site.
	Relationship of MEC/MC Sources to Habitat and Potential Receptors	MEC is not suspected at the site. MC potential migration pathways include leaching to groundwater, plant/animal uptake, and ingestion, dermal contact, and dust inhalation from surface soil.

A key element of the CSM is the exposure pathway analysis. For MEC, a complete or potentially complete exposure pathway must include the following components: 1) a source (e.g., locations where MEC are expected to be found); 2) access (e.g., controlled or uncontrolled access, items on the surface or within the subsurface); 3) an activity (e.g., non-intrusive grounds maintenance or intrusive construction); and 4) receptors (e.g., Navy personnel, construction workers, recreational users, or authorized visitors). It is important to recognize that environmental mechanisms (e.g., erosion) and/or human intervention may result in the repositioning of MEC.

For MC, a complete or potentially complete exposure pathway must include the following components: 1) a source (e.g., locations where MC are expected to be found); 2) an exposure medium (e.g., surface soil); 3) an exposure route (e.g., dermal contact); and 4) receptors (e.g., Navy personnel, construction workers, recreational users, or authorized visitors). If the point of

exposure is not at the same location as the source, the pathway may also include a release mechanism (e.g., erosion) and a transport medium (e.g., surface water).

The potential interactions between the source and receptors are assessed differently between MEC and MC. For MC, interaction between the source and receptors involves a release mechanism for the MC, an exposure medium that contains the MC, and an exposure route that places the receptor into contact with the contaminated medium. For MEC, interaction between the potential receptors and an MEC source has two components. The receptor must have access to the source and must engage in some activity that results in contact with individual MEC items within the source area.

#### **MEC Interactions and Pathway Analysis**

As discussed in [Section 5.2.4](#), the former Machine Gun Bore Sight Range is not suspected to contain MEC. Expended machine gun and small arms ammunition are not considered an explosives safety concern. Therefore, no MEC pathway analysis figure was prepared.

#### **MC Interactions and Pathway Analysis**

By design when the range was in use there were concrete taxiways leading up to the targets so that pilots could maneuver their planes into position for test firing of the aircraft mounted machine guns. The concrete taxiways would have prevented rounds from entering the surface or subsurface soil. The range was designed so that the machine gun and small arms pistol ammunition fired at the range would impact a berm. The berm is visible on an aerial photo of the range. The final disposition of the berm is unknown. A portion of the area has been improved by a building, parking pad and storage lot. These improvements essentially provide a cap to minimize the transport of subsurface MC (if it exists at the site).

The MC pathway analysis and the potential for exposure to MC are shown in [Figure 5.2-6](#). Soil from the berm may still remain on site, and thus the potential exists for MC in the undeveloped portion of the site. In the event that development to the site occurs in the future, potentially complete pathways are indicated for maintenance and construction workers and the Navy personnel that would be supervising them via ingestion, dermal contact, and inhalation. Due to the lack of data regarding biota in the area, the exposure pathways are marked as potentially complete. No surface water or sediment is present on the range; therefore, this pathway is shown incomplete for all receptors.

MC, if present, have the potential to leach to shallow groundwater; however, wells in and around the installation are on average at depths exceeding 100 feet. No drinking water well are located within the footprint of the range. Based upon these findings, the groundwater pathway is shown as incomplete for all receptors.

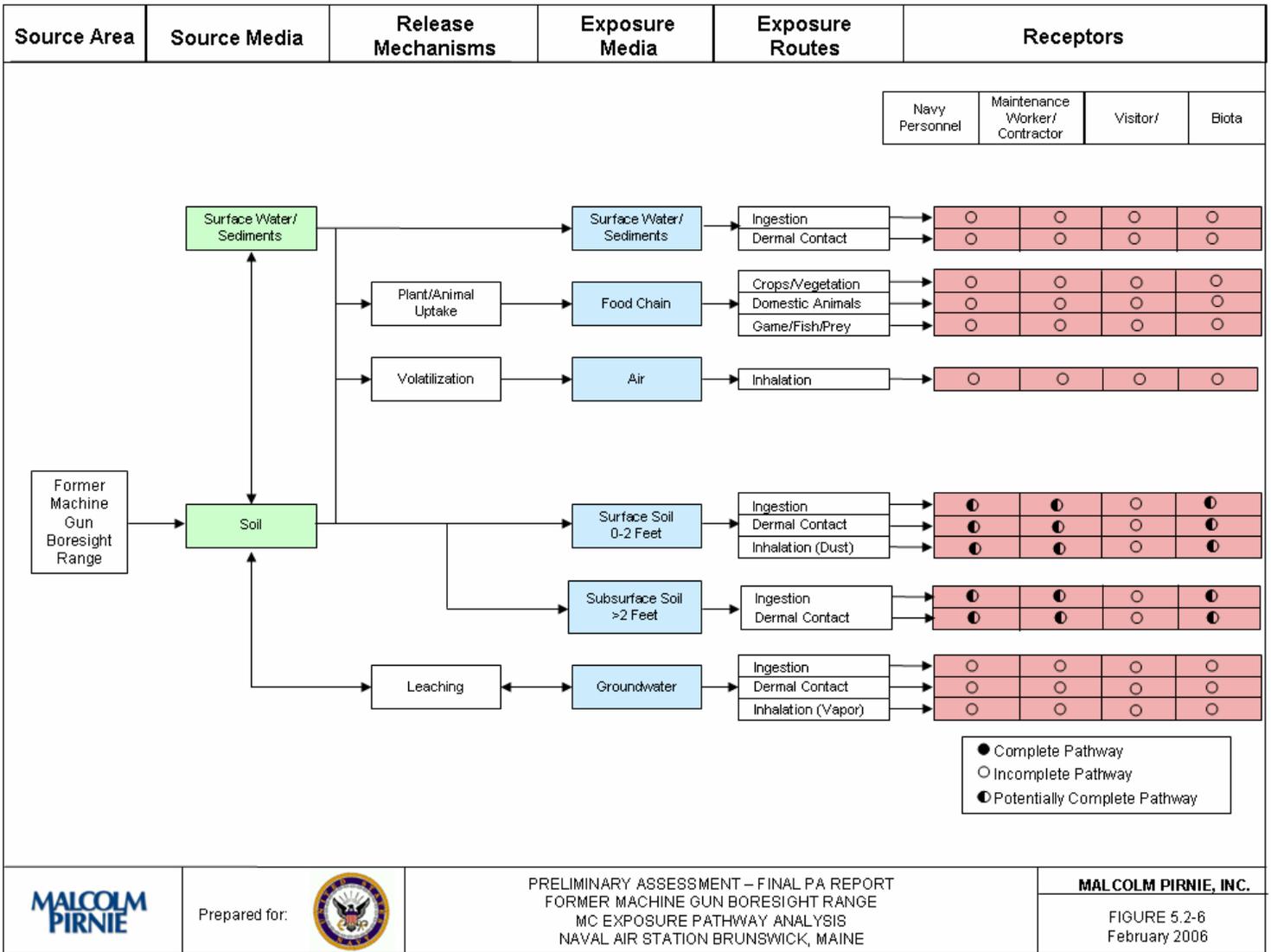


Figure 5.2-6: MC Exposure Pathway Analysis

### *5.2.12. Summary*

The former Machine Gun Bore Sight Range was used during the 1950s to align and test fire aircraft mounted guns. Naval aircraft of the 1950s would have fired machine gun (small arms) ammunition including .30 caliber and .50 caliber. Given the size of the range and the proximity of the range to the installation boundary (200 meters based on review of a 1952 map), rounds that may have missed the target could have had the potential to land outside the installation. At the time the range was active, the area east (direction of fire) of the range was undeveloped and wooded. The range is visible on the 1957 aerial photo of the installation. From the aerial photo the area of the compass rose and berm are visible. Today, however, there are no visible remnants of the Machine Gun Bore Sight Range, the range berm, or the compass rose.

An undated map believed to be from the late 1950s to early 1960s found at the National Archives had the range labeled as a pistol range. The exact history or use of the range as a pistol range is unknown. The layout of the installation was later changed and eventually the taxiways connecting the runways to the range area were removed and the range was abandoned.

Today Building 55 sits on the approximate area of the former range and compass rose area. Approximately 0.5 acres of the former range area is paved over for the parking lot and storage area associated with Building 55.

The former Machine Gun Bore Sight Range is not suspected to contain MEC. However, there is the potential for MC. The primary MC of concern associated with machine gun and small arms ammunition is lead. By design, the majority of the bullets fired at the range would have landed and accumulated in the berm. It is unknown if NASB had any procedures in place to remove and dispose of lead as it accumulated on the range when it was active or when the range was closed. The ultimate disposition of the berm is unknown. Sampling data was not available to estimate the potential for lead in the soil.

**Preliminary Assessment  
Naval Air Station Brunswick, Maine**

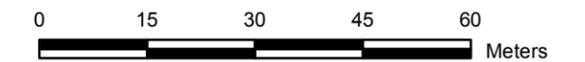


**MALCOLM  
PIRNIE**

**Map 5.2-1  
Visual Survey  
Machine Gun Boresight Range**

**Legend**

-  Installation Boundary
-  Site Reconnaissance
-  Machine Gun Boresight Range



Data Source: USGS 7.5 Minute Series  
Digital Ortho Photo Quadrangle  
Brunswick, ME, 1998

Coordinate System: UTM Zone 19N  
Datum: NAD 83  
Units: Meters

Contract: N62472-02-D-1300  
Edition: Final Preliminary Assessment  
Date: February 2006

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Naval Air Station Brunswick, Maine**



**MALCOLM  
PIRNIE**

**Map 5.2-2  
Range/Site Details  
Machine Gun Boresight Range**

**Legend**

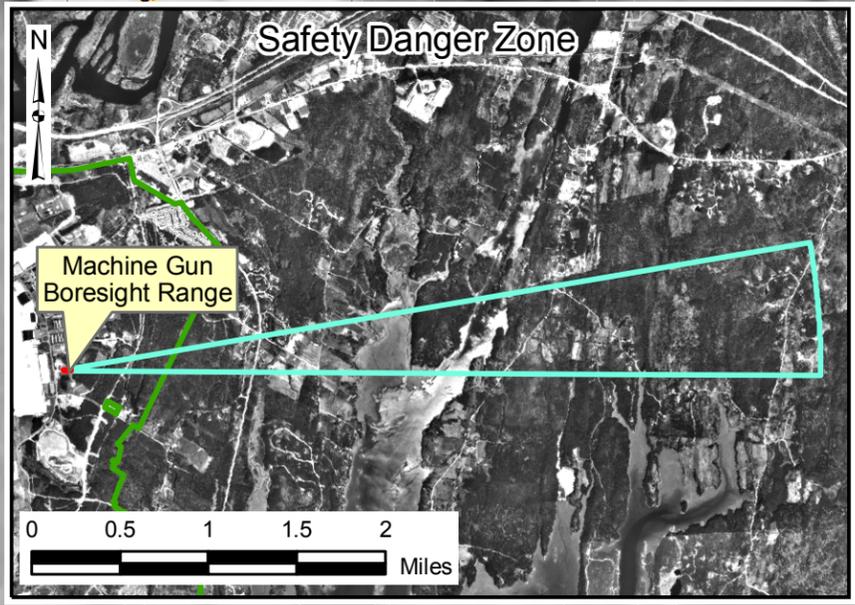
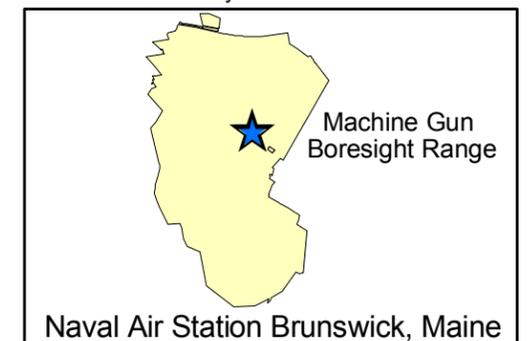
- Installation Boundary
- Structures
- Roads
- Fence Lines
- Streams
- Contours
- Wetlands
- Berm
- Compass Rose
- Safety Danger Zone
- Machine Gun Boresight Range



Data Source: USGS 7.5 Minute Series  
Digital Ortho Photo Quadrangle  
Brunswick, ME, 1998

Coordinate System: UTM Zone 19N  
Datum: NAD 83  
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Date: February 2006



**Preliminary Assessment  
Naval Air Station Brunswick, Maine**



**MALCOLM  
PIRNIE**

**Map 5.2-3  
Munitions Characterization  
Machine Gun Boresight Range**

**Legend**

-  Installation Boundary
-  Machine Gun Boresight Range
- MEC Presence\***
-  Known
-  Suspect

\* There is no evidence of MEC Presence as determined through historical documentation, interview, and/or visual survey. Visual observations and/or historical documentation indicate that MC may be present at the site, but MC Presence has not been confirmed by sampling or other means.



Data Source: USGS 7.5 Minute Series  
Digital Ortho Photo Quadrangle  
Brunswick, ME, 1998

Coordinate System: UTM Zone 19N  
Datum: NAD 83  
Units: Meters

Contract: N62472-02-D-1300  
Edition: Final Preliminary Assessment  
Date: February 2006



### 5.3. SKEET RANGE

#### *5.3.1. History and Site Description*

The Skeet Range was located in the southeast portion of the installation in an open field approximately 75 meters north and 100 meters east of Building 55 (just off Orion Street). The former range was located adjacent to Range Road just northeast of the taxiway intersection.

The layout of the installation during the time frame the Skeet Range was active was much different than its current layout. Over the years, the footprints of the runways and the associated support buildings and structures nearby have changed. As shown on a map dated June 30, 1952, taxiways connected the runways to the southeast portion of the installation that provided pilots access to the compass calibration pad (compass rose) and the Machine Gun Bore Sight Range (covered in [Section 5.2](#)). Range Road (now known as Orion Road) intersected the taxiway leading to the compass rose and the Machine Gun Bore Sight Range.

The direction of fire of the Skeet Range shown on a 1946 historical map was to the north. On a 1957 aerial photograph, the taxiway connecting the runways to the area of the compass rose and the Machine Gun Bore Sight Range is no longer prevalent. The Skeet Range is shown in the same relative position as in the 1946 map; however, the direction of fire is towards the east. Sometime between 1946 and 1957, the layout of the range and direction of fire were changed. The orientation of the Skeet Range was most likely changed in the 1950s due to the construction of barracks in the area. Explosives safety regulations and guidance of the time would have required the direction of fire to be changed to maintain a safe separation distance between the range and surrounding buildings. Henceforth, the north-oriented Skeet Range will be referred to as the “Skeet Range (pre-1950), the east-oriented Skeet Range will be referred to as the “Skeet Range (post-1950), and the term “Skeet Range” will encompass both orientations.

The 1957 aerial photo of the installation was used to create [Figure 5.3-1](#). On the figure, the location of the Skeet Range (post-1950) is shown relative to the compass rose and the former Machine Gun Bore Sight range. Under magnification, trap houses are visible in the aerial photo. These structures are no longer present on the site and have not been for many years.



**Figure 5.3-1: Skeet Range (post-1950) as shown on 1957 aerial photo**

The historic files reviewed provided information on the location and layout of the range but had limited information on the specific use of the range. However, Navy facility guidance documents from the time frame of when the range was operational provide some guidelines on the layout and use of Navy shore facilities, which would have included the NASB. The guidelines can be used to establish how the NASB, and in particular the Skeet Range, was most likely setup and used. Guidelines available to the data collection team included the Bureau of Aeronautics published

Programming Guide, entitled *U.S. Naval Aeronautical Shore Facilities* NAVAER 00-100-504, March 1958. NAVAER 00-100-504 prescribed guidelines for military construction of Naval aeronautical shore facilities. The Programming Guide provided general construction guidelines for just about every building, structure, or improvement that was authorized on Naval shore facilities. The Programming Guide included construction guidelines for ranges under Section 179 “Training Facilities Other Than Buildings.”

The 1958 Programming Guide (Section 179 40.2 “Skeet Range”) outlined the requirement for an outdoor skeet range. The skeet range was an integral part of a pilots training as outlined in the Programming Guide, “A shotgun and skeet range is an outdoor practice facility to train military personnel in the principles of leading, timing, and firing on flying targets. In addition to providing sighting proficiency, it may also serve off-duty recreation purposes.”<sup>6</sup> “Air installations conducting operational pilot training may be authorized one shotgun and skeet range.”<sup>7</sup>

The Programming Guide also listed the design criteria for the skeet range. “The minimum facility consists of two trap houses and five individual firing stations or positions, ammunition, and a service shed or locker. The range should have a danger zone of fire of 900 foot radius from the shooting field. The facility will also include a control shelter and storage place for clay pigeons. The trap houses are known as the high and low towers. The structures are normally wood-frame construction.”<sup>8</sup>

The Skeet Range encompassed approximately 73.2 acres. This total area takes into account both the northern and eastern orientations of the Skeet Range. Historic maps and aerial photos were used to estimate the area. It is unknown if a berm existed to limit the extent of the range. According to construction guidelines in the Bureau of Aeronautics Programming Guide of 1958, skeet ranges were required to have a SDZ radius of 900-feet from the shooting field. Therefore, the potential for MC exists over this 900-foot arc. According to ITRC guidance, the positions of the shooters and the angles at which the skeet targets are thrown create a fan shaped shotfall zone.

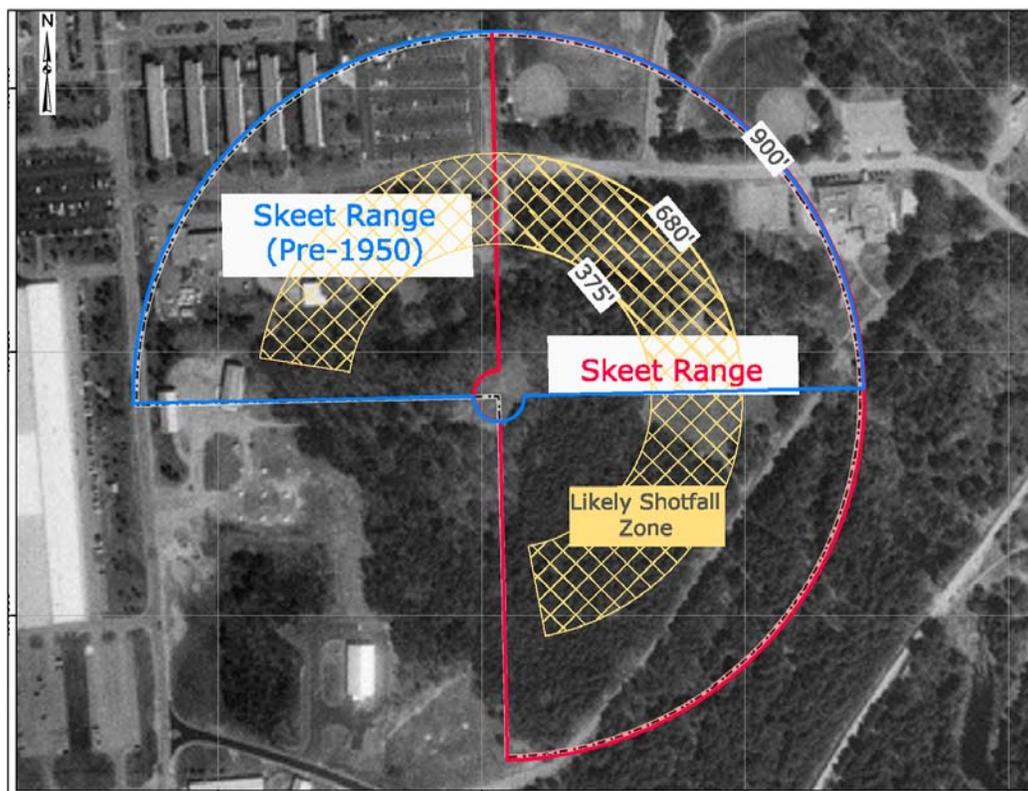
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<sup>6</sup> Bureau of Aeronautics, *U.S. Naval Aeronautical Shore Facilities Programming Guide NA/VAER 00-100-504*, March 1958, Section 179, 40.2 page 100-39.

<sup>7</sup> Bureau of Aeronautics, page 100-39.

<sup>8</sup> Bureau of Aeronautics, page 100-39.

Depending upon the shot angle, wind, and the blocking effect of the trees, the *likely* shotfall zone extends up to 680 feet. The likely shotfall zone (between 375 feet and 680 feet) is the area in which the highest concentrations of MC are expected ([Figure 5.3-2](#)). As shown below, the western half of the pre-1950 Skeet Range area and the northern portion of the post-1950 Skeet Range area have been almost fully developed and are currently covered by several buildings and paved areas; therefore, much of the soil that was present when the Skeet Range was active has likely been disturbed, graded, or removed.



**Figure 5.3-2: Skeet Range Likely Shotfall Zone**

The layout of the Skeet Range is shown on [Map 5.3-1](#) at the end of Section 5.3. The boundaries of the range and location as well as various features in and around the area (e.g., wetland area) are also shown on [Map 5.3-1](#). A monitoring well (well 078) is located within the boundary of the former Skeet Range. Soil boring logs and some sampling data were available to the data collection team. The soil boring and sampling data is discussed in subsequent sections. The monitoring well was installed as part of the NASB environmental program and not specifically installed because of skeet range activities. The well is 17 feet deep with a screening depth range of seven to 12 feet; its location is also shown on [Map 5.3-1](#) at the end of Section 5.3.

### 5.3.1.1. Topography

The area of the former Skeet Range is primarily flat with gently sloping areas near the retention pond.

### 5.3.1.2. Geology

The soil boring logs for monitoring well 078 provides information to 17 feet. The description listed on the soil boring log (silty clay with occasional fine sand, trace small fragments, wet soft, very soft) corresponds to the description of the Presumpscot Formation presented in [Section 3.3](#).

### 5.3.1.3. Soil and Vegetation Types

The soils in the area of the former Skeet Range are from the Suffield-Buxton-Hollis Association. This association consists of deep to shallow, moderately well drained to somewhat poorly drained soils that are characterized by low permeability. The field boring log for monitoring well 078 lists the topsoil as dark brown, fine, sandy silt with black, silty, fine sand just below the topsoil. From 0.1 to 5 ft the soil is reddish brown to tan moist loose sand.



**Figure 5.3-3: Former Skeet Range Area**

The majority of the Skeet Range is open and grassy with various crops of woodland species of trees as shown in [Figure 5.3-3](#). Tree species common to NASB include white pine, pitch pine, hemlock, spruce, and fir with lesser numbers of hardwoods (oak, maple, ash, poplar, and birch). However, most of the trees surrounding the range area are pine. The western portion of the Skeet Range (pre-1950) is highly developed and vegetation consists mainly of urban landscaping and small trees.

#### 5.3.1.4. Hydrology

Approximately 2.8 acres in the northern portion of the site is considered wetlands. A retention pond is located east of a retention wall within this wetlands area (see [Figure 5.3-4](#)). Surface water flows towards the retention pond.



**Figure 5.3-4: Wall West of Retention Pond**



**Figure 5.3-5: Retention Pond within Skeet Range**

#### 5.3.1.5. Hydrogeology

According to the boring log for monitoring well 078, groundwater is at 8.7 feet below the surface. The water at 8.7 feet is from glacial outwash. The well is only 17 feet deep; therefore, site specific information for groundwater deeper than 17 feet is unknown for the Skeet Range. However, boring logs on and near the installation indicates that the bedrock beneath the NASB produces limited quantities of groundwater. The yield of bedrock wells in the vicinity of the NASB ranges from less than 10 gpm to over 50 gpm. Most of the wells in the vicinity are between 101 and 300 feet deep.

#### 5.3.1.6. Cultural and Natural Resources

Based on information provided by NASB, no significant cultural resources have been identified in the area to date.

### **5.3.1.7. Endangered and Special Status Species**

Threatened and endangered species data for the NASB are presented in [Section 3.8](#). No evidence was found indicating the presence of the species listed on the area of the Skeet Range.

### **5.3.2. *Visual Survey Observations and Results***

The data collection team conducted a visual survey of the Skeet Range as part of the data collection effort for the PA. The purpose of the site walk was to identify any UXO or ordnance-related materials (e.g., casings) or surface features (e.g., target areas) that could provide additional information to aid in the characterization of the study area. The visual survey can be used to enhance, augment, or confirm the archival data and in some cases may be the only data available to the team. During the visual survey of the area, the data collection team did not locate any evidence of MEC in the area, and there were no signs of the former range structures (e.g., firing positions, trap houses) associated with the range.

A visual depiction of the site reconnaissance is provided on [Map 5.3-1](#) located at the end of Section 5.3. Additional range/site details are illustrated on [Map 5.3-2](#), also located at the end of Section 5.3.

### **5.3.3. *Munitions and Munitions Related Materials Associated with the Site***

This section describes the munitions or munitions related materials known or suspected to be at the site, including the types and estimated maximum penetration depths. This includes both MEC and non-hazardous munitions related scrap (e.g., fragmentation, base plates, and/or inert mortar fins). Potential ordnance concentrations areas are presented along with a discussion on the presence of special consideration ordnance.

Based on historical documents and information obtained during the data collection process, there is no evidence of MEC at the Skeet Range as only small arms were used. Firing records were not available, and there is no defensible method of determining the amount of ammunition potentially fired at the range. The 1958 Programming Guidance indicated that the range was used for pilot training. It is unknown if the range was also used for recreational purposes. An

ordnance technical data sheet for the 12 gauge shotgun ammunition listed above is included in [Appendix D](#). No other munitions types are known or are suspected to have been used at the site.

Based on the information obtained during the data collection process, no special consideration munitions are known or suspected to have been used at the site; therefore, the Skeet Range is not suspected to contain special consideration MEC.

#### ***5.3.4. MEC Presence***

The entire site has been subdivided and categorized into one of three levels of MEC presence including: Known MEC Areas, Suspect MEC Areas, and Areas where No Evidence exists to indicate that MEC is known or is suspected to be at the site. The MEC presence is discussed below.

[Map 5.3-3](#) illustrates the munitions characterization of the NASB and is provided at the end of Section 5.3.

##### **5.3.4.1. Known MEC Areas**

Based on historical documents and information obtained during the data collection process, there is no evidence of MEC at the Skeet Range as only small arms were used. Therefore, there are no known MEC areas.

##### **5.3.4.2. Suspected MEC Areas**

Based on historical documents and information obtained during the data collection process, there is no evidence of MEC at the Skeet Range as only small arms were used. Therefore, there are no suspected MEC areas.

##### **5.3.4.3. Areas Not Suspected to Contain MEC**

Based on historical documents and information obtained during the data collection process, there is no evidence of MEC at the Skeet Range as only small arms were used. Therefore, the entire Skeet Range is not suspected to contain MEC.

### **5.3.5. *Ordnance Penetration Estimates***

For small arms ranges, the ITRC has prepared a document titled, “Characterization and Remediation of Soils at Closed Small Arms Firing Ranges”, dated January 2003, to provide information on the general layout of small arms ranges, as well as information on areas that may be impacted with MC and/or MEC as a result of range use and the characteristics of the munitions used. According to the ITRC guidance, the penetration depth of small arms on the range floor is one foot or less. The document states that rounds that impact the range floor are typically a flat trajectory that fell short of or missed the target or those resulting from ricochet, and these fragments are usually found within the top six inches of soil. For trap and skeet ranges, the ammunition is dispersed as pellets over a small area in the direction of fire. According to the 1958 Programming Guide, the minimum safe range from a skeet/trap range is 900 feet. Pellets dispersed from a shotgun would be deposited on the ground surface and not significantly penetrate the ground unless disturbed.

### **5.3.6. *Munitions Constituents***

The primary MC of concern with shotgun ammunition used during the time that the range was active is lead. It is unknown if the air station had any procedures in place to remove and dispose of lead as it accumulated on the range when it was active or when the range was closed. However, during the 1950s, lead was not considered to be an environmental issue or a health hazard; therefore, it is not unusual that records were not kept of lead related activities. The ultimate disposition of the soil that may have been contaminated with lead is unknown. There is the potential that MC contaminated soil remains at the site.

Other associated MC (less likely to be of concern) may include: antimony (increases hardness), arsenic (present in lead), nickel (coating on some shot), and lead azide (associated with gunpowder). Another common contaminant associated with trap and skeet ranges are polycyclic aromatic hydrocarbons (PAHs). PAHs have been linked with clay target pigeons used for target practice at other skeet ranges. The types and quantities of targets used at the NASB Skeet Range is unknown. The potential for lead and PAH contamination is greatest within the shot fall zone ([Figure 5.3-2](#)).

Limited groundwater sampling data (for volatiles only) from monitoring well 078 located within the boundaries of the range was available to the data collection team. A review of the

groundwater data indicated the presence of non-skeet related volatiles. Sampling data for metals and inorganics (including lead) was not available for the monitoring well. Soil sampling data was also not available for the site.

### **5.3.7. Contaminant Migration Routes**

There are two primary routes for the migration of MC, if it exists: surface runoff to surface water bodies or infiltration to groundwater. Approximately 2.8 acres in the northern portion of the site are considered wetlands. The surface water at the site flows into the retention pond located in this wetlands area. Migration to groundwater is reduced by the presence of low permeability soils across the majority of the site; however, the wetlands area may provide significant recharge to the shallow aquifer thus providing a preferential pathway for contaminant migration.

### **5.3.8. Receptors**

Navy personnel, maintenance/construction workers and biota represent potential receptors. Maintenance and construction workers include those who provide landscaping services. Construction workers include those who may undertake intrusive projects in the future. Biota includes indigenous species.

#### **5.3.8.1. Nearby Populations**

As Maine's second largest employer, NASB employs more than 4,800 military and civilian personnel. Approximately 1,480 military personnel reside on the installation. NASB is located approximately two miles east of the Brunswick's main business district. Residential properties are located approximately one to two miles west, northwest, and southwest of the installation. Based on estimates from the 2000 U.S. Census, the population of Cumberland County is just over 265,600 and comprises approximately 20% percent of the State's population. The Town of Brunswick, including NASB, has an estimated population of approximately 16,000, which comprises approximately 6% of Cumberland County's population.

#### **5.3.8.2. Buildings Near/Within Site**

Several buildings are present in the western portion of the Skeet Range (pre-1950) including Buildings 79, 29, 201, 293, and 52. There are no buildings present within the Skeet Range (post-1950).

### **5.3.8.3. Utilities On/Near Site**

Overhead utilities are not present at the former range. Buried utilities, if present, would follow a utility corridor along Orion Street.

### **5.3.9. Land Use**

The Skeet Range (pre-1950) is highly developed and is covered by several buildings as shown on [Map 5.3-2](#). The Skeet Range (post-1950) is undeveloped except for the northernmost portion which contains a baseball field and is intersected by Neptune Drive. Currently, there are no plans in place to alter the use or to develop the area; therefore, the anticipated future land use is for the area to remain the same as the current use.

### **5.3.10. Access Controls / Restrictions**

A security check is necessary to enter the NASB. There are no security or access restrictions to the Skeet Range once on the installation.

### **5.3.11. Conceptual Site Model**

This CSM was developed following guidance documents issued by the USEPA for hazardous waste sites and the USACE for OE sites. Guidance documents included the USEPA's Guidance for Conducting Remedial Investigations and Feasibility Studies under CERCLA (EPA/540/G-89/004) and the USACE CSM Guidance Development of Integrated Conceptual Site Models for Environmental Ordnance and Explosives Sites, finalized in February 2003.

The CSM describes the site and its environmental setting. The CSM presents information regarding: 1) MEC and/or MC known or suspected to be at the site; 2) current and future reasonably anticipated or proposed uses of the real property; and 3) actual, potentially complete, or incomplete exposure pathways linking them. The CSM is the basis for the risk evaluation, prioritization, and remediation cost estimate.

The CSM is presented in a series of information profiles that present information about the site. The information profiles are included in [Table 5.3-1](#) below.

Table 5.3-1: Conceptual Site Model Information Profiles – Skeet Range		
Profile Type	Information Needs	Preliminary Assessment Findings
Range/Site Profile	Installation Name	Naval Air Station Brunswick
	Installation Location	Cumberland County, Maine
	Range/Site Name	Skeet Range
	Range/Site Location	Located approximately 75 meters north and 100 meters east of the current Building 55 and adjacent to the Old Machine Gun Range.
	Range/Site History	Shown on installation maps from 1946 and in an aerial photo from 1957
	Range/Site Area and Layout	The Skeet Range encompasses approximately 73.2 acres. On the map from 1946, the range is shown with the firing towards the north; however, in the 1957 aerial photo and on later maps, the range is shown firing to the east.
	Range/Site Structures	Aerial photos show shot house for skeet; however, structures that existed when the range was active are no longer present at the site.
	Range/Site Boundaries	N: Building 211 S: Forested area E: Forested area. W: Orion Street.
	Range/Site Security	No security or access restrictions to the site once on the installation.
Munitions/Release Profile	Munitions Types	Shotgun ammunition – 12 gauge
	Maximum Probability Penetration Depth	Small arms, one foot or less.
	MEC Density	Not applicable.
	MEC Scrap/Fragments	Not applicable.
	Associated Munitions Constituents	Primary MC is lead, other associated MC (less likely to be of concern) may include: antimony (increases hardness), arsenic (present in lead), nickel (coating on some shot), lead azide (associated with gunpowder) and PAHs.

Table 5.3-1: Conceptual Site Model Information Profiles – Skeet Range		
Profile Type	Information Needs	Preliminary Assessment Findings
	Migration Routes/Release Mechanisms	Erosion – The area is flat, so no significant run-off is anticipated. Run-off that does occur will flow into retention pond.  Human Intervention – Minimal (current and anticipated future use limited to grounds crew, pedestrian traffic)
<b>Physical Profile</b>	Climate	Continental climate with three well-defined seasons. Highest temperatures occur in July (79 F or higher). Coldest temperatures occur in January (21 F or lower).
	Topography	The Skeet Range is mainly flat.
	Geology	Silty clay with occasional fine sand, trace small fragments, wet soft, very soft) corresponds to the description of the Presumpscot Formation.
	Soil	Soils are from the Suffield-Buxton-Hollis Association which consists of deep to shallow, moderately well drained to somewhat poorly drained soils that are characterized by low permeability. The field boring log for monitoring well 078 lists the topsoil as dark brown, fine, sandy silt with black, silty, fine sand just below the topsoil. From 0.1 to 5 ft the soil is reddish brown to tan moist loose sand.
	Hydrogeology	The yield of bedrock wells in the vicinity of the NASB ranges from less than 10 gpm to over 50 gpm. Most of the wells in the vicinity are between 101 and 300 feet deep.
	Hydrology	Surface water flows towards retention pond.
	Vegetation	The majority of the Skeet Range (post-1950) area is open and grassy with various crops of woodland species of trees (mostly pine). The Skeet Range (pre-1950) is highly developed and vegetation consists mainly of urban landscaping and small trees.
<b>Land Use and Exposure Profile</b>	Current Land Use	The Skeet Range (pre-1950) is highly developed and is covered by several buildings as shown on Map 5.3-2. The Skeet Range (post-1950) is undeveloped except for the northernmost portion which contains a baseball field and is intersected by Neptune Drive.
	Current Human Receptors	Current human receptors include: Navy personnel, maintenance workers/contractors, and visitors.

Table 5.3-1: Conceptual Site Model Information Profiles – Skeet Range		
Profile Type	Information Needs	Preliminary Assessment Findings
	Current Activities (frequency, nature of activity)	Grounds crew and pedestrian traffic.
	Potential Future Land Use	Same as current.
	Potential Future Human Receptors	Same as current
	Potential Future Land Use-Related Activities:	Same as current.
	Zoning/Land Use Restrictions	No site specific restrictions or access controls.
	Demographics/Zoning	Cumberland County population density is approximately 50,000 persons per square mile.
	Beneficial Resources	Groundwater is the source of the municipal water supply. However, the wells are screened in the deep aquifer (>100 feet below surface).
<b>Ecological Profile</b>	Habitat Type	Scrub/shrub in open field, wetland area nearby along with retention pond.
	Degree of Disturbance	Limited to surface activities including grounds maintenance.
	Ecological Receptors and Species of Special Concern	Potential ecological receptors include indigenous species. No species of special concern are known to be present at the site.
	Relationship of MEC/MC Sources to Habitat and Potential Receptors	MEC not suspected at site. MC potential migration pathways include infiltration to subsurface soil, infiltration and leaching to groundwater, and to a lesser extent dust emissions and volatilization to ambient air.

A key element of the CSM is the exposure pathway analysis. For MEC, a complete or potentially complete exposure pathway must include the following components: 1) a source (e.g., locations where MEC are expected to be found); 2) access (e.g., controlled or uncontrolled access, items on the surface or within the subsurface); 3) an activity (e.g., non-intrusive grounds maintenance or intrusive construction); and 4) receptors (e.g., Navy personnel, construction workers, recreational users, or authorized visitors). It is important to recognize that environmental mechanisms (e.g., erosion) and/or human intervention may result in the repositioning of MEC.

For MC, a complete or potentially complete exposure pathway must include the following components: 1) a source (e.g., locations where MC are expected to be found); 2) an exposure medium (e.g., surface soil); 3) an exposure route (e.g., dermal contact); and 4) receptors (e.g.,

Navy personnel, construction workers, recreational users, or authorized visitors). If the point of exposure is not at the same location as the source, the pathway may also include a release mechanism (e.g., erosion) and a transport medium (e.g., surface water).

The potential interactions between the source and receptors are assessed differently between MEC and MC. For MC, interaction between the source and receptors involves a release mechanism for the MC, an exposure medium that contains the MC, and an exposure route that places the receptor into contact with the contaminated medium. For MEC, interaction between the potential receptors and an MEC source has two components. The receptor must have access to the source and must engage in some activity that results in contact with individual MEC items within the source area.

#### **MEC Interactions and Pathway Analysis**

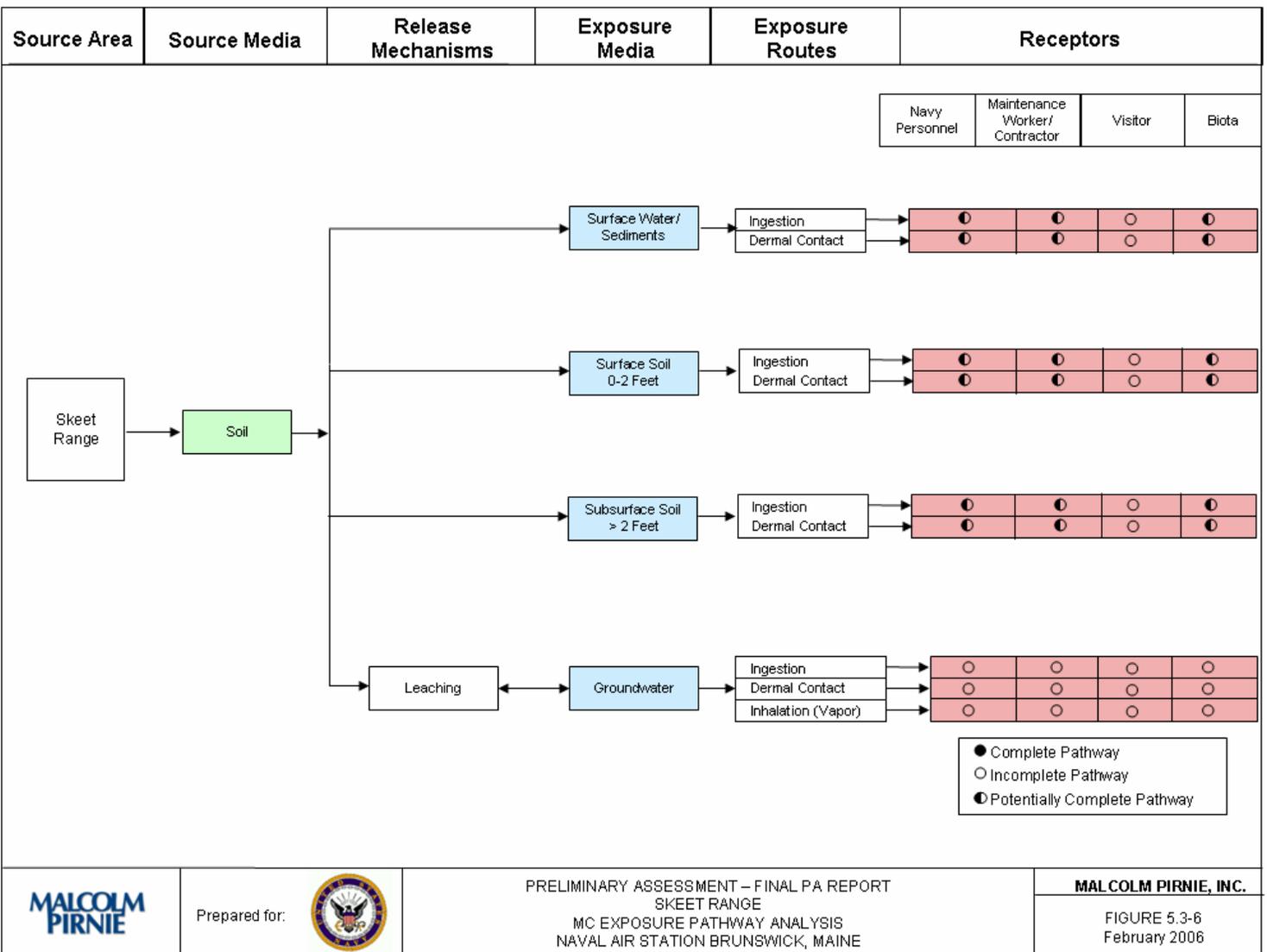
As discussed in [Section 5.3.4](#), the Skeet Range is an area not suspected to contain MEC. The expended shot gun ammunition used at range is not considered an explosives safety concern. Therefore no MEC pathway analysis figure was prepared.

#### **MC Interactions and Pathway Analysis**

The MC pathway analysis and the potential for exposure to MC are shown in [Figure 5.3-6](#). MC may be present in surface soil and in surface water/sediments due to run-off; therefore, potentially complete pathways are indicated for maintenance workers, contractors and Navy personnel. There is also a potential for MC to be present in subsurface soil due to infiltration. In the event that intrusive activities occur, potentially complete pathways are indicated for maintenance and construction workers and the Navy personnel that would be supervising them via ingestion and dermal contact. Due to the lack of data regarding biota in the area, the exposure pathways are marked as potentially complete.

MC, if present, have the potential to leach to shallow groundwater; however, wells in and around the installation are on average at depths exceeding 100 feet. No drinking water wells are located within the footprint of the range. Based upon these findings, the groundwater pathway is shown as incomplete for all receptors.

Figure 5.3-6: MC Exposure Pathway Analysis



### ***5.3.12. Summary***

The former Skeet Range was used for training of military personnel during the 1950s. Navy Programming Guidance from the 1950s defined the SDZ of a skeet range as a 900 foot radius from the shooting field. The configuration of the range has changed over the years. On range maps from 1952, the range is shown with the direction of fire towards the north; however, in a 1957 aerial photo, the range is shown with the direction of fire to the east. It appears that the layout of the range and direction of fire were changed sometime around 1950, possibly due to the construction of barracks in the area. By changing the direction of fire, the installation was able to maintain a safe separation distance from the shooting field outlined in the Programming Guide because the area east of the range was undeveloped. The area depicted in the PA takes into account both range layouts (direction of fire towards the east and north).

The lead shot from expended shot gun ammunition is not considered MEC. However, there is the potential for MC. The primary constituent of concern associated with the Skeet Range is lead. It is unknown if the Navy performed any lead removal from the range when it was active or after it was abandoned. During the time the range was operational, lead was not considered an environmental or health hazard. Other associated MC (less likely to be of concern) may include: antimony (increases hardness), arsenic (present in lead), nickel (coating on some shot), and lead azide (associated with gunpowder). Sampling data for metals and inorganics in groundwater and soil was not available to gauge the potential of MC. Sampling data for volatiles for the groundwater monitoring well (No 078) located within the boundary of the site was available. A review of this data indicated the presence of non-skeet related volatiles.

Potentially complete pathways exist for surface soil, subsurface soil, and surface water / sediment for maintenance and construction workers. No signs of the range (e.g., target area, shot houses) remain at the site. The western portion of the former Skeet Range is highly developed and contains several buildings but the eastern half of the Skeet Range remains undeveloped.

**Preliminary Assessment  
Naval Air Station Brunswick, Maine**

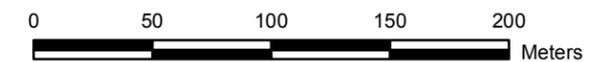
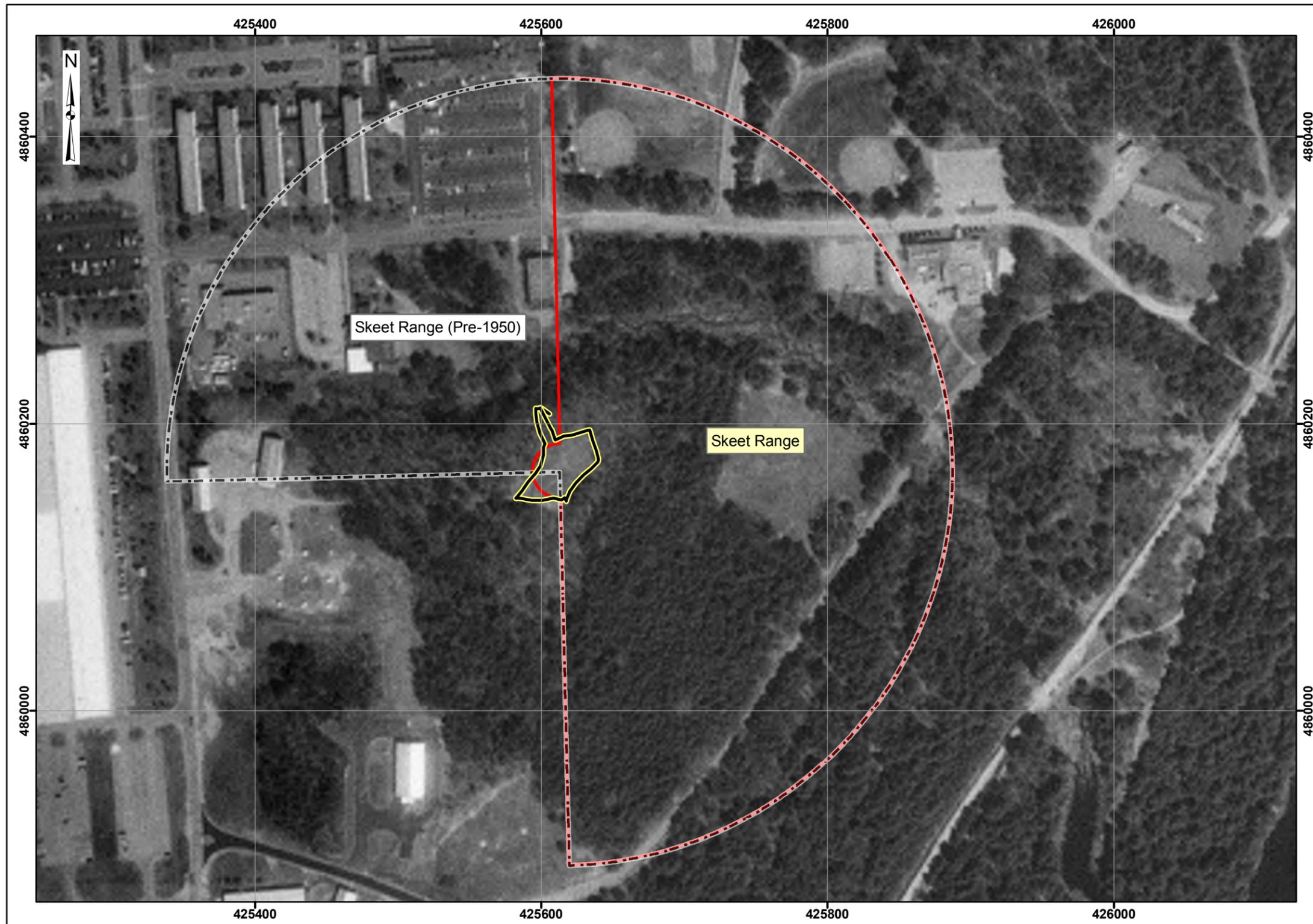


**MALCOLM  
PIRNIE**

**Map 5.3-1  
Visual Survey  
Skeet Range**

**Legend**

-  Installation Boundary
-  Site Reconnaissance
-  Skeet Range (Pre-1950)
-  Skeet Range



Data Source: USGS 7.5 Minute Series  
Digital Ortho Photo Quadrangle  
Brunswick, ME, 1998

Coordinate System: UTM Zone 19N  
Datum: NAD 83  
Units: Meters

Contract: N62472-02-D-1300  
Edition: Final Preliminary Assessment  
Date: February 2006

**Preliminary Assessment  
Naval Air Station Brunswick, Maine**

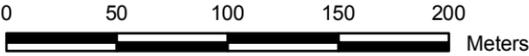


**MALCOLM  
PIRNIÉ**

**Map 5.3-2  
Range/Site Details  
Skeet Range**

**Legend**

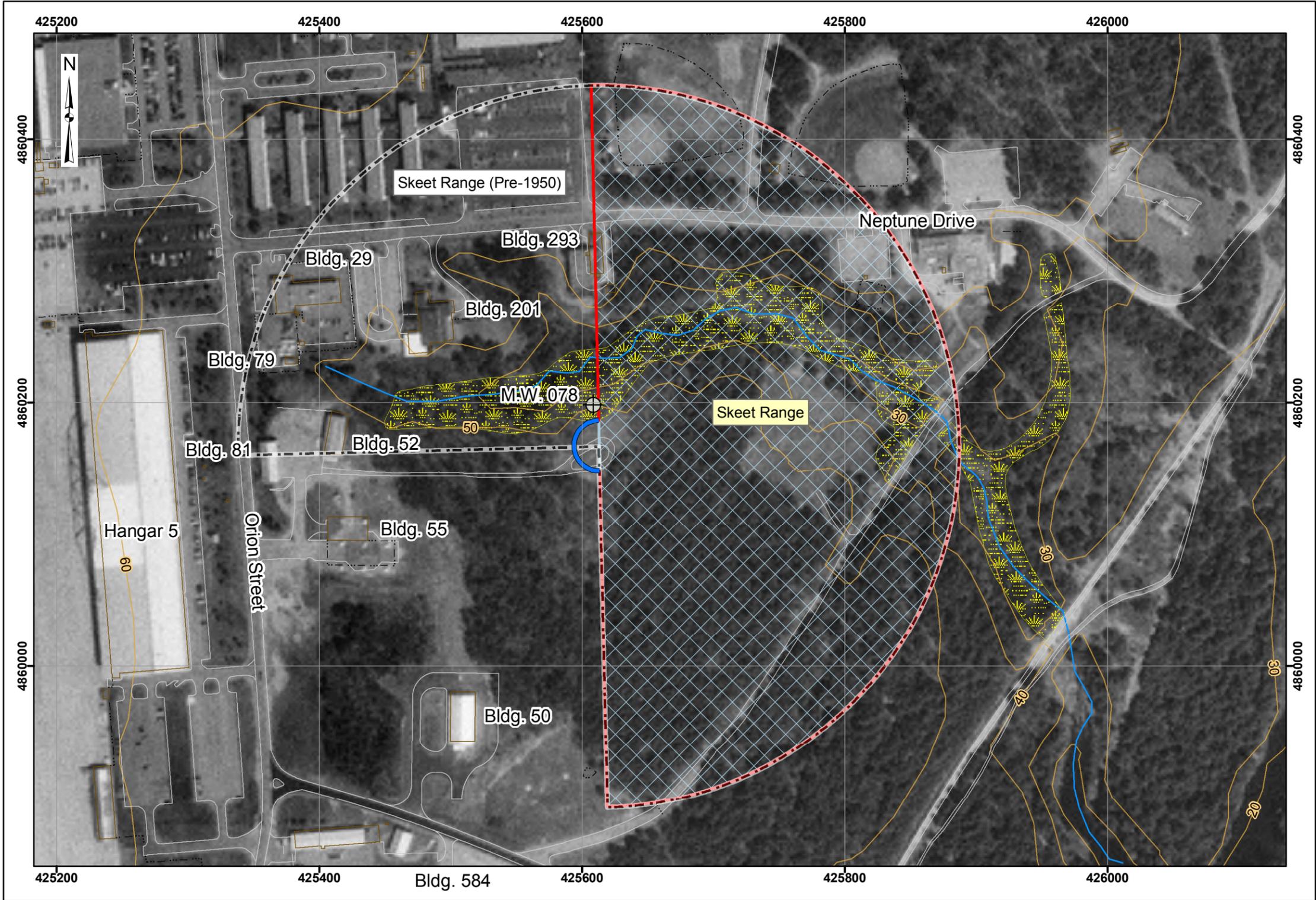
-  Installation Boundary
-  Structures
-  Roads
-  Fence Lines
-  Contours
-  Streams
-  Wetlands
-  Monitoring Well
-  Firing Line
-  Surface Danger Zone
-  Skeet Range (Pre-1950)
-  Skeet Range



Data Source: USGS 7.5 Minute Series  
Digital Ortho Photo Quadrangle  
Brunswick, ME, 1998

Coordinate System: UTM Zone 19N  
Datum: NAD 83  
Units: Meters

Contract: N62472-02-D-1300  
Edition: Final Preliminary Assessment  
Date: February 2006



**Preliminary Assessment  
Naval Air Station Brunswick, Maine**



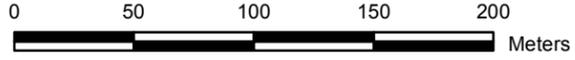
**MALCOLM  
PIRNIE**

**Map 5.3-3  
Munitions Characterization  
Skeet Range**

**Legend**

-  Installation Boundary
-  Skeet Range (Pre-1950)
-  Skeet Range
- MEC Presence\***
-  Known
-  Suspect

\* There is no evidence of MEC Presence as determined through historical documentation, interview, and/or visual survey. Visual observations and/or historical documentation indicate that MC may be present at the site, but MC Presence has not been confirmed by sampling or other means.



Data Source: USGS 7.5 Minute Series  
Digital Ortho Photo Quadrangle  
Brunswick, ME, 1998

Coordinate System: UTM Zone 19N  
Datum: NAD 83  
Units: Meters

Contract: N62472-02-D-1300  
Edition: Final Preliminary Assessment  
Date: February 2006



## Appendix A: References

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**Former Munitions Bunker West Area**

Naval Air Station Brunswick, Maine, Release/Receipt Document, Blank Small Arms Cartridges

[\\Reference\\_Documents\Source\\_Data\Appendix\\_C\Appendix\\_C-1\Brunswick\\_ref13](\\Reference_Documents\Source_Data\Appendix_C\Appendix_C-1\Brunswick_ref13)

Naval Air Station Brunswick, Maine, Release/Receipt Document, Hand Signal Devices

[\\Reference\\_Documents\Source\\_Data\Appendix\\_C\Appendix\\_C-1\Brunswick\\_ref14](\\Reference_Documents\Source_Data\Appendix_C\Appendix_C-1\Brunswick_ref14)

Naval Air Station Brunswick, Maine, Release/Receipt Document, Signal Cartridges

[\\Reference\\_Documents\Source\\_Data\Appendix\\_C\Appendix\\_C-1\Brunswick\\_ref15](\\Reference_Documents\Source_Data\Appendix_C\Appendix_C-1\Brunswick_ref15)

Naval Air Station Brunswick, Maine, Release/Receipt Document, Small Arms Cartridges

[\\Reference\\_Documents\Source\\_Data\Appendix\\_C\Appendix\\_C-1\Brunswick\\_ref16](\\Reference_Documents\Source_Data\Appendix_C\Appendix_C-1\Brunswick_ref16)

Naval Air Station Brunswick, Maine, Release/Receipt Document, Smoke Ammunition – Red  
M18

[\\Reference\\_Documents\Source\\_Data\Appendix\\_C\Appendix\\_C-1\Brunswick\\_ref17](\\Reference_Documents\Source_Data\Appendix_C\Appendix_C-1\Brunswick_ref17)

Naval Air Station Brunswick, Maine, Release/Receipt Document, Smoke Ammunition – Yellow  
M18

[\\Reference\\_Documents\Source\\_Data\Appendix\\_C\Appendix\\_C-1\Brunswick\\_ref18](\\Reference_Documents\Source_Data\Appendix_C\Appendix_C-1\Brunswick_ref18)

Naval Air Station Brunswick, Maine, Release/Receipt Document, Smoke Signals

[\\Reference\\_Documents\Source\\_Data\Appendix\\_C\Appendix\\_C-1\Brunswick\\_ref19](\\Reference_Documents\Source_Data\Appendix_C\Appendix_C-1\Brunswick_ref19)

Naval Air Station Brunswick, Maine, Release/Receipt Document, Surface Flares

[\\Reference\\_Documents\Source\\_Data\Appendix\\_C\Appendix\\_C-1\Brunswick\\_ref20](\\Reference_Documents\Source_Data\Appendix_C\Appendix_C-1\Brunswick_ref20)

**Machine Gun Bore Sight Range**

Map of U.S. Naval Air Station Brunswick, Maine, Showing Conditions as of June 30, 1946.

[\\Reference\\_Documents\Source\\_Data\Appendix\\_C\Appendix\\_C-2\Brunswick\\_ref21](#)

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[\\Reference\\_Documents\Source\\_Data\Appendix\\_C\Appendix\\_C-2\Brunswick\\_ref23](#)

Memo to Chief of Bureau of Ordnance, Subject: NAS Brunswick, March 21, 1945.

[\\Reference\\_Documents\Source\\_Data\Appendix\\_C\Appendix\\_C-2\Brunswick\\_ref24](#)

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Memo to Chief of Bureau of Yards and Docks, Subject: Revised Layouts of Naval Air Stations Brunswick, Sanford, Lewiston, and Rockland, Maine, February 26, 1943.

[\\Reference\\_Documents\Source\\_Data\Appendix\\_C\Appendix\\_C-2\Brunswick\\_ref27](#)

*U.S. Naval Aeronautical Shore Facilities NAVAER 00-100-505, p200-9, March 1958.*

[\\Reference\\_Documents\Source\\_Data\Appendix\\_C\Appendix\\_C-2\Brunswick\\_ref28](#)

U.S. Naval Air Station Brunswick, Maine, Existing Conditions Map, November 19, 1965.

[\\Reference\\_Documents\Source\\_Data\Appendix\\_C\Appendix\\_C-2\Brunswick\\_ref29](#)

**FINAL PRELIMINARY ASSESSMENT**

U.S. Naval Air Station Brunswick, Maine, Public Works Department Map, April 15, 1957.

[\\Reference\\_Documents\Source\\_Data\Appendix\\_C\Appendix\\_C-2\Brunswick\\_ref30](#)

**Skeet Range**

NASB Environmental Department, Soil Boring Logs and/or Well Construction Data and Monitoring Sampling Results for well MW-NASB-078.

[\\Reference\\_Documents\Source\\_Data\Appendix\\_C\Appendix\\_C-3\Brunswick\\_ref31](#)

*U.S. Naval Aeronautical Shore Facilities NAVAER 00-100-505, p100-39, March 1958.*

[\\Reference\\_Documents\Source\\_Data\Appendix\\_C\Appendix\\_C-3\Brunswick\\_ref32](#)

## **Appendix B: Project Source Data – General**

(SOURCE DATA INCLUDED ON ENCLOSED CD)

## **Appendix C: Project Source Data – Site Specific**

**(SOURCE DATA INCLUDED ON ENCLOSED CD)**

**Appendix C-1: FORMER MUNITIONS BUNKER  
WEST AREA**

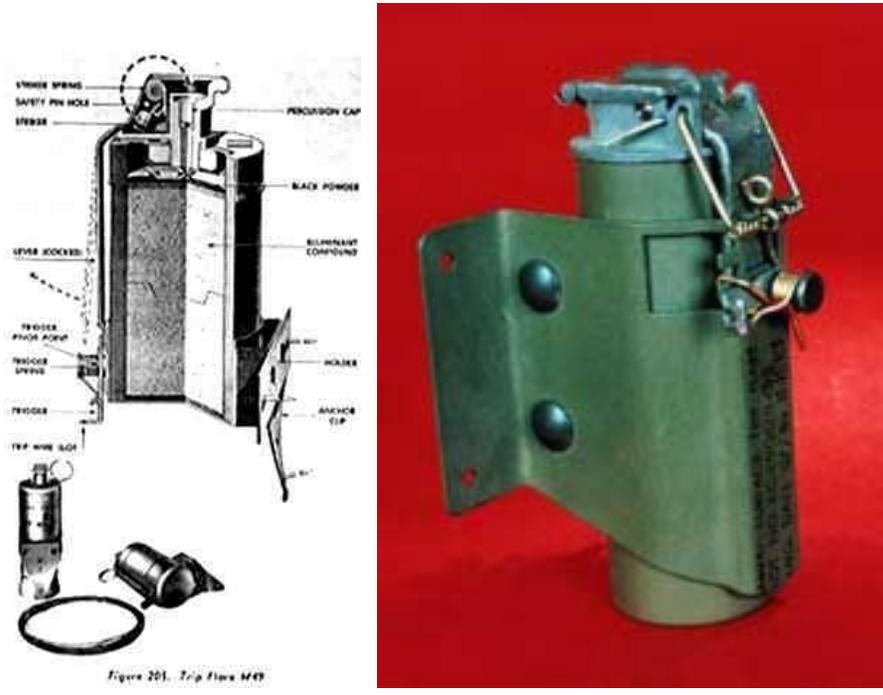
**Appendix C-2: MACHINE GUN BORE SIGHT  
RANGE**

## Appendix C-3: SKEET RANGE

## **Appendix D: Ordnance Technical Data Sheets**

# **FORMER MUNITIONS BUNKER WEST AREA**

# Ordnance Technical Data Sheet



**Nomenclature:** Flare surface TripM49A1  
**Ordnance Family:** Smoke – Pyrotechnic  
**DODIC:** L495  
**Filler:** Pyrotechnic composition  
**Filler weight:** ± not provided  
**Item weight:** 1.44 lbs  
**Dia:** not provided  
**Length:** not provided  
**Fuze:** Mechanical (pull, pressure release)

**Usage:** The purpose of the flare is to reveal the approach of enemy troops. Fixed to one end is a pull-type, spring-actuated firing mechanism to which the trip wire is attached. Enclosed in the tube are the primer, black-powder charge, impregnated muslin disc, and pyrotechnic composition. Two 40-foot lengths of wire are available, making it possible to have two trip wires running in opposite directions. A web belt secures the flare to a tree.

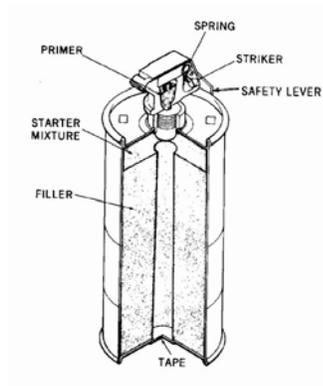
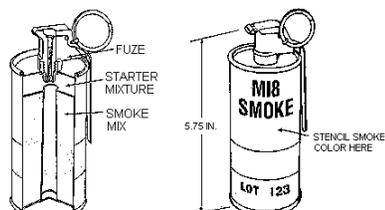
**Item Description:** The flare has a grenade-shaped cylindrical body, with a nose fuze that protrudes 0.875-inch from the head end. A mounting bracket and a spring-loaded trigger mechanism are mounted on a metal base cap. The upper arm of the trigger is attached to a trip wire, and the lower arm of the trigger restrains the safety lever after the removal of the safety pin.

**Reference:** ORDATA Online

# Ordnance Technical Data Sheet

## Grenade, Hand Smoke M18

GRENADE, HAND: SMOKE (RED), M18



**Nomenclature:** Grenade Hand Smoke M18  
**Ordnance Family:** Pyrotechnic  
**DODIC:** G945  
**Filler:** Smoke Mixture  
**Filler weight:**  $\pm$  326.03 g  
**Item weight:** 536 g (19 oz)  
**Diameter:** 64 mm  
**Length:** 146 mm (5.75in)  
**Maximum Range:** N/A  
**Fuze:**

**Usage:** The M18 is a hand-thrown, smoke grenade which emits red or yellow, or violet smoke for 50 to 90 seconds. The M18 may also emit green smoke. These grenades use a pyrotechnic, delay-igniting fuze which provides an approximate 2-second delay.

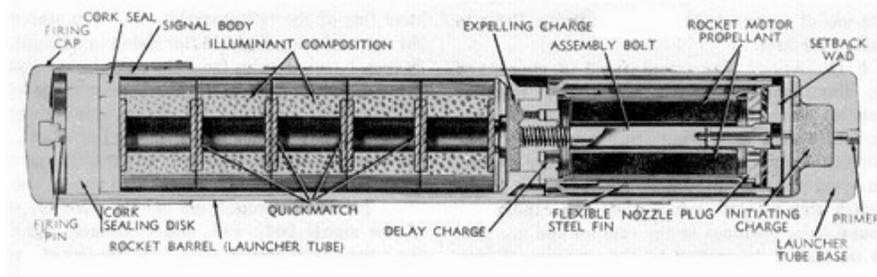
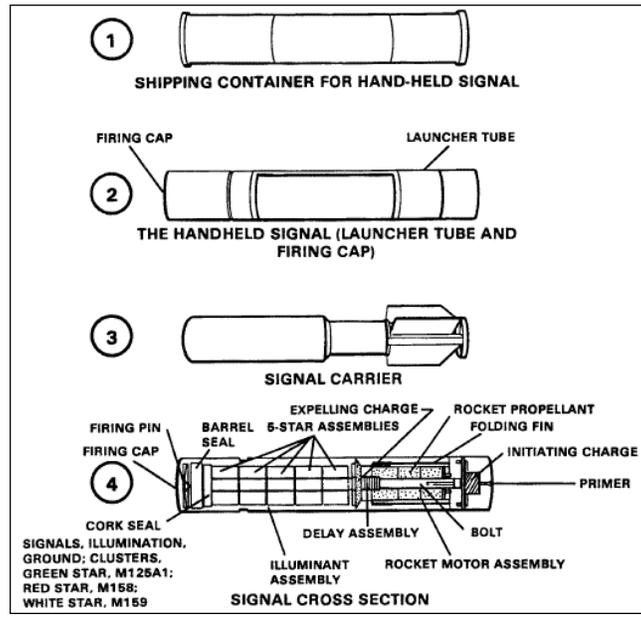
**Description:** The M18 grenade may be olive drab with a light green band around the lower body and nomenclature and smoke color stenciled in light green, or light green with stenciled the color of the smoke. The top of the grenade is painted the color of the smoke.

**Reference:** ORDATA II Version 1.0

# Ordnance Technical Data Sheet

## Signal Illumination Ground

### M125A1



- Nomenclature:** Signal Illumination Ground M125A1
- Ordnance Family:** Pyrotechnic/Flare
- DODIC:** L314
- Propellant Charge:** Black powder
- Filler:** Color Dependent
- Filler weight:** ± not provided
- Item weight:** 503.5 g (1.11 lbs)
- Diameter:** 42 mm (1.564in)
- Length:** 258 mm (10.5in)
- Maximum Range:** 250 m (273yds)
- Usage:** Ground pyrotechnic signals are capable of signaling for communication or illuminating a small area.

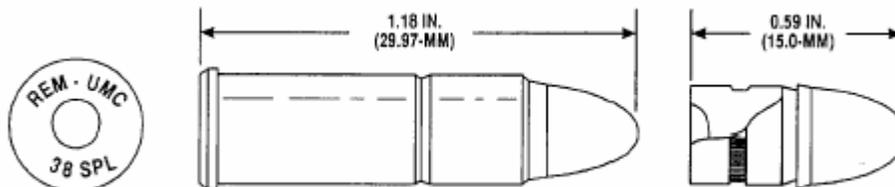
**Description:** These signals are issued in their own launching mechanism and are designed to reach a minimum height of 200 meters. This group of signals includes five-star clusters, single-star parachutes, and smoke parachutes. Handheld signals have replaced all rifle-projected pyrotechnic signals and chemical grenades.

**Reference:** ORDATA Online, FM3-23.30

# **MACHINE GUN BORE SIGHT RANGE**

# Ordnance Technical Data Sheet

## .38 Caliber Small Arms



<b>Nomenclature:</b>	.38 Caliber Small Arms Ammunition
<b>Ordnance Family:</b>	Small Arms
<b>DODIC:</b>	A408
<b>Filler:</b>	Single or Double Base Powder
<b>Filler weight:</b>	4.8 gr
<b>Item weight:</b>	196 gr
<b>Projectile Weight:</b>	60.5 gr
<b>Diameter:</b>	.38 Caliber
<b>Length:</b>	1.18 in. (29.97mm)

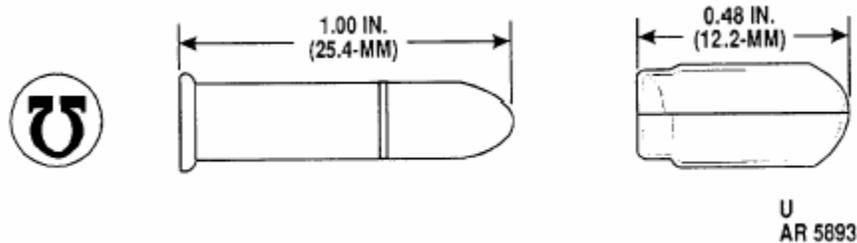
**Usage:** Caliber .38 weapons. The cartridge is for CONUS-guard or security use in caliber .38 weapons.

**Description:** BALL Cartridge. The cartridge is identified by a plain bullet tip.

**Reference:** TM 43-0001-27

# Ordnance Technical Data Sheet

## .22 Caliber Small Arms



<b>Nomenclature:</b>	.22 Caliber Small Arms Ammunition
<b>Ordnance Family:</b>	Small Arms
<b>DODIC:</b>	A086
<b>Filler:</b>	Single or Double Base Powder
<b>Filler weight:</b>	2.5 gr
<b>Item weight:</b>	416 gr
<b>Projectile Weight:</b>	40.5 gr
<b>Diameter:</b>	.22 Caliber
<b>Length:</b>	1 in. (25.4 mm)

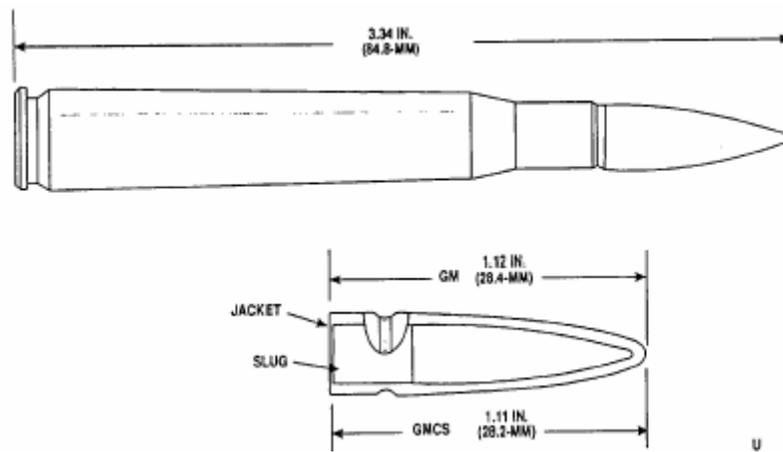
**Usage:** Subcaliber Rifle M2A1; Caliber .22 Rifle; Remington Models 40X and M513T; Steven's Model 416-2; Winchester Models 52 and 75; Machine Gun Trainers M3 and M4; pistols for gallery practice and training purposes. The cartridge is intended for use against small game for survival purposes.

**Description:** BALL Cartridge. The cartridge is identified by a plain bullet tip.

**Reference:** TM 43-0001-27

# Ordnance Technical Data Sheet

## .30 Caliber Small Arms



<b>Nomenclature:</b>	.30 Caliber Small Arms Ammunition
<b>Ordnance Family:</b>	Small Arms
<b>DODIC:</b>	A212
<b>Filler:</b>	Single or Double Base Powder
<b>Filler weight:</b>	± Various
<b>Item weight:</b>	416 gr
<b>Diameter:</b>	.30 Caliber
<b>Length:</b>	3.34 in. (84.8mm)

**Usage:** Machine Guns, Caliber .30, M37, M1919A4 and M1919A6; and Rifle, Caliber .30, M1. The cartridge is intended for use against personnel or unarmored targets.

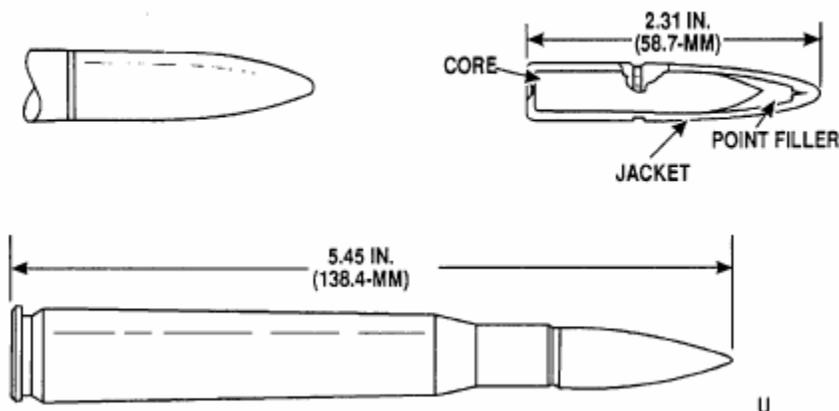
**Description:** BALL Cartridge. The cartridge is identified by a plain bullet tip.

**Reference:** TM 43-0001-27

# Ordnance Technical Data Sheet

## **.50 Caliber Small Arms**

CARTRIDGE, CALIBER .50, BALL, M2



<b>Nomenclature:</b>	.50 Caliber Small Arms Ammunition
<b>Ordnance Family:</b>	Small Arms
<b>DODIC:</b>	A552
<b>Filler:</b>	Single or Double Base Powder
<b>Filler weight:</b>	± Various
<b>Item weight:</b>	1813 gr
<b>Diameter:</b>	.50 Caliber
<b>Length:</b>	5.45 in. (138.4 mm)

**Usage:** Machine Guns, Caliber .50, M2 and M85. The cartridge is intended for use against personnel or unarmored targets.

**Description:** BALL Cartridge. The cartridge is identified by a plain bullet tip.

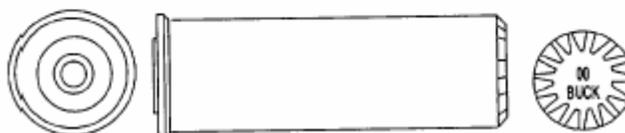
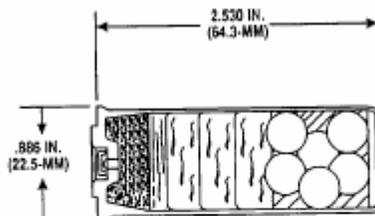
**Reference:** TM 43-0001-27

# **SKEET RANGE**

# Ordnance Technical Data Sheet

## 12 Gage Shotgun, NO 00

CARTRIDGE, 12 GAGE, SHOTGUN, NO. 00, M162



<b>Nomenclature:</b>	12 Gage Shotgun, NO 00
<b>Ordnance Family:</b>	Small Arms
<b>DODIC:</b>	A011
<b>Filler:</b>	Smokeless Powder
<b>Filler weight:</b>	± Various
<b>Item weight:</b>	0.736 gr
<b>Diameter:</b>	.886 in
<b>Length:</b>	2.53 in. (64.3 mm)

**Usage:** Military issue shotgun, 2-3/4 inch chamber. The cartridge is intended for guard and combat use.

**Description:** The cartridge case is all plastic, and is loaded with smokeless powder and No. 00 commercial shot.

**Reference:** TM 43-0001-27