FINAL

Site Inspection Report for Wallops Flight Facility Project 07, Accomack County, Virginia

DERP FUDS Project No. **C03VA030107**

Prepared for:

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Boat Basin at MRS 7

The views, opinions, and/or findings contained in this report are those of the author(s) and should not be construed as an official Department of the Army position, policy, or decision, unless so designated by other documentation.

June 2012

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Prepared Under: **Contract No. W912DY-04-D-0017**
Task Order # 00170001

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CONTRACTOR STATEMENT OF AUTHORSHIP AND INDEPENDENT TECHNICAL REVIEW

Human Factors Applications, Inc. (HFA), a wholly-owned subsidiary of TerranearPMC, LLC (TPMC), prepared this Site Inspection Report for Wallops Flight Facility (WFF) Project 07, Formerly Used Defense Site (FUDS), Project No. C03VA030107. An independent technical review has been conducted that is appropriate to the level of risk and complexity inherent in the project, as defined in the Programmatic Work Plan. During the independent technical review, compliance with established policy principles and procedures, utilizing justified and valid assumptions, was verified. This included review of assumptions; methods, procedures, and material used in analyses; the appropriateness of data used and level of data obtained; and reasonableness of the results, including whether the product meets the customer's needs consistent with existing Corps policy. In accordance with Corps requirements, significant authors to this report are presented below.

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Significant concerns and explanation of the resolutions are documented within the project file.

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LIST OF ACRONYMS AND ABBREVIATIONS

ADR	Automated Data Review
Alion	Alion Science and Technology Corporation
AN	Standardized for Army and Navy
AP	Armor-Piercing
ASR	Archives Search Report
BG	Background
bgs	Below ground surface
BHG-1	Borehole Gradiometer
°C	Degrees Celsius
CAS	Chemical Abstract Service
CDQAR	Chemical Data Quality Assessment Report
CENAB	Corps of Engineers North Atlantic Division Baltimore District
CENAO	Corps of Engineers North Atlantic Division Norfolk District
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
CHE	Chemical Warfare Materiel Hazard Evaluation
CONUS	Continental United States
COPC	Chemical of Potential Concern
COPEC	Chemical of Potential Ecological Concern
CNAAS	Chincoteague Naval Auxiliary Air Station
CQAR	Chemical Quality Assurance Report
CSM	Conceptual Site Model
CTT	Closed Transferring and Transferred
CWM	Chemical Warfare Materiel
CX	Center of Expertise
DA	Department of the Army
DC	Design Center
DCR	Department of Conservation and Recreation
DERP	Defense Environmental Restoration Program
DMM	Discarded Military Munitions
DNT	Dinitrotoluene
DoD	Department of Defense
DoI	Department of Interior
DQI	Data Quality Indicator
DQO	Data Quality Objective
Eco-SSL	Ecological Soil Screening Level
EDD	Electronic Data Deliverable
EDMS	Environmental Data Management Systems
EDS	Environmental Data Services, Inc.

LIST OF ACRONYMS AND ABBREVIATIONS

EHE	Explosive Hazard Evaluation
EM	Engineering Manual
EOD	Explosive Ordnance Disposal
EP	Engineering Pamphlet
ER	Engineering Regulation
˚F	Degree (s) Fahrenheit
FDE	Findings of Determination and Eligibility
ft	Foot or Feet
FUDS	Formerly Used Defense Site(s)
FUDSMIS	FUDS Management Information System
GIS	Geographic Information Systems
GPS	Global Positioning System
HFA	Human Factors Applications, Inc.
HHE	Health Hazard Evaluation
HHRA	Human Health Risk Assessment
HRS	Hazard Ranking System
HTRW	Hazardous Toxic and Radioactive Waste
HQ	Hazard Quotient
ID	Identification
IDW	Investigative Derived Waste
In.	Inch (es)
Inc.	Incorporated
INPR	Inventory Project Report
ITRC	Interstate Technology and Regulatory Council
J	Analyte is present. Reported value may not be accurate or precise.
K	Analyte is present and that the reported value may be biased high
K_{ow}	Octanol-water partitioning coefficient
L	Analyte is present and that the reported value may be biased low
LLC	Limited Liability Company
LOQ	Limit of Quantitation
Ltd.	Limited
m	Meter
MC	Munitions Constituents
MCL	Maximum Contaminant Level
MD	Munitions Debris
MDL	Method Detection Limit

LIST OF ACRONYMS AND ABBREVIATIONS

MEC	Munitions and Explosives of Concern
mg/kg	Milligram per kilogram
mi	mile(s)
Mk	Mark
mm	millimeter(s)
MMRP	Military Munitions Response Program
Mod	Model
MPPEH	Material Potentially Presenting an Explosive Hazard
MQO	Measurement Quality Objective
MRA	Munitions Response Area
MRS	Munitions Response Site
MRSPP	Munitions Response Site Prioritization Protocol
MS/MSD	Matrix Spike/Matrix Spike Duplicate
Msl	Mean Sea Level
NAAS	Naval Auxiliary Air Station
NACA	National Advisory Committee for Aeronautics
NAD	North American Datum
NAOTS	Naval Aviation Ordnance Test Station
NASA	National Aeronautics and Space Administration
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
ND	No Detection
NDAI	No Department of Defense Action Indicated
NG	Nitroglycerin
NMFS	National Marine Fisheries Service
NOAA	National Oceanic and Atmospheric Administration
NSL	No Screening Level
NTCRA	Non-Time Critical Removal Action
NWIS	National Water Information System
PA	Preliminary Assessment
PAH	Polycyclic Aromatic Hydrocarbon
PFSP	Programmatic Field Sampling Plan
PGM	Program Manager
PM	Project Manager
PMMQL	Preferred Maximum Method Quantitation Limits
PWP	Programmatic Work Plan
PWS	Performance Work Statement
QA	Quality Assurance
QC	Quality Control
QR	Qualitative Reconnaissance
QSM	Quality Systems Manual

LIST OF ACRONYMS AND ABBREVIATIONS

R	Analyte is rejected. Reported value may or may not be present.
RAC	Risk Assessment Code
RDX	Hexahydro-1,3,5-trinitro-1,3,5-triazine
RI/FS	Remedial Investigation/Feasibility Study
RL	Reporting Limit
RMIS	Restoration Management Information System
RPD	Relative Percent Difference
RSL	USEPA Regional Screening Level
SEDD	Staged Electronic Data Deliverable
SHPO	State Historic Preservation Office
SI	Site Inspection
SLERA	Screening Level Ecological Risk Assessment
SS	Surface Soil
SSL	Soil Screening Level
SS-WP	Final Site-Specific Work Plan Addendum to the MMRP Programmatic Work Plan for the Site Inspection of WFF Project 07
T&E	Threatened and Endangered
TAL	Target Analyte List
Tetryl	Methyl-2,4,6-trinitrophenylnitramine
TNT	Trinitrotoluene
ToC	Town of Chincoteague
TPMC	TerranearPMC, LLC
TCRA	Time Critical Removal Action
TPP	Technical Project Planning
U	Not detected
UJ	Not detected. The associated detection limit is an estimate and may be inaccurate or imprecise. Value are reporting limits (RLs)
UL	Not detected. The quantitation limit may actually be higher.
U.S.	United States
USACE	U.S. Army Corps of Engineers
USAESCH	U.S. Army Engineering and Support Center, Huntsville
USDA	U.S. Department of Agriculture
USEPA	U.S. Environmental Protection Agency
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey
UTM	Universal Transverse Mercator
UXO	Unexploded Ordnance
VDEQ	Virginia Department of Environmental Quality
VDGIF	Virginia Department of Game and Inland Fisheries

LIST OF ACRONYMS AND ABBREVIATIONS

WFF	Wallops Flight Facility
WOE	Weight-of-Evidence

GLOSSARY OF TERMS

Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA) – Congress enacted CERCLA, commonly known as Superfund, on 11 December 1980. This law created a tax on the chemical and petroleum industries and provided broad Federal authority to respond directly to releases or threatened releases of hazardous substances that may endanger public health or the environment (USACE 2004b).

Discarded Military Munitions (DMM) – 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 of, consistent with applicable environmental laws and regulations. (10 USC 2710(e)(2)) (Department of the Army [DA] 2005).

Explosive Ordnance Disposal (EOD) – The detection, identification, on-site evaluation, rendering safe, recovery, and final disposal of unexploded explosive ordnance and of other munitions that have become an imposing danger, for example, by damage or deterioration (DA 2005).

Explosives Safety – A condition where operational capability and readiness, people, property, and the environment are protected from the unacceptable effects or risks of potential mishaps involving military munitions (DA 2005).

Formerly Used Defense Site (FUDS) – A FUDS is defined as a facility or site (property) that was under the jurisdiction of the Secretary of Defense and owned by, leased to, or otherwise possessed by the United States at the time of actions leading to contamination by hazardous substances. By the Department of Defense Environmental Restoration Program (DERP) policy, the FUDS program is limited to those real properties that were transferred from Department of Defense (DoD) control prior to 17 October 1986. FUDS properties can be located within the 50 States, District of Columbia, Territories, Commonwealths, and possessions of the United States. ER 200-3-1 (May 10, 2004).

Material Potentially Presenting an Explosive Hazard (MPPEH) – Material potentially containing explosives or munitions (e.g., munitions containers and packaging material; munitions debris remaining after munitions use, demilitarization, or disposal; and range-related debris); or material potentially containing a high enough concentration of explosives such that the material presents an explosive hazard (e.g., equipment, drainage systems, holding tanks, piping, or ventilation ducts that were associated with munitions production, demilitarization or disposal operations). Excluded from MPPEH are munitions within DoD's established munitions management system and other hazardous items that may present explosion hazards (e.g., gasoline cans, compressed gas cylinders) that are not munitions and are not intended for use as munitions (DA 2005).

GLOSSARY OF TERMS

Military Munitions – All ammunition products and components produced for or used by the armed forces for national defense and security, including ammunition products or components under the control of the DoD, the Coast Guard, the Department of Energy, and the National Guard. The term includes confined gaseous, liquid, and solid propellants; explosives, pyrotechnics, chemical and riot control agents, smokes, and incendiaries, including bulk explosives, and chemical warfare agents; chemical munitions, rockets, guided and ballistic missiles, bombs, warheads, mortar rounds, artillery ammunition, small arms ammunition, grenades, mines, torpedoes, depth charges, cluster munitions and dispensers, demolition charges; and devices and components thereof. The term does not include wholly inert items; improvised explosive devices; and nuclear weapons, nuclear devices, and nuclear components, other then nonnuclear components of nuclear devices that are managed under the nuclear weapons program of the Department of Energy after all required sanitization operations under the Atomic Energy Act of 1954 (42 USC 2011 et seq.) have been completed. (10 USC 101(e)(4)(A) through (C)) (DA 2005).

Munitions and Explosives of Concern (MEC) – This term, which distinguishes specific categories of military munitions that may pose unique explosives safety risks means: (A) Unexploded ordnance (UXO), as defined in 10 USC 101(e)(5); (B) DMM, as defined in 10 USC 2710(e)(2); or (C) Munitions constituents (e.g., trinitrotoluene, hexahydro-1,3,5-trinitro-1,3,5-triazine), as defined in 10 USC 2710(e)(3), present in high enough concentrations to pose an explosive hazard (DA 2005).

Munitions Constituents (MC) – Any materials originating from UXO, DMM, or other military munitions, including explosive and non-explosive materials, and emission, degradation, or breakdown elements of such ordnance or munitions. (10 USC 2710(e)(3)) (DA 2005).

Munitions Debris (MD) – Remnants of munitions (e.g., fragments, penetrators, projectiles, shell casings, links, fins) remaining after munitions use, demilitarization, or disposal (DA 2005).

Munitions Response Area (MRA) – Any area on a defense site that is known or suspected to contain UXO, DMM, or MC. Examples include former ranges and munitions burial areas. A munitions response area is comprised of one or more munitions response sites (32 Code of Federal Regulations [CFR] 179.3).

Munitions Response Site (MRS) – A discrete location within a Munitions Response Area that is known to require a munitions response (32 CFR 179.3).

GLOSSARY OF TERMS

Munitions Response Site Prioritization Protocol (MRSPP) – The MRSPP was published as a rule on 5 October 2005. This rule implements the requirement established in Section 311(b) of the National Defense Authorization Act for Fiscal Year 2002 for the DoD to assign a relative priority for munitions responses to each location in the DoD's inventory of defense sites known or suspected of containing UXO, DMM, or MC. The DoD adopted the MRSPP under the authority of 10 USC 2710(b). Provisions of 10 USC 2710(b) require that the DoD assign to each defense site in the inventory a relative priority for response activities based on the overall conditions at each location and taking into consideration various factors related to safety and environmental hazards.

Non-Time Critical Removal Action (NTCRA) – Actions initiated in response to a release or threat of a release that poses a risk to human health or the environment where more than six months planning time is available (USACE 2007).

Range – A designated land or water area that is set aside, managed, and used for range activities of the DoD. The term includes 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. The term also includes airspace areas designated for military use in accordance with regulations and procedures prescribed by the Administrator of the Federal Aviation Administration. (10 USC 101(e)(1)(A) and (B)) (DA 2005).

Range Activities – Research, development, testing, and evaluation of military munitions, other ordnance, and weapons systems; and the training of members of the armed forces in the use and handling of military munitions, other ordnance, and weapons systems. (10 USC 101(e)(2)(A) and (B)) (DA 2005).

Range Related Debris – Debris, other than munitions debris, collected from operational ranges or from former ranges (e.g. target debris, military munitions packaging, and crating material).

Risk Assessment Code (RAC) – An expression of the risk associated with a hazard. The RAC combines the hazard severity and accident probability into a single Arabic number on a scale from 1 to 5, with 1 being the greatest risk and 5 the lowest risk. The RAC is used to prioritize response actions (USACE 2004b).

Time Critical Removal Action (TCRA) – Removal actions conducted to respond to an imminent danger posed by the release or threat of a release, where cleanup or stabilization actions must be initiated within 6 months to reduce risk to public health or the environment (DA 2005).

Unexploded Ordnance (UXO) – Military munitions that (A) have been primed, fuzed, armed, or otherwise prepared for action; (B) have been fired, dropped, launched, projected, or placed in such a manner as to constitute a hazard to operations, installations, personnel, or material; and (C) remain unexploded whether by malfunction, design, or any other cause. (10 USC 101(e)(5)(A) through (C)) (DA 2005).

EXECUTIVE SUMMARY

ES.1 Under contract with the United States Army Corps of Engineers (USACE), TerranearPMC, LLC prepared this Site Inspection (SI) Report to document SI activities and findings for the Wallops Flight Facility (WFF) Project 07 Formerly Used Defense Site (FUDS), Property No. C03VA0301, located in Accomack County, Virginia (VA). The Department of Defense (DoD) has established the Military Munitions Response Program (MMRP) under the Defense Environmental Restoration Program (DERP) to address potential Munitions and Explosives of Concern (MEC) and Munitions Constituents (MC) remaining at FUDS properties, including WFF Project 07. This SI was completed under MMRP Project No. C03VA030107 and addresses potential MMRP hazards remaining at the WFF Project 07.

ES.2 **Site Inspection Objectives and Scope**. The primary objective of the MMRP SI is to determine whether or not the FUDS project warrants further response action under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA). The SI collects the minimum amount of information necessary to make this determination. The SI also (i) determines the potential need for a Time Critical Removal Action (TCRA); (ii) collects or develops additional data, as appropriate, for potential Hazard Ranking System (HRS) scoring by the United States Environmental Protection Agency (USEPA); and (iii) collects data, as appropriate, to characterize the hazardous substance release for effective and rapid initiation of the remedial investigation/feasibility study (RI/FS). An additional objective of the SI is to collect the additional data necessary to evaluate munitions response sites (MRSs) using the Munitions Response Site Prioritization Protocol (MRSPP).

ES.3 The scope of the SI is restricted to the evaluation of the presence of MEC or MC related to historical use of the WFF Project 07 prior to property transfer. Potential releases of hazardous, toxic, and/or radioactive waste (HTRW) are not within the SI scope.

ES.4 **WFF Project 07.** The WFF Project 07 is approximately 1.53 acres of land that includes four areas located in the Main Base Sector. The WFF Project 07 areas were used by the Naval Aviation Ordnance Test Station (NAOTS) between 1946 and 1959. In June 1959, the U.S. Navy ceased training and flight operations and the installation was declared excess and leased to the newly formed National Aeronautics and Space Administration (NASA). The Main Base was formally transferred to NASA on 1 December 1961.

ES.5 **Technical Project Planning.** The SI approach was developed in concert with stakeholders through USACE's technical project planning (TPP) framework, which was applied at the initial

TPP meeting on 6 May 2010. Stakeholders agreed to the SI approach, as presented and modified during the TPP meeting and finalized in the Site-Specific Work Plan (SS-WP). In summary, these agreements were to inspect the MRS and complete multimedia sampling in accordance with the Data Quality Objectives (DQOs) and Final SS-WP.

ES.6 **Munitions Response Site.** USACE programmatic documents identified one MRS at WFF Project 07: MRS 7, Boat Basin/Visitors Information Center, which includes the Pyrotechnics Burn Area, Gun Butt No. 1, Gun Butt No. 2, and South Bank of Boat Basin.

ES.7 **Site Qualitative Reconnaissance**. SI field activities were performed on 12 through 14 December 2011. Qualitative reconnaissance (QR) in and around MRS 7 was performed over approximately 1.76 acres of land during which analog geophysics was conducted and visual observations were made. The approach included magnetometer-assisted reconnaissance following a meandering path in and around sample locations to identify the presence/absence of MEC/Munitions Debris (MD) or other areas of interest (i.e., areas having indications of munitions use). Only expended and inert MD have been observed historically and no confirmed MEC was found during the SI field activities. Numerous surface anomalies were detected during QR at MRS 7 including military-related items (marston matting at South Bank of Boat Basin) and three MD at Gun Butts No. 1 and 2. Seven Material Potentially Presenting an Explosive Hazard (MPPEH) (20mm, larger than 20mm, burnt pyrotechnic items) were observed on the surface that could not be determined to not contain energetic material. NASA was notified and the UXO technician recommended the items be removed as soon as possible. Also, 37 distinct subsurface anomalies were detected on land in MRS 7. Five areas of concentrated subsurface anomalies (i.e., the UXO technician was unable to count individual anomaly points) were identified, two at the Gun Butts and three at the Pyrotechnics Burn Area (including the entire area within the Pyrotechnics Burn Area fence). In addition, approximately 0.31 acres of analog geophysics was completed within the water at the Boat Basin using a Bore Hole Gradiometer (BHG-1). Two underwater anomalies were noted during reconnaissance of the boat basin, and an undefined area along the South Bank of the Boat Basin was noted as having a large quantity (more than 50) of surface anomalies identified as rusty metal debris.

ES.8 **Munitions and Explosives of Concern Hazard Assessment**. A qualitative MEC hazard assessment for the land portion of MRS 7 was conducted based on the SI QR, as well as historical information documented in the Inventory Project Report (INPR) and Preliminary Assessment (PA). The MEC explosive safety hazard is based on the presence or absence of a MEC source, the accessibility or pathway to that source, and potential receptor contact with the source. Since military use ended, no confirmed MEC items are known to have been found at

MRS 7; however, MD and MPPEH have been observed. No MEC was observed during the 2005, 2007, and 2009 inspections and no confirmed MEC was observed during the 2011 SI field activities. Based on the known historical finds (inert) of the MD observed at MRS 7, and the condition of the MPPEH items found during SI field activities (too rusty to confirm identification), the possible presence of a MEC source is moderate. Currently the land associated with WFF Project 07 is owned by NASA. Portions of WFF Project 07 (Gun Butts No. 1 and 2) are open to the general public and have no access restrictions to the surrounding grounds. Portions (South Bank of Boat Basin and Pyrotechnics Burn Area) are fenced and not accessible to the public. The boat basin is used occasionally by NASA and the Marine Science Consortium. The future use is not expected to change. Therefore, the human interaction and accessibility categories have been rated as moderate. The site stability category was rated as moderate hazard due to the possibility of erosion and frost-heave. Based on this qualitative MEC hazard evaluation, the hazard to human receptors via contact with MEC at MRS 7 is moderate.

ES.9 **Munitions Constituents Sampling.** A total of 32 soil (21 surface and 11 subsurface), five sediment, one surface water, and four groundwater samples were collected at MRS 7, not including QA. A list of MC associated with munitions potentially used at each of the four areas at MRS 7 was developed and used to support sample analysis and assessment of results for the risk screening. The specific analyte list for each sample varied based on the location of sample collection, but the general list of analytes for MRS 7 included a select list of explosive constituents (2,4-Dinitrotoluene [DNT]; 2,6-DNT; 2-nitrotoluene; 3-nitrotoluene; 2-amino-4,6-DNT; 4-amino-2,6-DNT; and 4-nitrotoluene; 2,4,6-Trinitrotoluene [TNT]; 1,3,5-Trinitrobenzene; 1,3-Dinitrobenzene; Pentaerythritol Tetranitrate [PETN], Hexahydro-1,3,5-trinitro-1,3,5-triazine [RDX], Nitrobenzene, Tetryl, and Nitroglycerin [NG]) and a select list of metals (aluminum, antimony, barium, copper, iron, lead, magnesium, nickel, and zinc). Two of the surface soil samples collected from the Pyrotechnics Burn Area were analyzed for Polycyclic Aromatic Hydrocarbons (PAHs). The four groundwater samples were collected (one at each Gun Butt and two at the Pyrotechnics Burn Area) and analyzed for select metals, select explosive constituents, and perchlorate. Additionally, one surface water sample was collected from the Boat Basin and analyzed for select explosive constituents and perchlorate.

ES.10 **Munitions Constituents Risk Screening.** No explosive constituents, perchlorate, or PAHs were detected at concentrations above their respective Reporting Limits (RLs). Several metals were detected above their respective screening levels in samples collected at MRS 7. Iron detections in surface soil, subsurface soil, and groundwater exceeded the screening criterion selected for the Human Health Risk Assessment (HHRA). Therefore, iron was identified as a Chemical of Potential Concern (COPC) in surface soil, subsurface soil, and groundwater at

MRS 7. However, most iron detections in surface and subsurface soil did not exceed background concentrations; therefore, no additional risk to human receptors was identified in these media as a result of the munitions used at MRS 7. Detections of iron in groundwater collected from the Pyrotechnics Burn Area were below background concentrations and therefore not expected to present additional risk as a result of former military use. However, iron was detected in groundwater collected from the Gun Butts No. 1 and 2 area above background concentrations and determined to present a potentially unacceptable risk to human receptors. Aluminum was detected above screening criteria and identified as a COPC in subsurface soil and antimony was detected in groundwater above the screening criteria and designated a COPC. Aluminum in subsurface soil and antimony in groundwater were determined not to present a potentially unacceptable risk based on the conservatism of the screening levels. No COPCs were identified in sediment or surface water at MRS 7.

ES.11 The maximum concentrations of antimony, copper, lead, and zinc in surface soil exceeded the ecological soil screening levels (eco-SSLs) selected for the Screening Level Ecological Risk Assessment (SLERA) and were identified as a Chemicals of Potential Ecological Concern (COPECs) for surface soil at MRS 7. These detections also exceeded background concentrations, and potentially unacceptable risks to ecological receptors were identified in surface soil at MRS 7. Copper was also detected in sediment above the eco-SSLs and identified as a COPEC; however, based on the infrequent and negligible exceedance, copper in sediment is not expected to present an unacceptable risk to ecological receptors at MRS 7. No COPECs were identified in surface water.

ES.12 **Site Inspection Conclusions and Recommendations.** An RI/FS is recommended at MRS 7. Additional studies should focus on MEC and MC. MD items have been observed historically at MRS 7, and MD and MPPEH were observed during the 2011 SI field activities. Seven of the items observed during the SI field activities were in such condition that the UXO technician could not confirm that energetic material did not remain. Based on the continued finds of munitions items, human interaction, and accessibility, a qualitative MEC hazard assessment indicates that the explosive hazard is moderate at MRS 7. In addition, numerous subsurface anomalies were detected, including distinct anomalies and areas containing dense concentrations of anomalies. The SI is a limited scope study and does not include the intrusive investigation of subsurface anomalies. Iron was detected in groundwater collected at Gun Butt No 1 and 2 (COPC) above the background concentrations and may present a potentially unacceptable risk to human receptors; however, iron is not a CERCLA hazardous substance, so it was not used as the sole basis for an RI/FS recommendation. Antimony, copper, lead, and zinc were detected (COPECs) in surface soil and may present potentially unacceptable risks to ecological receptors

at MRS 7. During field activities, samples were collected just outside the fenced Pyrotechnics Burn Area due to the high concentration of subsurface anomalies (i.e., an anomaly free sample location inside the fenced area could not be identified). Therefore, samples could not be collected from the location most likely to contain the highest MC concentrations. This limitation, and that subsurface anomalies could not be investigated, were considered when recommending further work at MRS 7.

ES.13 A TCRA or Non-TCRA (NTCRA) is not recommended at the WFF Project 07 (Table ES-1).

ES.14 The Pyrotechnics Burn Area was found to be incorrectly positioned in the USACE-provided GIS. The correct location, as confirmed by visual evidence of burning contained within a deteriorated fence matching the description of the area cited in historical documents, was observed to be near the southwestern corner of the Pyrotechnic Burn Area. GPS coordinates were collected at each corner of the fence, which was approximately 500 square ft (20 ft by 25 ft). USACE should revise the MRS 7 GIS to reorient the Pyrotechnics Burn Area to encompass the four GPS coordinates collected during the 2011 SI field activities, as shown on the figures and Table 3-1 in this SI.

Table ES-1. Summary of Site Recommendations for WFF Project 07 (FUDS Project No. C03VA030107)

MRS	Recommendation	Basis for Recommendation	
		MEC	MC*
MRS 7- Boat Basin/Visitors Information Center	RI/FS to focus on MEC and MC TCRA/NTCRA not recommended	MEC Assessment: Moderate hazard Three MD and seven MPPEH items that could not be determined to not contain energetic material were observed during the 2011 SI field event. Numerous surface and subsurface anomalies and five areas of concentrated subsurface anomalies were detected during the 2011 SI field event.	*Risk Screening Assessment:* Iron* in groundwater may present a potentially unacceptable risk to human receptors and antimony, copper, lead, and zinc in surface soil may present potentially unacceptable risks to ecological receptors at MRS 7. *Surface soil:* Iron* was detected above the screening level selected for the HHRA and was identified as a COPC. However, most of the iron detections were below background concentrations, and no FUDS-related or potentially unacceptable risks were identified for human receptors in surface soil. Antimony, copper, lead, and zinc exceeded the screening level selected for the SLERA and were identified as a COPECs. These detections also exceeded background concentrations, and potentially unacceptable risks to ecological receptors were identified in surface soil at MRS 7. *Subsurface soil:* Based on the HHRA, aluminum* and iron* were identified as COPCs. However, based on the conservatism of the HHRA, aluminum in subsurface soil is not expected to present an unacceptable risk to human receptors. Also, iron detections were below background concentrations; therefore, no FUDS-related risk was identified to human receptors in subsurface soil. *Sediment:* Based on the HHRA, no COPCs were identified. Based on the SLERA, copper was identified as a COPEC. However, due to the infrequency and magnitude of detection, copper in sediment is not expected to present an unacceptable risk to ecological receptors. *Surface Water:* Based on the HHRA and SLERA, no COPCs or COPECs,were identified.

Table ES-1. Summary of Site Recommendations for WFF Project 07 (FUDS Project No. C03VA030107)

MRS	Recommendation	Basis for Recommendation	
		MEC	MC*
			Groundwater: Based on the HHRA, antimony and iron* were identified as COPCs. Antimony is not expected to present an unacceptable risk to human receptors based on the conservatism of the HHRA. However, iron* in groundwater may present a potentially unacceptable risk to human receptors.

*Chemicals that are not CERCLA hazardous substances (e.g., iron., aluminum) can be reported in the SI; however, the SI risk evaluation and conclusions includes a discussion of the limitations of the FUDS program to respond to such chemicals. Non-CERCLA chemical concentrations do not provide the basis for a RI/FS recommendation for MCs in this SI Report.

COPC – Chemical of Potential Concern COPEC – Chemical of Potential Ecological Concern FUDS – Formerly Used Defense Site HHRA – Human Health Risk Assessment MC – Munitions Constituents MD – Munitions Debris MEC – Munitions and Explosives of Concern MPPEH – Material Potentially Presenting and Explosive Hazard	MRS – Munitions Response Site NTCRA – Non-Time Critical Removal Action RI/FS – Remedial Investigation/Feasibility Study SI – Site Inspection SLERA – Screening Level Ecological Risk Assessment TCRA – Time Critical Removal Action WFF – Wallops Flight Facility

1. INTRODUCTION

1.0.1 This report documents the findings of the Military Munitions Response Program (MMRP) Site Inspection (SI) performed at the Wallops Flight Facility (WFF) Formerly Used Defense Site (FUDS) located in Accomack County, Virginia (VA) with the MMRP Project No. C03VA030107, abbreviated as WFF Project 07. Human Factors Applications, Inc. (HFA), a wholly-owned subsidiary of TerranearPMC, LLC (TPMC), along with support from its subcontractors (Environmental Data Services, Inc. [EDS]; Integral Consulting, Inc.; and TestAmerica, Inc.) prepared this report under contract to the United States Army Engineering and Support Center, Huntsville (USAESCH). This work is being performed in accordance with Contract No. W912DY-04-D-0017, Task Order 00170001 for FUDS in the Northeast Region of the Continental United States. This contract was transferred to TPMC from Alion Science and Technology Corporation (Alion) in February 2011; HFA was formerly a subsidiary of Alion. USAESCH transferred management of the contract to the Corps of Engineers North Atlantic Division Baltimore District (CENAB). CENAB is working with Corps of Engineers North Atlantic Division, Norfolk District (CENAO) and its contractor on the completion of this project in accordance with the SI Performance Work Statement (Appendix A).

1.0.2 The technical approach to this SI is based on the *Programmatic Work Plan for Formerly Used Defense Sites Military Munitions Response Program Site Inspections at Multiple Sites the Northeast Region* (Alion 2005) and the *Final Site-Specific Work Plan* (SS-WP) *Addendum to the MMRP Programmatic Work Plan for the Site Inspection of WFF Project 07* (TPMC 2011).

1.1 Project Authorization

1.1.1 The Department of Defense (DoD) has established the MMRP to address sites suspected of containing Munitions and Explosives of Concern (MEC) or Munitions Constituents (MC). Under the MMRP, the U.S. Army Corps of Engineers (USACE) is conducting environmental response activities for the Army, as DoD's Executive Agent for the FUDS program.

1.1.2 Pursuant to USACE's Engineer Regulation 200-3-1 (USACE 2004a) and the *Management Guidance for the Defense Environmental Response Program (DERP)* (DoD 2001), FUDS response activities are being conducted in accordance with the DERP statute (10 USC 2701 et seq.), the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA) (42 USC Section 9620), Executive Orders 12580 and 13016, and the National Oil and Hazardous Substances Pollution Contingency Plan (NCP) (40 Code of Federal Regulations

Part 300). As such, USACE is conducting SIs, as set forth in the NCP, to evaluate hazardous substance releases or threatened releases from eligible FUDS.

1.1.3 While not every MEC/MC constitute CERCLA hazardous substances, pollutants, or contaminants, the DERP statute provides DoD the authority to respond to releases of MEC/MC, and policy states that such responses shall be conducted in accordance with CERCLA and the NCP.

1.2 Project Scope and Objectives

1.2.1 The primary objective of the MMRP SI is to determine whether or not the FUDS project warrants further response action under CERCLA. The SI collects the minimum amount of information necessary to make this determination. The SI also (i) determines the potential need for a removal action; (ii) collects or develops additional data, as appropriate, for potential Hazard Ranking System (HRS) scoring by the U.S. Environmental Protection Agency (USEPA); and (iii) collects data, as appropriate, to characterize the hazardous substance release for effective and rapid initiation of the remedial investigation/feasibility study (RI/FS). An additional objective of the MMRP SI is to collect data necessary to evaluate munitions response sites (MRSs) using the Munitions Response Site Prioritization Protocol (MRSPP).

1.2.2 The scope of the SI is restricted to the evaluation of the presence of MEC or MC related to historical use of this MRS prior to property transfer. The evaluation is performed through records review, site qualitative reconnaissance (QR) to assess MEC presence/absence, and sampling where MC might be expected based on the conceptual site model (CSM). Evaluation of potential releases of hazardous, toxic, and radioactive waste (HTRW) is not within the scope of this SI.

1.3 Project Location

1.3.1 The WFF Project 07 is located in Accomack County and is depicted on a historical aerial photograph from 1963 (Figure 2-1). The North American Datum (NAD) 1983 Universal Transverse Mercator (UTM) Zone 18N, easting (X) and northing (Y) coordinates of the approximate center of the WFF Project 07 are 459895.52 meters (m) and 4199090.92 m, respectively.

1.4 Munitions Response Site Prioritization Protocol

1.4.1 This SI Report includes a draft MRSPP for MRS 7 in Appendix K. The MRSPP scoring will be updated on an annual basis, or when necessary, to incorporate new information, as appropriate.

2. SITE DESCRIPTION

2.1 Property and Project Description and History

2.1.1 There were three major phases of property acquisition, consisting of many individual transactions that resulted in the facility known today as the National Aeronautics and Space Administration (NASA) WFF, which is larger than the WFF FUDS. The first phase of property acquisition was in early 1942 for the construction of the Chincoteague Naval Auxiliary Air Station (CNAAS). The second phase involved the acquisition of land on Wallops Island for testing naval aviation ordnance in 1945. The third phase occurred in the 1950s and was for expanding and improving CNAAS and its facilities (USACE 2011).

2.1.2 The NASA WFF currently consists of three sectors: Main Base, Wallops Island, and Mainland; however, no military operations were conducted on Mainland, so this portion of the current NASA WFF is not included as part of the WFF FUDS (Figure 2-2). The Main Base was commissioned in 1943 and was originally known as CNAAS. In 1946, the Bureau of Ordnance established the Naval Aviation Ordnance Test Station (NAOTS) at the CNAAS to conduct secret aviation ordnance tests and munitions experiments. The Wallops Island sector was used both by NAOTS and National Advisory Committee for Aeronautics (NACA) (USACE 2011).

2.1.3 MRS 7 is located in the Main Base Sector as shown on Figure 2-3. The four areas that are included in this project are as follows.

- Pyrotechnics Burn Area. This was an approximately 20 ft by 25 ft fenced in area used by the Navy to dispose of parachute flares and practice bomb signals using either gasoline or trinitrotoluene (TNT). The date of construction or first use of the Pyrotechnics Burn Area is not known.
- Gun Butt No. 1. This area was constructed in 1952 and used to test and perfect the use of medium caliber (20mm – 37mm) aviation guns and ammunition. The test range included a firing point and a concrete impact berm filled with sand or soil. Aircraft guns fired medium caliber ammunition from Building J-8 (firing point) into the impact berm (J-130) located approximately 350 ft to the southeast of the firing point.
- Gun Butt No. 2. This area was constructed in 1952 and, similar to Gun Butt No. 1, was used to test and perfect the use of medium caliber (20mm – 37mm) aviation guns and ammunition. The test range included a firing point and a concrete impact berm filled with sand or soil. Aircraft guns fired medium caliber ammunition from Building J-17 (firing point) into the impact bunker (J-18) which was located approximately 150 ft to the south of the firing point.

- South Bank of Boat Basin. Dredging of the Boat Basin and channel was completed on 26 April 1949 by the Navy in order to establish a boat dock and basin to transport rocket testing materials from the Wallops Main Base to the Wallops Island test facilities. The South Bank of Boat Basin had no known munitions use; however, numerous munitions items have been observed in this area.

2.1.4 In June 1959, the U.S. Navy ceased training and flight operations. The CNAAS was declared excess and leased to the newly formed NASA, the successor to NACA. The Main Base was formally transferred to NASA on 1 December 1961. In 1981, the facility became part of the Goddard Space Flight Center and was renamed WFF (Alion 2010 and USACE 2011).

2.2 Munitions Response Site Identification and Munitions Information

2.2.1 The Preliminary Assessment (PA) identified the four areas associated with the WFF Project 07 as shown in Table 2-1. The list of munitions associated with MRS 7 and their constituents were derived from the PA and other USACE data sources and are summarized in Table 2-2 (USACE 2011).

2.2.2 The USACE-provided geographic information system (GIS) data determined that MRS 7 is approximately 1.53 acres of land (USACE 2011). Figure 2-2 shows the USACE-provided MRS and FUDS boundaries on recent aerial imagery. However, during the 2011 SI field activities, it was determined that the Pyrotechnics Burn Area portion of the MRS 7 boundary provided by USACE was in an incorrect location. The correct location of the Pyrotechnics Burn Area is noted on the figures in this SI with the GPS coordinates collected at the four corners of the approximately 20 ft by 25 ft fenced area. Per USACE request, sampling and reconnaissance were performed in areas outside the MRS 7 boundaries (TPMC 2011).

2.3 Physical Setting

2.3.0.1 The following sections provide a physical description of MRS 7 with respect to relief, vegetation, and climate as well as the local demographic and land use.

2.3.1 Topography and Vegetation

2.3.1.1 The topography of MRS 7 is generally low and flat with elevation ranging from zero to five feet (ft) above mean sea level (msl). The former target butts of the Gun Butts No. 1 and 2 portion of MRS 7 are no longer present, and these areas are currently developed with manicured grass and display rockets associated with the nearby NASA WFF visitor information center. A

shallow drainage swale separates the two former gun butt areas, and they are bordered by wetlands to the south and east. The South Bank of Boat Basin and Pyrotechnics Burn Area are forested with deciduous or evergreen trees and also contain wetland vegetation (USACE 2011 and USGS 2010).

2.3.2 Climate

2.3.2.1 MRS 7 is located adjacent to Mosquito Creek and Jenny's Gut. Further east of MRS 7 are several back bays, channels and inlets and the Atlantic Ocean. The climate of the VA coast is moderated by the nearby ocean. The coldest month is January with a mean normal temperature of 36.3 degrees Fahrenheit (˚F) and the warmest month is July with a mean normal temperature of 76.3 ˚F. The annual precipitation normal is 40.4 inches with precipitation occurring approximately equally per month throughout the year (NOAA 2002).

2.3.3 Local Demographics

2.3.3.1 MRS 7 is located near Wattsville in Accomack County, VA. The 2010 Census estimate indicates that the population density of Accomack County is 73.8 people per square mile (mi^2), and there were 33,164 people in 21,002 households. The Wattsville Census Designated Place (CDP) consists of 1,128 people in 497 households (U.S. Census Bureau 2010). There are no inhabited structures within the MRS boundary; however, the Visitor Information Center borders MRS 7. Within approximately two miles from the MRS boundary, there are more than 26 inhabited structures at NASA WFF (Google Earth 2011).

2.3.4 Current and Future Land Use

2.3.4.1 The WFF Project 07 currently is owned by NASA. A structure adjacent to the Gun Butts No. 1 and 2 is operated by NASA as a visitor information center. The visitor center is open to the general public and several rockets are on display on the surrounding grounds. There are no access restrictions to prevent visitors from accessing Gun Butts No. 1 and 2. The South Bank of the Boat Basin and the Pyrotechnics Burn Area are surrounded by fences and not easily accessible to the general public. However, the boat basin is still in use occasionally by NASA and the Marine Science Consortium. The potential receptors include employees, visitors, construction workers, trespassers and biota (TPMC 2011). Although future land use plans do not include residential reuse, stakeholders have requested that residents be included as potential future receptors. The future residential use of MRS 7 is not expected due to the unlikely closure of NASA WFF.

2.3.5 Geologic Setting

2.3.5.1 The WFF Project 07 is located within the embayed section of the Coastal Plain physiographic province. The geological features of the area are the result of the recent submergence of the Atlantic Coastal Plain due to weighting down under ice load during the last ice age, as well as the postglacial rise of sea level after large volumes of glacial melt waters returned to the ocean (USACE 2011).

2.3.5.2 The Coastal Plain province is characterized by low relief and surface streams emptying to marshy inlets. The elevation of the Coastal Plain province is commonly less than 100 ft above msl but can exceed 200 ft above msl (USACE 2011). Beach and marsh deposits of the Quaternary Period shape the landscape underlying the WFF. Beneath the Quaternary deposits lies the 400 ft thick Miocene age Calvert formation which is a bluish gray sandy silt. Below that lies the green, fine to coarse, glauconitic (20 to 40% glauconite), quartz sand of the Piney Point formation and the greenish to dark gray silts and clays of the Pamunkey formation. Bedrock is located approximately 4,500 ft beneath the surface (USACE 2011).

2.3.5.3 The soil series at MRS 7 include the Molena loamy sand (Gun Butt No. 1 and 2), ,Magotha fine sandy loam (Pyrotechnics Burn Area), and Udorthent and Udipsamment soils (Boat Basin) (TPMC 2011). The Molena soil series is very deep, rarely flooded, and well drained. The Magotha soil series is very deep, frequently flooded, poorly drained, and typically found in salt marshes ranging from 0- 2 percent slope. The Udorthent and Udipsamment soils are rarely flooded and well drained (USDA 2009).

2.3.6 Hydrogeologic Setting

2.3.6.1 There are four major aquifers at the Eastern Shore of Virginia, including where the WFF Project 07 is located: the Pleistocene aquifer (Columbia Group) and the three separate units (upper, middle, and lower) of Miocene aquifers in the Yorktown Formation (USGS 2009). Wind-deposited beach sands, silts, and gravel typically overlie the unconfined Columbia aquifer, also known as the water table aquifer. The Columbia aquifer is located between 5 and 60 ft below the ground surface (bgs). The Pleistocene aquifer is separated by the Miocene aquifer by a 20 to 30 ft confining layer (aquitard) of clay silt. The shallowest confined Miocene aquifer of the Yorktown Formation at WFF occurs at depths of approximately 100 ft bgs. The Miocene aquifers are classified as the upper, the middle, and the lower Miocene aquifers and each Miocene aquifer is overlain by the upper, middle, and lower Miocene confining units (USACE 2011).

2.3.6.2 The groundwater at MRS 7 generally flows to the southeast toward the nearby Mosquito Creek and wetland areas. The water table at the Main Base ranges from depths of 0 to 30 ft bgs and is generally recharged by surface waters or infiltration of precipitation (USACE 2011). During 2011 field activities, the depth to groundwater at MRS 7 was found to be less than ten ft bgs (Appendix D). The confined aquifers are recharged by the same process at locations further away from WFF where these units outcrop near the land surface. Aquifer tests of the unconfined (Pleistocene) aquifer have confirmed the ease of recharge from surface water and/or precipitation and that there is no significant vertical leakage through the aquitard below the unconfined aquifer (USACE 2011).

2.3.7 Area Water Supply/Groundwater Use

2.3.7.1 According to the Accomack-Northampton Planning District Commission, residents in Accomack County receive their potable water entirely from groundwater. Groundwater supply relies on precipitation recharging local aquifers. The confined upper, middle, and lower Yorktown-Eastover aquifers predominately provide the drinking water for Accomack County. The USEPA designated the groundwater as the Columbia and Yorktown-Eastover Multiaquifer System Sole Source Aquifer to protect the drinking water supplies in the area (ANPDC 2011). Town of Chincoteague (ToC) water is sourced from three shallow and four deep wells located in an area close to NASA WFF, next to Route 175. The shallow well depths range from 55 to 60 ft deep and draw from the Columbia Aquifer. The deep wells are in the Yorktown Aquifer with a depth range from 225 to 262 ft based on metadata provided by USACE (Appendix L). The water from these wells is chlorinated, filtered to remove iron, treated to reduce the corrosivity, and then disinfected again before being distributed to ToC's water system (ToC 2009).

2.3.7.2 According to the U.S. Geological Survey (USGS) National Water Information System (NWIS) Mapper, there are two wells within 1,000 ft of the MRS 7 boundary; however, there are no wells within the MRS 7 boundary. The well located less than 1,000 ft from the Boat Basin was completed at a depth of 256 ft bgs and the well located less than 1,000 ft from the Gun Butts was completed at 280 ft bgs. There are seven wells less than 2,000 ft and seven wells on Chincoteague Island less than five miles from MRS 7 (USGS 2011b). The ToC and NASA water supply well locations within a four mile radius of MRS 7 are shown on Figure 2-5. Information regarding the location of groundwater supply wells for private residences is not available to the general public, thus these wells are not included on Figure 2-5.

2.3.8 Sensitive Environments

2.3.8.0.1 The following subsections discuss the sensitive environments associated with MRS 7 and the process used to determine the necessity for completing an ecological risk assessment.

2.3.8.1 Army Checklist for Important Ecological Places

2.3.8.1.1 In accordance with USACE Environmental and Munitions Center of Expertise guidance, the Army Checklist for Important Ecological Places (Table 2-3) is completed to determine if the MRS requires an ecological risk assessment (USACE 2006 and USACE 2007). As shown on Table 2-3, MRS 7 contains wetlands (USFWS 1998) (Section 2.3.8.2) and is located within the VA Coastal Zone (VDEQ 2010) (Section 2.3.8.3). Consequently, a screening level ecological risk assessment is required. The screening level ecological risk assessment is shown in Section 5 of this SI Report.

2.3.8.2 Wetlands

2.3.8.2.1 There are several types of wetlands present within MRS 7 (Figure 2-4). The Pyrotechnics Burn Area is located within an Estuarine and Marine Wetland and South Bank of Boat Basin is located in Freshwater Forested/Shrub Wetland. Gun Butt No. 1 and 2 have been largely redeveloped but border the Estuarine and Marine Wetlands (USFWS 1998).

2.3.8.3 Coastal Zones

2.3.8.3.1 The WFF Project 07 is located along the Virginia coast less than two miles southwest of the Chincoteague Bay. According to the VDEQ, the lead agency for the Virginia Coastal Zone Management Program, the WFF Project 07 is located is within the Virginia Coastal Zone established as directed by the Federal Coastal Zone Management Act (VDEQ 2010).

2.4 Previous Investigations for Munitions Constituents and Munitions and Explosives of Concern

2.4.0.1 A summary of previous historical investigations and related discoveries of MC and MEC is provided in the following subsections.

2.4.1 Archives Search Report for NASA

2.4.1.1 The USACE St. Louis District prepared the Archives Search Report (ASR) Findings for NASA. This ASR was intended for use only by NASA to plan future environmental investigations. The ASR included previous investigations at the MRS, property description, physical characteristics of the property, real estate, and evaluation of historical munitions use by

Navy/NAOTS. It also included identification and evaluation of operations related to HTRW, chemical warfare materiel (CWM), and petroleum, oil, and lubricants, as well as historical operations by NACA/NASA, which are outside the scope of this SI (USACE 2005).

2.4.1.2 The ASR identified WFF Project 07 as an area where munitions may have been used, tested, fired, and/or disposed. The WFF Project 07 is comprised of four areas: Pyrotechnics Burn Area, Gun Butt No. 1, Gun Butt No. 2, and South Bank of Boat Basin. These four areas were identified by historical documents and maps as having the potential to contain MEC/MD or MC from military munitions. During the ASR visit the field team observed a small pile of burnt, presumably demilitarized pyrotechnic devices within the footprint of the Pyrotechnics Burn Area. The team also identified numerous 20mm expended rounds on the surface in the vicinity of Gun Butt No. 1 and 2. Several 20mm and 37mm expended artillery rounds were also observed on the shoreline in the southern portion of South Bank of Boat Basin. There is no evidence that chemical warfare materiel (CWM) was used, stored, manufactured, or disposed of at WFF Project 07. The WFF Project 07 was scored with a Risk Assessment Code (RAC) of 2 in the ASR (USACE 2005).

2.4.2 Inventory Project Report

2.4.2.1 USACE issued the Inventory Project Report (INPR) for the WFF FUDS, including WFF Project 07, in 2009. The INPR determined that the project was eligible for further inspection as a result of prior DoD ownership, utilization, or activity. In addition, the INPR determined that an environmental restoration project was an appropriate undertaking within the purview of the DERP for FUDS for WFF Project 07 (USACE 2009).

2.4.3 Preliminary Assessment

2.4.3.1 The PA was prepared for the WFF FUDS in 2010. This report documented the munitions used at the property and other information related to the property. The PA stated that there was no indication that CWM was used at WFF (USACE 2011).

2.4.3.2 The PA identified the four areas within WFF Project 07/MRS 7. The USACE field team identified a small pile of what appeared to be demilitarized (burned) pyrotechnic devices including various parachute flares within the fenced area of the Pyrotechnics Burn Area. Numerous expended 20mm rounds were observed at Gun Butts No. 1 and 2 during the visit in 2009. The field team observed several 20mm and suspected 37mm expended practice rounds on the shoreline of the South Bank of Boat Basin. An MRSPP score of 4 was provided for the entire MRS (four areas included) based on the types of munitions used (i.e., completion of the

Explosive Hazard Evaluation [EHE] module). CWM was not known to be used, so the Chemical Warfare Materiel Hazard Evaluation (CHE) module was completed as no known or suspected hazard. The Health Hazard Evaluation (HHE) module of the MRSPP was rated as evaluation pending since no samples were collected for the PA (USACE 2011).

2.5 Citizen Reports of Munitions and Explosives of Concern

2.5.1 Citizen reports are the result of a citizen calling the local authorities to remove a munitions item. Records of these reports can be filed with local EOD units, police, and/or fire and rescue who would maintain these records. Since military use of the MRS ceased, there are no known citizen reports of MEC or MD found at MRS 7 (USACE 2011). It would be expected that NASA would have knowledge of such records since their ownership of the property began; however, NASA is unaware of a citizen report occurring within WFF Project 07 (TPMC 2012). Refer to Paragraph 3.1.1 for munitions finds mentioned by NASA during the TPP #1 meeting.

2.6 Non-Department of Defense Contamination/Regulatory Status

2.6.1 There is no evidence, based on historical review and stakeholder comments, that activities occurring prior to or after DoD use of the area contributed to potential MEC, MD, or MC presence (USACE 2009 and 2010, TPMC 2011).

Table 2-1. MRS Inventory (USACE 2011)

FUDS Name/ Project Name	MRS Name	Area Name	Land Acreage	Water Acreage	Total Acreage
WFF/ Project 07: Boat Basin/Visitors Information Center	MRS 7: Boat Basin/Visitors Information Center	Pyrotechnics Burn Area	0.09	0.00	0.09
		Gun Butt No. 1	0.66	0.00	0.66
		Gun Butt No. 2	0.53	0.00	0.53
		South Bank of Boat Basin	0.25	0.00	0.25

FUDS – Formerly Used Defense Site
MRS – Munitions Response Site
No. - Number
WFF – Wallops Flight Facility

Table 2-2. Military Munitions Type and Composition
MRS 7 - Boat Basin/Visitors Information Center

MRS Name	Area Name	Munitions ID	Munitions Type	Composition (explosive constituents and metallic components)	Associated MC Analysis [2]
MRS 7-Boat Basin/ Visitors Information Center	**Pyrotechnics Burn Area[9]**	Pyrotechnics	Parachute Flare (Mk6)	***Body:*** Aluminum ***Priming Charge[1]:*** Black powder [3] (potassium nitrate, charcoal, sulfur), dextrin ***Flare Charge/Illuminant***: Magnesium, barium nitrate, iron, sodium oxalate, aluminum, castor and linseed oil, sulfur ***Miscellaneous:*** trinitrotoluene (TNT) and/or gasoline or other combustible material may have been used during demolition. PAHs may be present due to the potential use of gasoline as an accelerant. Although perchlorates were not in wide spread use prior to 1957 (approximate timeframe of FUDS use), this facility was a research and development facility and perchlorate may have been used in some of the pyrotechnic devices disposed of at this area.	Explosive constituents: • TNT [6] Metals: • Aluminum • Antimony • Barium • Iron • Lead • Magnesium • Zinc Other: • Perchlorate (groundwater only)[7] • PAHs (soil only)
			AN-Mk4 Signals, ANMk5/ Mk23/Mk43 practice bombs	***Signals:*** Shotgun shell, black powder[3] (potassium nitrate, charcoal, sulfur) and red phosphorous pyrotechnic mixture ***Body:*** AN-Mk 5: zinc alloy; AN-Mk 23: cast iron; AN-Mk 43: lead-antimony alloy	
	Gun Butt No. 1 and Gun Butt No. 2[8]	Large Caliber (37mm and larger), HE (CTT18)	37mm, HE, tracer and practice	***Projectile:*** soft or forged steel (carbon and iron); filler for HE projectile: TNT or in some cases Tetryl ***Propellant:*** Smokeless powder or FNH powder (Nitrocellulose[4], nitroglycerin (NG),	Explosive constituents: • NG • DNT[5] • TNT [6] • RDX • Tetryl Metals (not analyzed at firing point):

Table 2-2. Military Munitions Type and Composition
MRS 7 - Boat Basin/Visitors Information Center

MRS Name	Area Name	Munitions ID	Munitions Type	Composition (explosive constituents and metallic components)	Associated MC Analysis [2]
				dinitrotoluene (DNT), potassium sulfate, graphite), diphenylamine ***Primer[1]:*** Lead sulphocyanate, antimony sulfide, potassium chlorate, TNT, black powder (sodium nitrate or potassium nitrate plus charcoal and sulfur) ***Tracer[1]:*** Magnesium, magnesium-aluminum alloy, strontium nitrate, barium oxide, calcium resinate, polyvinyl chloride	• Antimony • Copper • Iron • Lead • Nickel Other (per stakeholder request): • Perchlorate (groundwater only)[7]
		Medium Caliber (20 mm), HE and practice (CTT18)	20mm HE, tracer and practice	***Projectile:*** 20 mm ball (steel), 20mm HE (TNT or RDX). ***Propellant:*** Single- or Double-base smokeless powder (nitrocellulose[4], NG, DNT, potassium sulfate, graphite) ***Tracer[1]:*** Magnesium, magnesium-aluminum alloy, strontium nitrate, barium oxide, calcium resinate, polyvinyl chloride	
		Small Arms (CTT01)	Small Arms .50 Machine Gun	***Projectile:*** .50 cal: Lead, antimony, cupro-nickel, and soft steel ***Propellant:*** Single or Double-base smokeless powder (nitrocellulose[4] NG, DNT, potassium sulfate, graphite ***Tracer[1]:*** Magnesium, magnesium-aluminum alloy, strontium nitrate, barium oxide, calcium resinate, polyvinyl chloride	
	South Bank of Boat Basin[9]	Large Caliber (CTT18), Medium Caliber	37mm, HE, tracer and practice, 20mm HE, tracer and	**Refer to the MEC/MC list for Gun Butts No. 1 and 2 since munitions ID**	Explosive constituents: • NG • DNT[5] • TNT[6] • RDX

Table 2-2. Military Munitions Type and Composition
MRS 7 - Boat Basin/Visitors Information Center

MRS Name	Area Name	Munitions ID	Munitions Type	Composition (explosive constituents and metallic components)	Associated MC Analysis [2]
		(CTT18),	practice, Small Arms .50 Machine Gun	**and Type are the same**	• Tetryl Metals (sediment, surface soil, and subsurface soil only): • Antimony • Copper • Iron • Lead • Nickel Other (per stakeholder request): • Perchlorate (surface water only)[7]

CERCLA = Comprehensive Environmental Response, Compensation, and Liability Act
CTT = Closed Transferring and Transferred
DNT = Dinitrotoluene
DoD = Department of Defense
FUDS = Formerly Used Defense Site
g = grams
HE = High Explosive
ID = Identification
ITRC = Interstate Technology Regulatory Council
Lb = Pound
MC = Munitions Constituent
Mk = Mark
mm = millimeter
MRS = Munitions Response Site
NG = Nitroglycerine
oz = ounce
PWP = Programmatic Work Plan
RDX = Hexahydro-1,3,5-trinitro-1,3,5-triazine
RI/FS = Remedial Investigation/Feasibility Study
Tetryl = N-Metryl-N,2,4,6-tetranitroaniline
TNT = Trinitrotoluene

[1] Fuzes and other internal components (e.g. igniters, primers, tracers) of the munitions represent a very small percentage by weight of the MC of concern. Where munitions less than 90mm (3.54") were used, MC associated with the primer, booster, detonator, and fuze were not analyzed due to the small amount within these components. The primer and tracer are assumed to be expended at the firing point, and the booster, detonator, tracer, and fuze are assumed to be expended at the impact area.

[2] Chemicals that are not CERCLA hazardous substances (e.g., iron) can be reported in the SI; however, the SI risk evaluation and conclusions includes a discussion of the limitations of the FUDS program to respond to such chemicals. Non-CERCLA chemical concentrations do not provide the basis for a RI/FS recommendation for MCs in this SI report

[3] Black powder was not sampled within the FUDS because, a) the black powder is a rapidly burning material that, when fired, leaves little residue as either decomposition products or uncombusted compounds (ITRC 2003), and b) typically any residual amounts are insignificant in volume to present a MC hazard. Additionally, the original chemical constituents and the decomposition products are, in general, common soil compounds (organic carbon, CO2, nitrates, etc.), which would be difficult to specifically identify as originating from within the FUDS boundary.

[4] Simple single-based nitrocellulose readily breaks down in the environment and is not expected to persist (Duran et al. 1994). Nitrocellulose is not considered toxic, and consequently no risk-based screening values have been developed for the compound. Furthermore, there are no chemical analysis techniques that quantify nitrocellulose separately from the natural common essential nutrient nitrate. Based on this rationale, no sampling for nitrocellulose was conducted.

[5] DNT and DNT break-down products currently on the approved PWP (Alion 2005) explosive constituents analysis

Table 2-2. Military Munitions Type and Composition
MRS 7 - Boat Basin/Visitors Information Center

MRS Name	Area Name	Munitions ID	Munitions Type	Composition (explosive constituents and metallic components)	Associated MC Analysis [2]

using method 8330A list (2,4-Dinitrotoluene; 2,6-Dinitrotoluene; 2-Amino-4,6-dinitrotoluene; 2-Nitrotoluene; 3-Nitrotoluene; 4-Nitrotoluene; 4-Amino-2,6-dinitrotoluene) were analyzed.

[6].TNT and breakdown products currently on the approved PWP (Alion 2005) explosive constituents analysis using method 8330A list (including 2-Amino-4,6-dinitrotoluene; 4-Amino-2,6-dinitrotoluene; Nitrobenzene; 2,6-dinitrotoluene; 1,3,5-trinitrobenzene) were analyzed.

[7] Unlike some of the other explosive constituents, perchlorate does not adsorb to soil easily and is not persistent in soil (i.e., it typically migrates downward through the soil to groundwater). Furthermore, given the high solubility and mobility of perchlorate (i.e., perchlorate does not adsorb to soil easily and does not persist in soil [DoD 2007]), detection of this compound in soil more than 50 years after DoD use ended is unlikely. Perchlorate was analyzed in groundwater samples only.

[8] Munitions were assumed to be expended at Gun Butts No. 1 and 2. Propellant constituents, which are expected to be expended when munitions are fired, were analyzed at the firing point. Projectile constituents, which are expected to be found at the terminal location of the munition, were analyzed at the impact area.

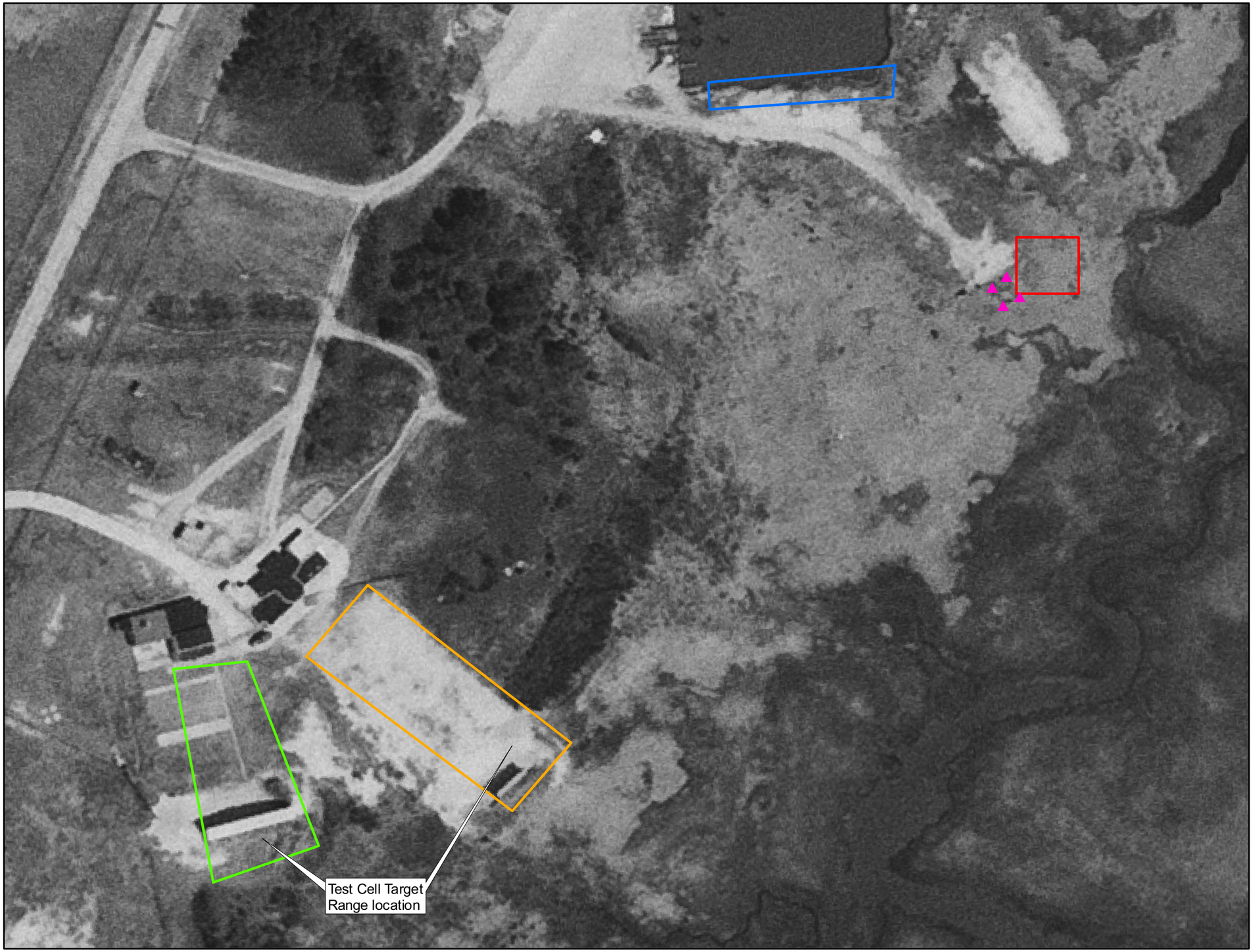
[9] Complete munitions may have been transported or disposed at the Pyrotechnics Burn Area or the South Bank of the Boat Basin; therefore, constituents associated with the entire round were analyzed at these areas.

Table 2-3. Army Checklist for Important Ecological Places

Number	Checklist Item	Response		Comments
1.	Locally important ecological place identified by the Integrated Natural Resource Management Plan, Base Realignment and Closure Act Cleanup Plan or Redevelopment Plan, or other official land management plans.		No	
2.	Critical habitat for Federally designated endangered or threatened species. See No. 12 below.		No	
3.	Marine Sanctuary		No	
4.	National Park		No	
5.	Designated Federal Wilderness Area		No	
6.	Areas identified under the Coastal Zone Management Act	Yes		MRS 7 is located with the Virginia Coastal Zone (VDEQ 2010)
7.	Sensitive Areas identified under the National Estuary Program or Near Coastal Waters Program		No	
8.	Critical areas identified under the Clean Lakes Program		No	
9.	National Monument		No	
10.	National Seashore Recreational Area		No	
11.	National Lakeshore Recreational Area		No	
12.	Habitat known to be used by Federally designated or proposed endangered or threatened species	Yes		Federally designated threatened (Loggerhead sea turtle, Northeastern Beach tiger beetle, Piping Plover, Seabeach amaranth) and endangered (Delmarva Peninsula Fox squirrel, Roseate tern) species are within WFF Project 07 (USFWS 2011a).
13.	National preserve		No	
14.	National or State Wildlife Refuge		No	The Wallops Island National Wildlife Refuge is approximately 500 ft from the boundary of the MRS (USFWS 2011b).
15.	Unit of Coastal Barrier Resources System		No	
16.	Coastal Barrier (undeveloped)		No	
17.	Federal land designated for protection of natural ecosystems		No	
18.	Administratively Proposed Federal Wilderness Area		No	
19.	Spawning areas critical for the maintenance of fish/shellfish species within river, lake, or coastal tidal waters		No	
20.	Migratory pathways and feeding areas critical for maintenance of anadromous fish species within river reaches or areas in lakes or coastal tidal waters in which fish spend extended periods of time		No	
21.	Terrestrial areas utilized for breeding by large or dense		No	

Table 2-3. Army Checklist for Important Ecological Places

Number	Checklist Item	Response		Comments
	aggregations of animals			
22.	National river reach designated as Recreational		No	
23.	Habitat known to be used by state designated endangered or threatened species	Yes		State designated threatened (Loggerhead sea turtle, Northeastern Beach tiger beetle, Piping Plover, Seabeach amaranth) and endangered (Delmarva Peninsula Fox squirrel, Roseate tern) species are within WFF Project 07 (VDGIF 2011b).
24.	Habitat known to be used by species under review as to its Federal endangered or threatened status		No	
25.	Coastal Barrier (partially developed)		No	
26.	Federally designated Scenic or Wild River		No	
27.	State land designated for wildlife or game management		No	
28.	State-designated Scenic or Wild River		No	
29.	State-designated Natural Areas		No	
30.	Particular areas, relatively small in size, important to maintenance of unique biotic communities		No	
31.	State-designated areas for protection or maintenance of aquatic life		No	
32.	Wetlands	Yes		Wetlands are present within MRS 7 (USFWS 1998) (Figure 2-4)
33.	Fragile landscapes, land sensitive to degradation if vegetative habitat or cover diminishes		No	



Wallops Flight Facility - Project 07

Wattsville, Virginia
Accomack County

Legend

- Pyrotechnics Burn Area fence corners
- Pyrotechnics Burn Area
- Gun Butt No. 1
- Gun Butt No. 2
- South Bank of Boat Basin

FUDS and MRS Source: USACE (2011)

Imagery Source: US Aerial Archive (8 April 1963)

N
W E
S

Feet
100 50 0 100

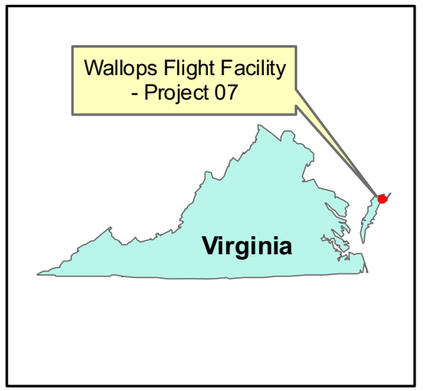


Figure 2-1. Historical MRS 7 Layout

Figure 2-2. MRS 7 Boundary and Current Aerial Imagery

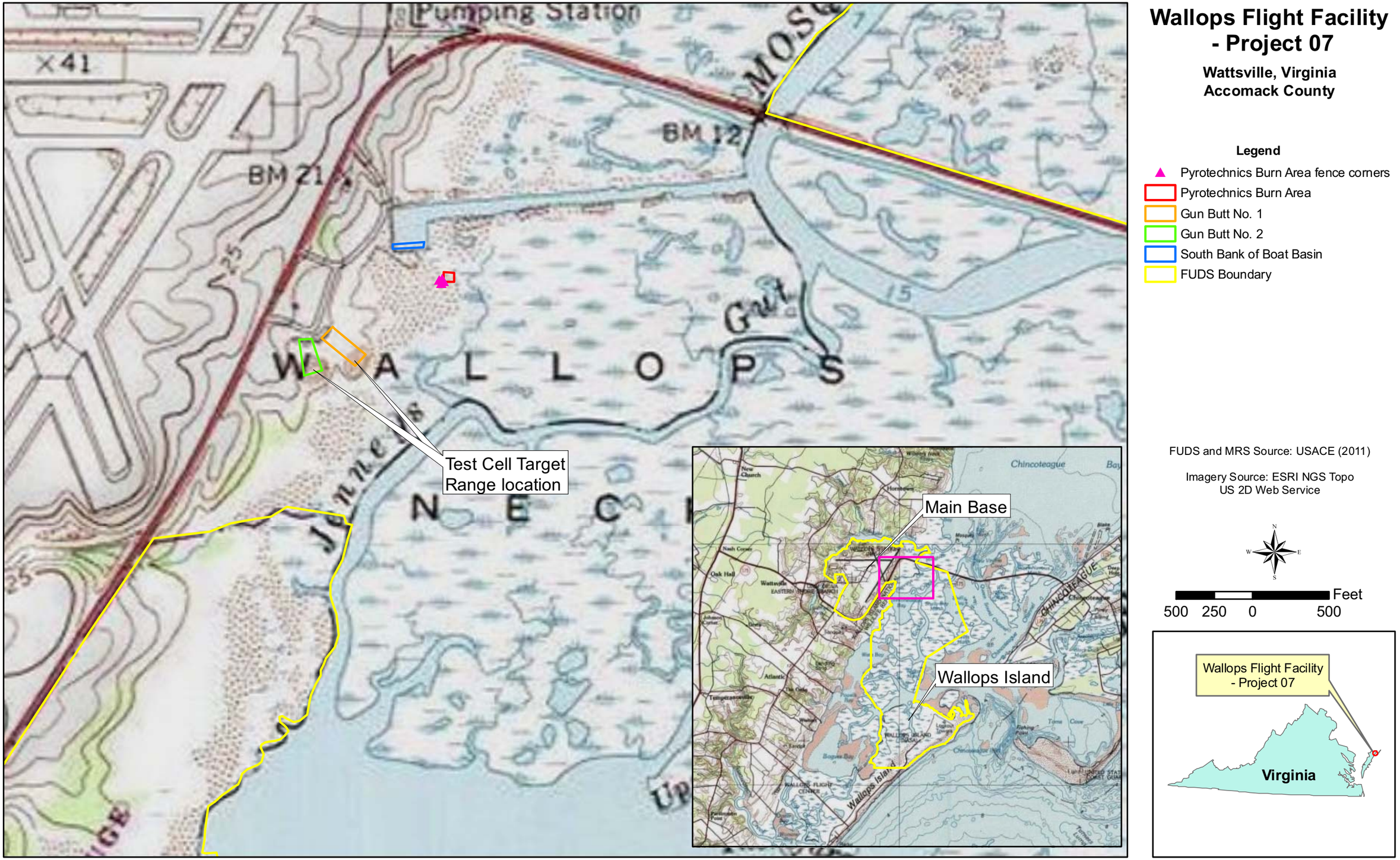


Figure 2-3. General Location of the FUDS Property and MRS 7

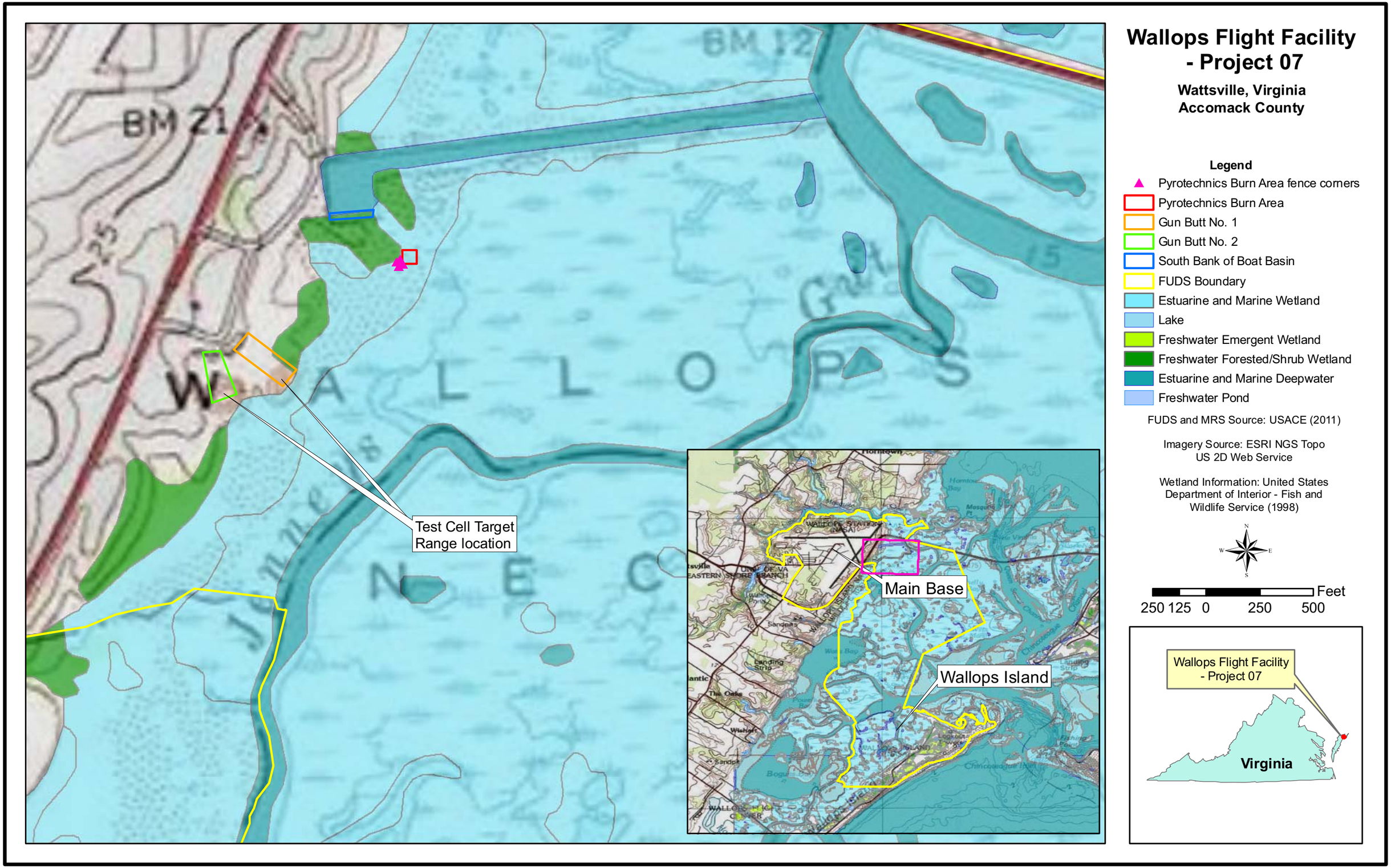
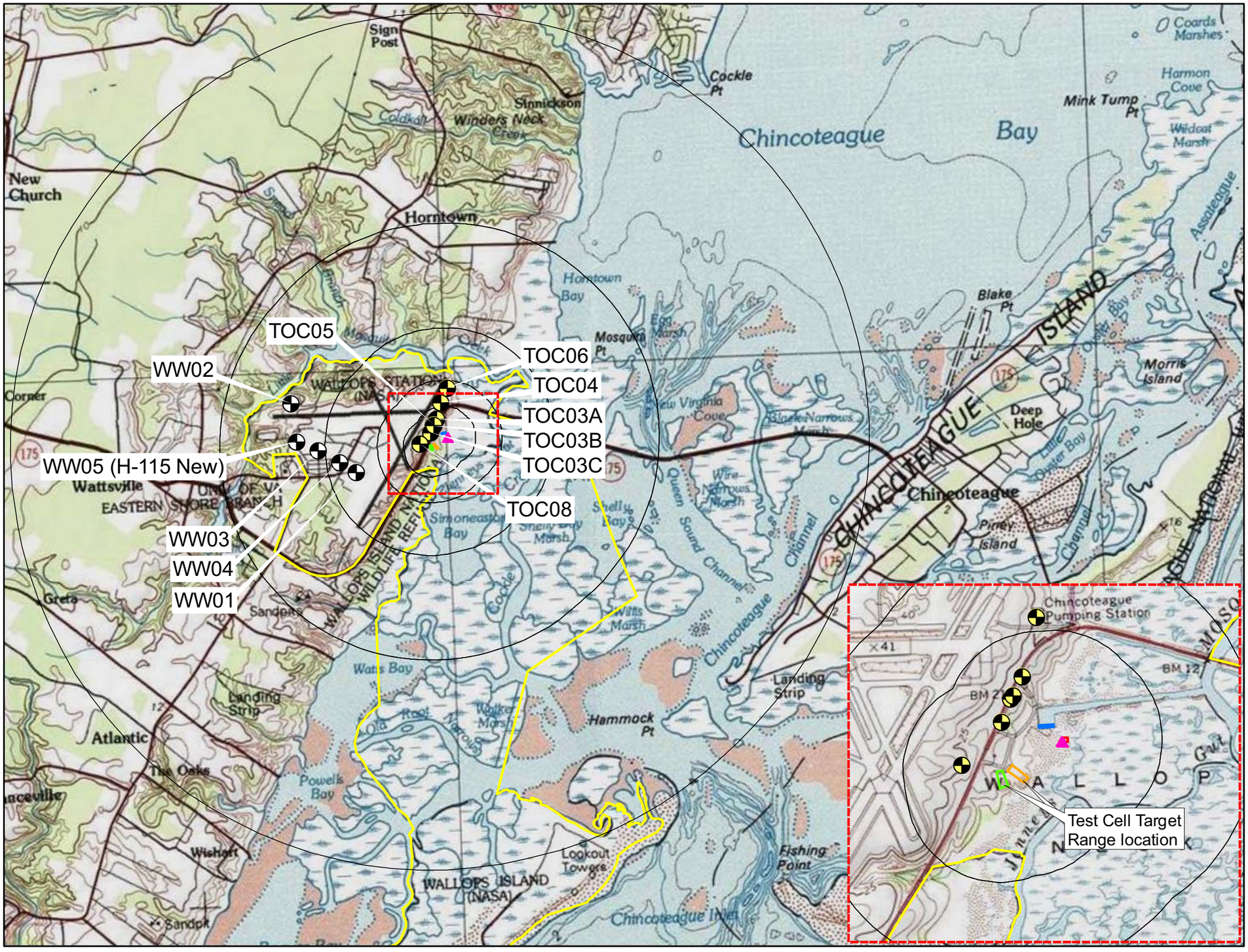


Figure 2-4. Topography and Wetlands in the vicinity of the MRS 7



Wallops Flight Facility - Project 07

Wattsville, Virginia
Accomack County

Legend

- NASA wells
- Town of Chincoteague
- Pyrotechnics Burn Area fence corners
- ¼, ½, 1, 2, 4 Mile Radii
- Pyrotechnics Burn Area
- Gun Butt No. 1
- Gun Butt No. 2
- South Bank of Boat Basin
- FUDS Boundary

FUDS and MRS Source: USACE (2011)

Imagery Source: ESRI NGS Topo US 2D Web Service

Well Source: NASA (TranSystems Corporation)

Feet
4,0002,000 0 4,000 8,000

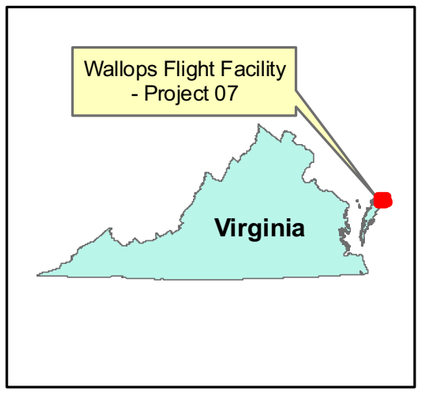


Figure 2-5. Wells in Proximity to MRS 7

3. SITE INSPECTION ACTIVITIES

3.1 Technical Project Planning

3.1.1 The first TPP meeting for WFF Project 07 was conducted on 6 May 2010 at the NASA WFF in Accomack County, VA. The Final TPP Memorandum documenting the meeting was issued in August 2010 (Alion 2010). NASA, VDEQ, CENAB, CENAO, USEPA Region 3, and HFA participated in this meeting. The participants in the meeting discussed the results of previous investigations, historical and current aerial photographs, the CSM, and Data Quality Objectives (DQOs) as documented in the TPP memorandum (Appendix B). During the TPP #1 meeting, NASA indicated that a removal action was conducted at the location of the former Gun Butts No. 1 and 2 in 2006 and hundreds of 20mm and 37mm projectiles and other MD were removed from the site (Alion 2010).

3.1.2 **DQO 1 – Determine if MRS 7 requires additional investigation through an RI/FS or if MRS 7 may be recommended for a No DoD Action Indicated (NDAI) designation based on the presence or absence of MEC and MC.** The basis of an RI/FS recommendation, detailed in the DQO of Appendix B, includes evaluation of evidence (e.g., historical data, field data, etc.), such as the data noted below, to make a final recommendation for an NDAI designation or RI/FS (e.g., presence of MD alone will not justify an RI/FS recommendation).

3.1.2.1 The basis for an RI/FS recommendation related to the presence of MEC includes:

- If there is historical data that indicates the presence of MEC or MD.
- If there is visual evidence of MEC/MD or surface anomalies which are classified as MEC or MD.
- If there are one or more anomalies in a target area near historical or current MEC/MD finds or within an impact crater.
- If there is physical evidence indicating the presence of MEC (e.g., distressed vegetation, stained soil, ground scarring, bomb craters, burial pits).

3.1.2.2 The basis for an RI/FS recommendation related to the presence of MC includes:

- If the maximum concentrations at MRS 7 exceed USEPA Regional Screening Values based on current and future land use.
- If the maximum concentrations at MRS 7 exceed USEPA interim ecological risk screening values.

- If the maximum concentrations at MRS 7 exceed site-specific background levels.
- Data indicating the presence or absence (less than the Reporting Limit [RL]) of analytes for which no screening criteria are available are to be used to support the weight-of-evidence (WOE) evaluation of MC at MRS 7.

3.1.2.2 In each of these instances, lines of evidence (e.g., historical data, field data) are used to make a final recommendation for an NDAI designation or RI/FS. If none of the above scenarios occur, then a recommendation for an NDAI designation for MEC/MC is a possible option.

3.1.3 **DQO 2 – Determine the potential need for a Time Critical Removal Action (TCRA) for MEC and MC by collecting data from previous investigations/reports, conducting an MRS visit, performing analog geophysical activities, and by collecting MC samples.** The basis for recommendations is specified below:

- A TCRA may be initiated if there is a complete pathway between source and receptor and if the MEC/MC and the situation are viewed as an imminent danger posed by the release or threat of a release. Cleanup or stabilization actions must be initiated within six months to reduce risk to public health or the environment.
- A non-TCRA (NTCRA) may be initiated if a release or threat of release that poses a risk where more than six months planning time is available.

3.1.3.1 In each of these instances, lines of evidence (e.g., historical data, field data) are to be used to make a final recommendation for a TCRA or NTCRA.

3.1.4 **DQO 3 – Collect or develop additional data, as appropriate, to support potential Hazard Ranking System scoring by USEPA.**

- This DQO is attained via verification in the SI Report that data were collected in accordance with the Final SS-WP. However, this SI was not intended to be the only source of data used to score WFF Project 07 in the HRS. While there is insufficient data in the SI for USEPA to perform an evaluation under the HRS Model, any data gaps will be discussed during the scoping process of the future RI.

3.1.5 **DQO 4 – Collect the additional data necessary to complete the MRSPP.**

- This DQO is attained via completion of the MRSPP for the MRS with available data and documentation of any data gaps for future annual updates.

3.1.6 The meeting participants concurred with the DQOs and the general technical approach for the planned SI activities discussed during the first TPP meeting and as revised and subsequently documented in the Final SS-WP (Alion 2010). In summary, these agreements were to inspect the MRS and conduct sampling in accordance with the Final SS-WP, and complete the assessment in accordance with the DQOs. As part of this SI Report, the DQOs were evaluated and a DQO attainment verification worksheet was completed to document completion of the DQOs (Appendix B). The four DQOs were attained during this SI.

3.2 Supplemental Records Review

3.2.0.1 State and federal agencies were contacted regarding threatened and endangered (T&E) species and cultural and archaeological resources at MRS 7.

3.2.1 Threatened and Endangered Species

3.2.1.1 According to the United States Fish and Wildlife Service (USFWS) and VA Fish and Wildlife Information Service, nineteen federal or state threatened or endangered bird, invertebrate, mammal, reptile and vascular plant species have been identified in Accomack County or within a five-mile radius of the WFF. The nineteen species and their respective statuses are listed in the PA (USACE 2011a) (Appendix L). In addition, the Wallops Island National Wildlife Refuge is approximately 500 ft from the boundary of the MRS (USFWS 2011b).

3.2.1.2 The USFWS, Virginia Department of Game and Inland Fisheries (VDGIF), VA Department of Conservation and Recreation (VDCR), and National Oceanic and Atmospheric Administration (NOAA) National Marine Fisheries Service (NMFS) were sent the proposed field activities for review to determine if any T&E species are present and were likely to be adversely affected by the field activities presented in this SS-WP. The responses from the DCR and USFWS indicated that no adverse impacts to T&E species are anticipated based on the limited field activities at WFF Project 07. However, USFWS identified several federally threatened (Loggerhead sea turtle, Northeastern Beach tiger beetle, Piping Plover, Seabeach amaranth) and endangered (Delmarva Peninsula Fox squirrel, Roseate tern) species within WFF Project 07 (USFWS 2011a). The VDGIF was unable to provide an assessment of the project at that time (VDGIF 2011a). The NMFS responded that several species of T&E sea turtle species may be found along the coast of Virginia, but due to the shallow depth of the Boat Basin it would be extremely unlikely that sea turtles would be present in that area and no further coordination was

required (NOAA 2011). No changes were made to the field activities as a result of possible T&E species. The response letters from each agency are included in Appendix L.

3.2.2 Cultural and Archaeological Resources

3.2.2.1 Prior to the SI field activities at WFF Project 07, USACE sent a letter with supporting figures (proposed sampling and areas of archaeological sensitivity) to the Virginia Department of Historic Resources for consultation. The letter indicated that, based on the cultural resource assessment completed in 2003 and the limited intrusive sampling proposed during the SI field activities, significant impacts to cultural resources were not expected. Given the limited field activities, USACE concluded that no adjustments were necessary to the sampling design to avoid impact on cultural resources. The letter and supporting figures sent by USACE, dated 28 February 2011, to VA SHPO is included in Appendix L.

3.3 Site Inspection Fieldwork

3.3.0.1 SI field activities at MRS 7 were conducted on 12, 13, and 14 December 2011. A summary of the observations and MC samples collected at MRS 7 is provided in the following subsections. Additional information pertaining to the field activities for MRS 7, including field notes and forms, and chain of custody forms, are provided in Appendix D. As-collected sample locations, designations, rationale, and field observations for MRS 7 are summarized in Table 3-1. MRS 7 sample locations, QR paths, and anomalies are depicted on Figures 3-1a and 3-1b, respectively. A photo documentation log from the SI field activities is included in Appendix E, and photo locations are shown on Figure 3-2. Locations, designations, rationale, and field observations for background sediment samples collected during the 2011 SI field activities are summarized in Table 3-2. Locations of sediment background samples collected during the 2011 SI field activities are depicted on Figure 3-3. Background surface and subsurface soil and groundwater sample information was obtained from an existing background study (Appendix L) and is discussed in Paragraph 3.3.2.4 and in the context of the MRS 7 MC risk screening in Section 5 of this SI Report.

3.3.1 Site Inspection Munitions and Explosives of Concern Field Observations

3.3.1.1 An estimated 1.76 acres of land were assessed during the field work completed at MRS 7 using a Whites XLT metal detector (to detect ferrous and non-ferrous metals) and visual reconnaissance along a meandering path and around sample locations. The approximate land acreage of QR completed for each area within MRS 7 is 0.68 acres at and between Gun Butts No. 1 and 2; 0.22 acres at Pyrotechnics Burn Area; 0.86 acres at the South Bank and around the perimeter of the Boat Basin. Analog geophysics was used primarily to support anomaly

avoidance activities for the field crew. Although no samples were collected within the Boat Basin (outside of MRS 7), approximately 0.31 acres of analog geophysics was completed in the water portion of the Boat Basin using a Bore Hole Gradiometer (BHG)-1 to detect ferrous metals.

3.3.1.2 **MRS 7 – Boat Basin/Visitors Information Center.** The former Pyrotechnics Burn Area, Gun Butts No. 1 and 2, and the South Bank of the Boat Basin were the primary focus of the 2011 SI field activities; however, additional QR and sampling were completed outside of the boundary of these four areas. The following observations were made during the SI field event.

- Portions of MRS 7 (Pyrotechnics Burn Area and Boat Basin) are fenced and not accessible to the public; however, the Marine Science Consortium and NASA employees have access to the Boat Basin. Other portions of MRS 7 (Gun Butt No. 1 and Gun Butt No. 2) are in an area outside of the Visitor Information Center that is open to the public.
- There is a gate at the entrance to the visitor center parking lot to regulate/control entering this area if necessary; however, the gate is open during daylight hours (10 am to 4 pm) on a schedule that is seasonal but a minimum of five days a week.
- Approximately 37 subsurface (single) and numerous surface anomalies were detected throughout the QR paths walked within and in close proximity to MRS 7. In addition, five areas of concentrated subsurface anomalies were documented. The surface anomalies were identified as military debris (e.g., Marston mat, MD). Two anomalies were detected while conducting analog geophysics within the water of the Boat Basin, and an undefined area along the South Bank of the Boat Basin was noted as having a large quantity (more than 50) of surface anomalies identified as rusty metal debris.
- No confirmed MEC was observed during the SI field event at MRS 7. However, three MD were observed. Also, seven Material Potentially Presenting an Explosive Hazard (MPPEH) items that could not be determined to not contain energetic material were observed and their locations recorded using a GPS unit. In accordance with the procedures outlined in the Final SS-WP, USACE and NASA were notified of the MPPEH items and the UXO technician recommended to NASA that the MPPEH items be removed as soon as possible. It was agreed that an emergency response action would not be initiated because the items were not viewed as an “immediate and unacceptable hazard” to the local populace or site personnel.

3.3.2 Site Inspection Munitions Constituents Samples Collected

3.3.2.1 **MRS 7 – Boat Basin/Visitors Information Center.** A total of 32 soil (21 surface and 11 subsurface), six sediment, four groundwater, and one surface water samples were collected at

MRS 7 (not including QA). Six co-located surface and subsurface soil samples, ten surface soil samples, and two groundwater samples were collected between and within the Gun Butts No. 1 and 2. Five sediment samples, one surface water sample, and one co-located surface and subsurface soil sample were collected from the South Bank of the Boat Basin. Four co-located surface and subsurface samples were collected (at each corner outside the fence), and two groundwater samples were collected at the Pyrotechnics Burn Area. The two groundwater samples were collected at the eastern and southern fence corner of the Pyrotechnic Burn Area. The list of analytes for the MRS 7 samples included a select list of explosive constituents and metals based on munitions used in these areas historically (Table 2-2). Two of the surface soil samples and one of the field duplicate surface soil samples collected at the Pyrotechnics Burn Area of MRS 7 also were analyzed for Polycyclic Aromatic Hydrocarbons (PAHs) due to the possible use of accelerants (Table 2-2). Additionally, perchlorate was analyzed in groundwater and surface water samples collected at MRS 7. The surface water sample and one field duplicate surface water samples were collected from the boat basin by placing the bottle within the water near the bottom of the water column. Refer to Section 3.4 for changes to proposed sample locations that occurred during field activities.

3.3.2.2 **Background Samples.** As agreed at the TPP meeting, samples collected at WFF Project 07 were compared to a previously established background data set for the WFF Main Base provided by NASA. Specifically, MRS 7 soil and groundwater samples were compared to the analytical results contained in the report, “Background Soil and Groundwater Investigation Report for the Main Base”, which was completed in May 2004. The report does not include background data for perchlorate in groundwater or any analytes in sediment or surface water. NASA indicated that perchlorate has not been detected in groundwater samples collected to date at WFF; therefore, a background groundwater/surface water sample was not collected for background perchlorate comparison. Three sediment samples were collected outside the MRS boundary and analyzed for select metals (aluminum, antimony, barium, copper, iron, lead, magnesium, nickel, and zinc) for comparison to MRS 7 samples. Refer to Section 3.4 for changes to proposed background sample locations that occurred prior to or during field activities.

3.4 Work Plan Deviations and Field Determinations

3.4.1 Deviations from the WFF Project 07 Final SS-WP (TPMC 2011) occurred with respect to sample locations at MRS 7.

3.4.1.1 During the field event, the location proposed in the Final SS-WP for the groundwater sample WFF-MRS7-GW-00-04 was not conducive to transmitting water to sample. The field team received approval from USACE to collect a sample south of the proposed location.

Therefore, groundwater sample WFF-MRS7-GW-00-04 was moved slightly south of the former impact area Gun Butt No. 2.

3.4.1.2 The locations proposed in the SS-WP for the five sediment samples at the South Bank of the Boat Basin were located within the boat basin surface water feature. USACE provided concurrence to move the samples to the South Bank of the Boat Basin where MD was observed historically and during the field event.

3.4.1.3 The Pyrotechnics Burn Area was found to be incorrectly positioned in the USACE-provided GIS (USACE 2011). The correct location, as confirmed by visual evidence of burning contained within a deteriorated fence matching the description of the area cited in historical documents, was observed to be near the southwestern corner of the Pyrotechnic Burn Area shown in the Final SS-WP. GPS coordinates were collected at each corner of the fence, which was approximately 500 square ft (20 ft by 25 ft). The USACE-provided boundary for the Pyrotechnics Burn Area and the GPS coordinates for the four fence corners are shown on the figures in this SI Report. USACE approved moving the proposed samples for the Pyrotechnic Burn Area to be collected within the fenced area. However, due to a dense concentration of subsurface anomalies within the fenced area, the UXO Technician could not locate sample areas that were free of anomalies. USACE concurred with collecting the samples just outside the fenced Pyrotechnics Burn Area where an area could be cleared by the UXO technician.

3.5 Site Inspection Laboratory Data Quality Indicators

3.5.1 This section summarizes the data quality assessment for the WFF Project 07 SI analytical data. Data were generated by the TestAmerica, Inc. laboratory in Arvada, Colorado under the DoD Quality Systems Manual (QSM) Version 4.2 (DoD 2010) and validated by a third-party (EDS) using USEPA Region III Functional Guidelines. The detailed Test America, Inc. and EDS reports are contained in Appendixes F and G, respectively. The data were analyzed using the Automated Data Review Version 8.2 based on the DoD QSM 4.2 guidelines, and these results are included in the Environmental Data Management System (EDMS) database. Data Quality Indicators (DQIs) include precision, accuracy, representativeness, completeness, and comparability as well as sensitivity. At WFF Project 07, no quality assurance (QA) split samples were collected in accordance with USACE direction. Therefore, the USACE Memorandum for Record-Chemical Quality Assurance Report of Quality Assurance Split Samples is not applicable to this SI Report. However, CENAB will provide a Chemical Data Quality Assessment Report (CDQAR) for inclusion in Appendix G of the Final SI Report.

3.5.2 Precision is a measure of the reproducibility of repetitive measurements of the same process under similar conditions. Precision is determined by measuring the agreement among individual measurements of the same property, under similar conditions, and is calculated as an absolute value. The degree of agreement was expressed as the relative percent difference (RPD) between the separate measurements (usually matrix spike/matrix spike duplicate [MS/MSD] pairs) and the observed relative percent difference compared to acceptable values. Field precision is measured by the comparison of field duplicate samples to their associated parent samples.

3.5.2.1 For MRS 7, the MS/MSD samples pairs achieved acceptable RPD values. The field duplicate samples achieved acceptable values (Appendix G). The objectives for the precision DQI were met.

3.5.3 Accuracy is the degree of agreement of a measurement with an accepted reference or true value. Accuracy measures the bias or systematic error of the entire data collection process. To determine accuracy, a sample that has been spiked with a known concentration is analyzed by the laboratory as the MS, MSD, surrogate and blank spikes, or Laboratory Control Spike. EDS assessed accuracy according to Region III Functional Guidelines and assigned qualifiers as appropriate.

3.5.3.1 For MRS 7, the laboratory QA samples achieved acceptable values with the exception of the MS/MSD (antimony, iron, lead, 3-NB), Method Blank (iron, lead, copper, nickel, 2,4,6-TNT, 2-NT, Acenaphthylene, and Naphthalene), Field Blank (magnesium and zinc) and Surrogate Spike (1,2-dinitrobenzene), which required sample qualification. The affected samples were qualified appropriately as shown in Appendix G. The evaluation of the qualified analytical data and its validity for use in the risk assessment screening process presented in Paragraph 5.1.2.2. The objectives for the accuracy DQI were met (Appendix G).

3.5.4 Representativeness expresses the degree to which data accurately and precisely represents a characteristic of a population, parameter variations at a sampling point, or an environmental condition. Representativeness is achieved through proper development of the field sampling program during the TPP and work plan development. Some sample locations were moved during field work to areas where media was present or in the correct location (South Bank of Boat Basin, within the Pyrotechnics Burn Area) resulting in deviations from the Final SS-WP. The location movements were necessary to produce data that accurately represent the MC concentrations in the media present at the MRS. The samples collected were analyzed as

proposed; therefore, the objectives for the representative DQI were achieved for the WFF Project 07.

3.5.5 Completeness is a measure of the amount of valid data obtained from a measurement system compared to the amount that was expected to be obtained under normal conditions. Data are complete and valid if the data achieve the acceptance criteria including accuracy, precision, and any other criteria specified by the particular analytical method being used. Each sample proposed in the Final SS-WP was collected, although some were relocated as discussed previously. The acreage of QR that was completed during the SI field event (approximately 1.76 acres of land and 0.31 acres within the Boat Basin) exceeded the QR proposed in the SS-WP (approximately 1.30 acres). All of the 847 analyte results associated with the MRS 7 SI sampling effort, with the exception of 17 antimony results, were accepted by EDS. Therefore, the WFF Project 07 data achieved 98.66% completeness and met the objectives for the completeness DQI.

3.5.6 Comparability expresses the confidence with which one data set can be compared to another. The comparability DQI was evaluated with respect to the comparability of sampling results within the data set based on analytical and data validation procedures prescribed in the DQOs. Standard methods for sampling and analyses were followed as described in the SS-WP. These methods were consistent with other samples collected under the MMRP. The MRS sample results for WFF Project 07 were compared to the background data set collected during the SI for sediment comparisons (metals) and the previous background study for soil comparisons (metals and PAHs). Since the background sediment samples were collected from similar sediment types using the same collection/analysis methods, the comparability of the data sets has a high degree of confidence. The background data set for soil was collected from a similar soil series. The background data set for groundwater was collected from a similar depth (shallow) and condition (unfiltered). The use of the background soil and groundwater comparisons was agreed to by stakeholders at the TPP #1 meeting as documented in the Final TPP Memorandum and SS-WP. Therefore, the objectives for the comparability DQI were achieved.

3.5.7 Sensitivity is a measure of the screening criteria as they compare to detection limits. If screening criteria are below the limit of quantitation (LOQ), the usability of the “non-detected” results to indicate that MCs are present at levels at which no unacceptable risks may occur is called into question. The laboratory reported to the LOQ, which represents the lowest concentration which can be reliably achieved at the specified limits of precision and accuracy. Consequently, if sensitivity Measurement Quality Objectives (MQOs) were achieved for MCs, the RLs are adequate to detect risks at levels of concern for the identified receptor. In this

instance, non-detected data sufficiently indicates that no unacceptable risk to receptors is present from the sample or group of samples.

3.5.7.1 The sensitivity MQO was achieved for analyte/receptor/matrix combinations at MRS 7 with the exception of nitroglycerin (NG) in surface and subsurface soil, surface water, and groundwater (human receptors), antimony in groundwater (human receptors), and 1,3,5-trinitrobenzene (TNB) and nitrobenzene in sediment (ecological receptors). In addition, no human health screening values were available for magnesium, acenaphthylene, benzo[g,h,i]perylene, and phenanthrene in soil or magnesium in groundwater for human receptors. No ecological screening values were available for NG, 1,3,5-TNB, magnesium, and iron in soil; magnesium in sediment or groundwater; and perchlorate and tetryl in surface water. Uncertainties associated with the cases in which the MQOs for sensitivity were not met, and the absence of human and ecological screening values, are discussed within the context of analytical sample results in Section 5. This discussion indicates that for this particular MRS, the absence of screening values does not undermine the certainty with which the determinations of risk for human and ecological receptors can be made.

3.6 Second Technical Project Planning Meeting

3.6.1 Following the completion of the Draft Final SI Report, stakeholders had an opportunity to participate in a second TPP meeting to discuss the findings, conclusions, and recommendations of the SI Report; review the MRSPP (Appendix K); and confirm that the project objectives and DQOs were achieved. The second TPP meeting was held concurrent with the Remedial Project Manager (RPM) meeting at the NASA WFF on 14 June 2012. A memorandum summarizing the meeting minutes is included in Appendix B of the SI Report. Additionally, the responses to stakeholder comments, which are included at the end of this SI Report, were discussed with stakeholders in person during the TPP #2 meeting and via telephone calls that occurred on 7 and 20 June 2012.

Table 3-1. WFF Project 07 Sample Locations and Descriptions

Location	Sampling ID	Coordinate System: UTM Zone: 18N Datum: NAD 1983 CONUS		Description of Sample Location
		Easting(m)	Northing(m)	
Pyrotechnics Burn Area	WFF-MRS7-SS-01-01/ WFF-MRS7-SB-02-01	460110.19	4199133.71	Eastern corner just outside the fenced-in Pyrotechnics Burn Area (Fence corner: 460109.98 m E, 4199134.07 m N)
	WFF-MRS7-SS-01-02/ WFF-MRS7-SB-02-02	460106.61	4199140.56	Northern corner just outside the fenced-in Pyrotechnics Burn Area (Fence corner: 460105.867 m E, 4199140.781 m N)
	WFF-MRS7-SS-01-03/ WFF-MRS7-SB-02-03	460104.36	4199130.81	Southern corner just outside the fenced-in Pyrotechnics Burn Area (Fence corner: 460104.376 m E, 4199131.216 m N)
	WFF-MRS7-SS-01-04/ WFF-MRS7-SB-02-04	460100.45	4199137.76	Western corner just outside the fenced-in Pyrotechnics Burn Area(Fence corner: 460100.867 m E, 4199137.465 m N)
	WFF-MRS7-GW-00-01	460107.11	4199131.82	Southern corner just outside the fenced-in area of the Pyrotechnics Burn Area
	WFF-MRS7-GW-00-02	460111.37	4199136.05	Eastern corner just outside the fenced-in area of the Pyrotechnics Burn Area
Gun Butt No. 1	WFF-MRS7-SS-01-05/ WFF-MRS7-SB-02-05	459937.84	4198978.81	Near the Gun Butt No. 1 former impact berm
	WFF-MRS7-SS-01-06/ WFF-MRS7-SB-02-06	459932.90	4198994.66	Near the Gun Butt No. 1 former impact berm
	WFF-MRS7-SS-01-07/ WFF-MRS7-SB-02-07	459922.83	4198981.41	Near the Gun Butt No. 1 former impact berm
	WFF-MRS7-SS-01-12	459917.34	4199014.42	Within Gun Butt No. 1 between the former firing point and impact berm
	WFF-MRS7-SS-01-13	459889.74	4199010.85	Within Gun Butt No. 1 between the former firing point and impact berm
	WFF-MRS7-SS-01-14	459876.43	4199036.85	At the Gun Butt No. 1 former firing point
	WFF-MRS7-GW-00-03	459932.41	4198984.70	Near the Gun Butt No. 1 former impact berm
Gun Butt No. 2	WFF-MRS7-SS-01-08/ WFF-MRS7-SB-02-08	459841.29	4198974.90	Near the Gun Butt No. 2 former impact berm
	WFF-MRS7-SS-01-09/ WFF-MRS7-SB-02-09	459841.15	4198962.38	Near the Gun Butt No. 2 former impact berm
	WFF-MRS7-SS-01-10/ WFF-MRS7-SB-02-10	459856.40	4198971.47	Near the Gun Butt No. 2 former impact berm
	WFF-MRS7-SS-01-15	459828.03	4198996.56	Within Gun Butt No. 2 between the former firing point and impact berm
	WFF-MRS7-SS-01-16	459852.86	4198992.26	Within Gun Butt No. 2 between the former firing point and impact berm
	WFF-MRS7-SS-01-17	459834.45	4199017.19	At the Gun Butt No. 2 former firing point

Table 3-1. WFF Project 07 Sample Locations and Descriptions

Location	Sampling ID	Coordinate System: UTM Zone: 18N Datum: NAD 1983 CONUS		Description of Sample Location
		Easting(m)	Northing(m)	
	WFF-MRS7-GW-00-04	459860.56	4198952.86	South of the Gun Butt No. 2 former impact berm
Outside MRS/ Drainage Area between Gun Butt No. 1 & 2	WFF-MRS7-SS-01-18	459870.99	4199005.88	Drainage area between Gun Butt No. 1 & 2
	WFF-MRS7-SS-01-19	459888.41	4198978.20	Drainage area between Gun Butt No. 1 & 2
	WFF-MRS7-SS-01-20	459929.91	4198956.99	Drainage area behind Gun Butt No. 1 former berm location
	WFF-MRS7-SS-01-21	459861.09	4198945.17	Drainage area behind Gun Butt No. 2 former berm location
South Bank of Boat Basin	WFF-MRS7-SD-01-01	460015.26	4199207.09	On the southern portion of the shoreline of the boat basin below the water line
	WFF-MRS7-SD-01-02	460043.45	4199208.05	On the southern portion of the shoreline of the boat basin below the water line
	WFF-MRS7-SD-01-03	460068.37	4199210.77	On the southern portion of the shoreline of the boat basin below the water line
	WFF-MRS7-SD-01-04	460028.76	4199205.13	On the southern portion of the shoreline of the boat basin on the shore
	WFF-MRS7-SD-01-05	460056.94	4199208.10	On the southern portion of the shoreline of the boat basin on the shore
	WFF-MRS7-SS-01-11/ WFF-MRS7-SB-02-11	460042.60	4199201.72	On the southern portion of the shoreline upland of the boat basin
	WFF-MRS7-SW-00-01	460041.29	4199207.81	Within the boat basin waters
Background	WFF-MBBG-SD-01-01	460251.35	4199592.52	Background sediment sample
	WFF-MBBG-SD-01-02	460254.87	4199648.07	Background sediment sample
	WFF-MBBG-SD-01-03	460253.55	4199559.59	Background sediment sample

CONUS= Continental United States
GW= Groundwater
ID= Identification
MBBG= Main Base Background
m= meter
MRS= Munitions Response Site
N= North
No.= Number
NAD= North American Datum
SB= Subsurface Soil
SD= Sediment
SS= Surface Soil
SW= Surface water
UTM= Universal Transverse Mercator
WFF= Wallops Flight Facility

Figure 3-1a. MRS 7 Sample Locations and Geophysical Reconnaissance Path

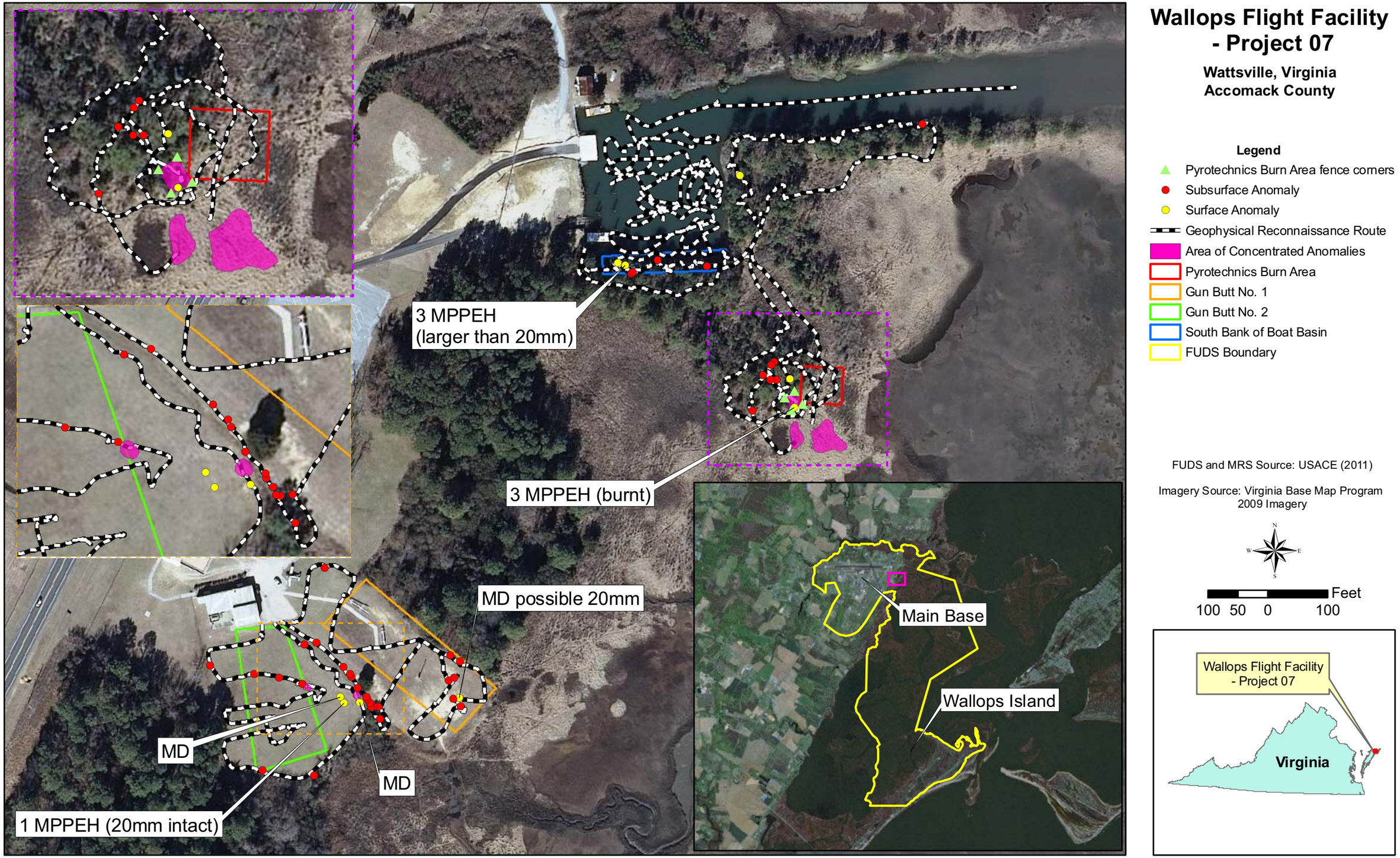


Figure 3-1b. MRS 7 Geophysical Reconnaissance Path and Findings

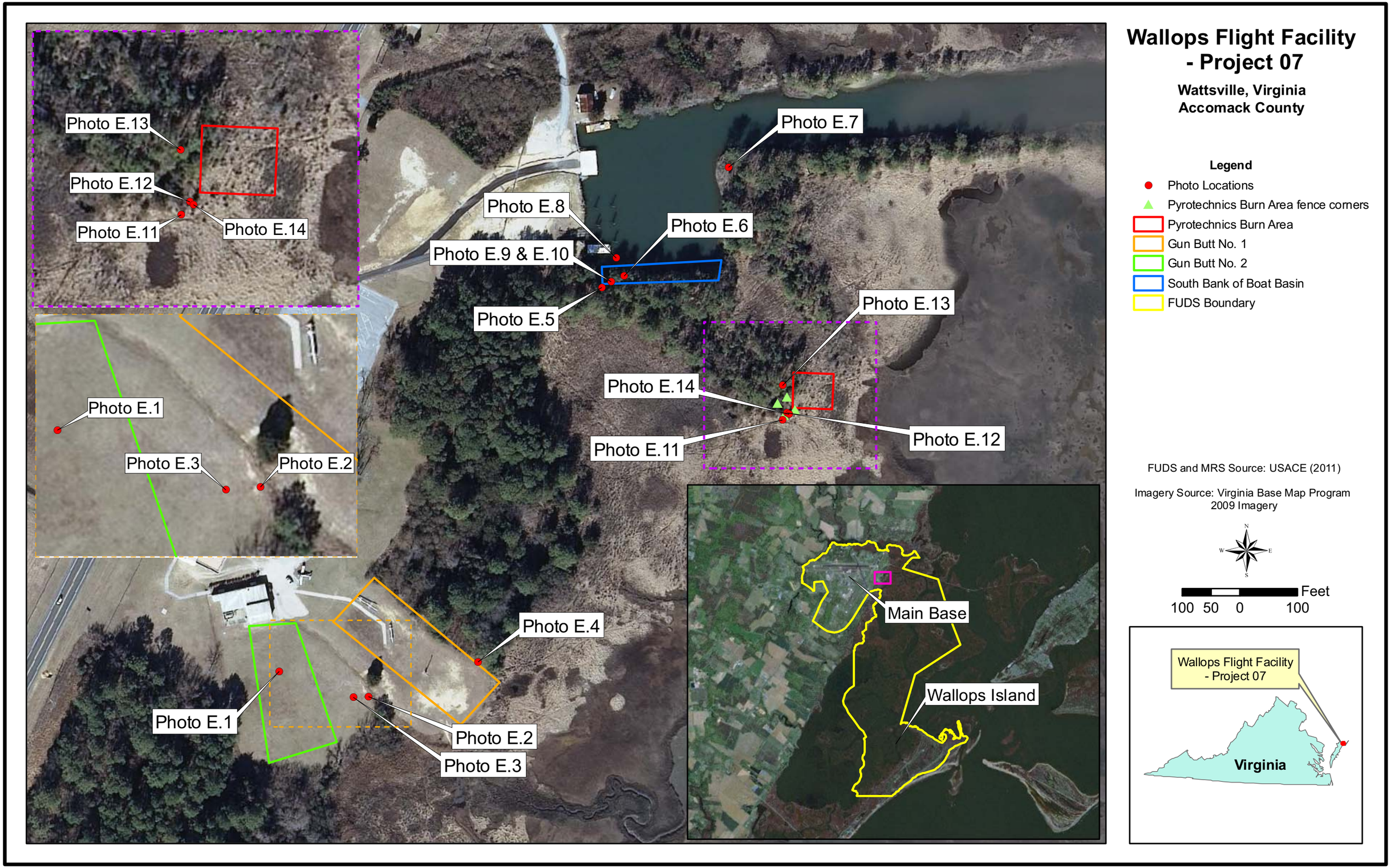


Figure 3-2. MRS 7 Photograph Locations

Figure 3-3. Background Sample Locations

4. MUNITIONS AND EXPLOSIVES OF CONCERN HAZARD ASSESSMENT

4.1 Munitions and Explosives of Concern Hazard Assessment Criteria

4.1.0.1 A qualitative MEC hazard assessment was conducted based on the SI QR, as well as historical data documented in the PA (USACE 2011). A qualitative hazard evaluation assesses the potential explosive safety hazard and communicates the hazard that may exist at the MRS along with the potential causes (USAESCH 2001).

4.1.0.2 An explosive safety hazard is the probability for an MEC item to detonate and potentially cause harm as a result of human activities. An explosive safety hazard exists if a person can come near or in contact with MEC and act on it to cause a detonation. The potential for an explosive safety hazard depends on the presence of three elements (USAESCH 2001).

- Ordnance and Explosive Factors - a source (presence of MEC)
- Site Characteristics Factors – accessibility and stability
- Human Factors – a receptor (person) and interaction (e.g., touching or picking up an item).

4.1.0.3 Each of these primary factors was used to evaluate the field and historical data to generate an overall hazard assessment rating of low, moderate, or high at MRS 7 (Section 4.2). The CSM for MRS 7 reflects this MEC assessment strategy (Appendix J).

4.1.0.4 The MEC source is based on the type, sensitivity, density and depth distribution. The type of MEC dictates the likelihood and severity of exposure, and thereby injury, if it should function when encountered. MEC sensitivity affects the likelihood of an item functioning as designed when encountered by a receptor (e.g., pressure from stepping on the item, fuze activation from moving the item, etc.). MEC quantity/density and depth, if present, are generally unknown during the SI and are evaluated during follow on studies (RI/FS).

4.1.0.5 Site characteristics refer to the physical conditions of the MRS and natural events that occur. Site accessibility affects the likelihood of a receptor coming in contact with MEC and include manmade (e.g., walls or fences) or natural barriers (e.g., terrain, topography, vegetation) that may prevent access to the MRS. A MEC item tends to remain in place unless disturbed through human or natural forces (e.g., frost heaving, erosion, tidal or wave action). If MEC movement occurs, the probability of direct human contact may increase, but not necessarily result in direct contact or exposure.

4.1.0.6 Human interaction includes the type of activities that exist at the MRS, the human population that may have access, and the frequency of that access. Activities are generally classified as recreational (hiking, camping, etc.) and occupational (farming, industrial, etc.). Activities at an MRS generate an exposure route for a MEC receptor. The MEC exposure route is typically direct contact with a MEC item on the surface or through subsurface activities (e.g., excavation during construction). The area population and frequency of use determines the likelihood of a receptor to encounter MEC. The hazard to the surrounding population is based on MRS characteristics and location, access restrictions, natural and/or manmade barriers, and the surrounding population.

4.1.0.7 Based on the hazard criteria delineated above, an MRS is qualitatively assigned a low, moderate, or high MEC hazard ranking. The MEC hazard assessment categories are summarized in Table 4-1.

4.2 Munitions and Explosives of Concern Hazard Assessment

4.2.1 MRS 7 – Boat Basin/Visitors Information Center

4.2.1.1 MRS 7 comprises four areas (Gun Butt No. 1, Gun Butt No. 2, the South Bank of the Boat Basin, and the Pyrotechnics Burn Area), which were the focus of this SI. However, the SI field activities included some areas outside the boundary of MRS 7. Numerous types of munitions were historically used at MRS 7, including HE. As discussed in Sections 2.4.1, 2.4.3, and 2.5, no MEC is known to have been historically found at MRS 7; however, numerous MD items have been observed historically. Three MD and seven MPPEH (20mm, larger than 20mm, burnt pyrotechnic items) were observed (one between the Gun Butts, three at the South Bank of the Boat Basin, three within the Pyrotechnics Burn Area) that could not be determined to not contain energetic material (Table 4-3 and Figure 3-1b). These items were identified as “MPPEH” but could not be confirmed as MD or MEC due to their rusty condition. In accordance with the procedures outlined in the Final SS-WP, the field team notified USACE and the property owner (NASA) of the presence of the MPPEH items. An emergency response action was not initiated because the MPPEH items were not viewed as an “immediate and unacceptable hazard” to the local populate or site personnel. However, NASA was notified that the MPPEH items should be removed as soon as possible. A removal report was not available from NASA for the Final SI Report. Also, 37 distinct subsurface anomalies were detected on land in or in close proximity to MRS 7. In addition, five areas of concentrated subsurface anomalies (i.e., the UXO technician was unable to count individual anomaly points) were identified, two at the Gun Butts and three at the Pyrotechnics Burn Area (including the entire area within the Pyrotechnics Burn Area fence).

Additionally, two underwater anomalies were noted (outside of MRS 7) during reconnaissance of the boat basin, and an undefined area along the South Bank of the Boat Basin was noted as having a large quantity (more than 50) of surface anomalies identified as rusty metal debris. The MEC type and sensitivity categories would be ranked as moderate.

4.2.1.2 The Gun Butt No. 1 and 2 portion of the MRS are open to NASA employees and visitors/trespassers; however, portions of MRS 7 (Boat Basin, Pyrotechnics Burn Area) are fenced (manmade barrier). The Marine Science Consortium staff and guests have access to the Boat Basin. Therefore, the access category was rated as moderate. The stability category was rated as moderate since erosion and frost-heave are possible.

4.2.1.3 Gun Butt No. 1 and 2 of MRS 7 is near the NASA Visitor Information Center which is open to the general public. Large rockets are on display and a tower was recently installed. Employees, visitors, construction workers, and trespassers have access to this portion MRS 7. The Boat Basin and Pyrotechnics Burn Area are fenced and not open to the public, but the Marine Science Consortium and NASA occasionally access boats in the Boat Basin. Therefore, the human interaction category was rated as moderate.

4.2.1.4 The overall MEC hazard is evaluated as moderate for MRS 7. Table 4-2 summarizes the qualitative MEC hazard at MRS 7. The MEC pathway is reflected as potentially complete at the surface and subsurface of MRS 7 in the CSM (Appendix J).

Table 4-1. MEC Hazard Assessment Categories

MEC Hazard	MEC Type	MEC Sensitivity	MRS Access	MRS Stability	Human Interactions
High	MEC that will cause an individual's death if detonated by an individual's activities	Very sensitive - Handling or movement may cause detonation	No Restriction - No manmade or natural barriers (e.g., no fence, gentle sloping terrain, no vegetation, no water) that restrict access	Site Unstable - MEC most likely will be exposed by natural events	High potential for and frequency of contact (e.g., general public has open and frequent access, high potential for surface/subsurface intrusive activity)
Moderate	MEC that will cause major injury to an individual if detonated by an individual's activities	Less sensitive - Fuzed but may be moved safely if identified as such by a UXO Technician	Limited Restriction - Manmade barriers and/or natural barrier (e.g., dense vegetation, water, snow or ice cover, and/or terrain) that restrict access	Moderately Stable - MEC may be exposed by natural events	Moderate potential for and frequency of contact (e.g., a limited number of the general public has open and somewhat frequent access, few MRS uses, surface/subsurface intrusive activity possible)
Low	MEC that will cause minor injury to an individual if detonated by an individual's activities	May have functioned correctly or is unfuzed but has a residual hazard	Restricted Access- All points of entry are controlled (manmade and/or natural barriers present)	Stable Site - MEC should not be exposed by natural events	Low potential for and frequency of contact (e.g., no general public access, infrequent MRS access primarily by personnel, no subsurface activity)
None	Inert MEC or scrap (MD), or only small arms used, will cause no injury	Inert MEC or scrap (MD), or only small arms used, will cause no injury	-	-	-

Table 4-2. MRS 7 – Boat Basin/Visitors Information Center Hazard Impact Assessment

	Historical Observations	SI Observations	Qualitative MRS Hazard
MEC Type and Sensitivity			
Munitions Type	Munitions types historically used include parachute flares, miniature practice bombs and signals, 37mm and 20 mm (including HE, tracer, and practice), and .50 caliber (Table 2-2) No MEC was observed at the MRS historically or during the 2005, 2007, and 2009 USACE visits. Numerous MD were observed and identified inert.	No confirmed MEC; however, MD and MPPEH items that could not be determined to not contain energetic material were observed during 2011 SI field event. 37 distinct subsurface anomalies and five areas of concentrated subsurface anomalies were identified during the field activities. Additionally, an undefined area along the South Bank of the Boat Basin was noted as having a large quantity (more than 50) of surface anomalies identified as rusty metal debris.	Moderate
MEC Sensitivity	Moderate	Same as above	Moderate
Access and Stability			
Accessibility	Gun Butts No. 1 and 2 not restricted, except for gate at entrance to visitor center. Boat Basin and Pyrotechnics Burn Area restricted by man made barrier (locked fence).	Limited restriction. Manmade barriers (gate and fence). Visitor center and consequently Gun Butts No. 1 and 2 are open during daylight hours. Boat Basin and Pyrotechnics Burn Area are behind fences, but Boat Basin accessible to NASA and Marine Science Consortium.	Moderate
Stability	Moderate	Moderately stable. Erosion and frost-heave possible.	Moderate
Human Interaction			
Population, Frequency of Use, Types of Activities	Low. No general public access. Wallops Island has been used for research and testing since military use ended.	Moderate. Boat Basin and Pyrotechnics Burn Area fenced, limited access. Gun Butts No. 1 and 2 are in landscaped lawn area with large rocket displays and recently installed tower.	Moderate
Overall MRS Hazard Ranking	Moderate		
MD – Munitions Debris MEC – Munitions of Explosive Concern MPPEH – Munitions Potentially Presenting an Explosive Hazard NASA – National Aeronautics and Space Administration		MRS – Munitions Response Site SI – Site Inspection USACE – U.S. Army Corps of Engineers WFF – Wallops Flight Facility	

Table 4-3. WFF Project 07 SI MD/MPPEH Items Locations and Descriptions

Location	Description	Coordinate System: UTM Zone: 18N Datum: NAD 1983 CONUS		Observations
		Easting(m)	Northing(m)	
Pyrotechnics Burn Area	Three MPPEH (burnt pyrotechnics)	460106.08	4199132.66	Inside the fence at southern fence line, items in small burn pile
Gun Butt No. 1	MD, possible 20mm	459935.18	4198984.82	In vicinity of the former berm location, very rusty condition
Gun Butt No. 2	None observed during 2011 SI field activities.	N/A	N/A	N/A
Outside MRS between Gun Butt No. 1 & 2	MD	459874.80	4198985.17	In drainage area, too deteriorated to identify
	MD	459884.71	4198982.47	In drainage area, too deteriorated to identify
	MPPEH (20mm intact)	459876.69	4198981.91	In drainage area, rusty condition
South Bank of Boat Basin	Three MPPEH (larger than 20mm)	460019.83	4199205.00	Located above water line at base of tree, items were deteriorated

CONUS= Continental United States
m= meter
MD= Munitions Debris
MRS= Munitions Response Site
N= North
N/A= Not Applicable
No.= Number
NAD= North American Datum
UTM= Universal Transverse Mercator
WFF= Wallops Flight Facility

5. MUNITIONS CONSTITUENTS SAMPLING AND ANALYSIS

5.0.1 A screening level human health risk assessment (HHRA) and screening level ecological risk assessment (SLERA) were conducted to determine whether MCs in environmental media at WFF Project 07 may warrant a more detailed assessment of potential risk to current or future human and ecological receptors. The screening methodology, CSM, analytical results for the MC sampling, and results of the screening assessment are presented below.

5.1 Data Evaluation Methodology

5.1.0.1 The following sections present the process used to evaluate the MC data collected for the WFF Project 07. The methodology is designed to evaluate data for relevant MCs in the HHRA and SLERA using the appropriate risk-based screening criteria. The methodology also provides a means to evaluate uncertainty in the screening HHRA and SLERA processes and provides context for the risk conclusions. This process is consistent with the decision rules outlined in Section 3.1 (TPP) of this report, and is described in more detail in the following sections.

5.1.1 Refinement of Munitions Constituents

5.1.1.1 During the SI process, MCs potentially associated with WFF Project 07 were identified based on knowledge of munitions historically used. Information on historical use was obtained from munitions data sheets, historical documents, and other munitions reference documents.

5.1.1.2 WFF Project 07 is composed of the following four areas: Pyrotechnics Burn Area, Gun Butt No. 1, Gun Butt No. 2, and South Bank of Boat Basin. Gun Butts No. 1 and 2 were combined into one area for the purpose of the risk assessment based on similarity in the historical use and MC, resulting in a three distinct areas of interest for the MC risk assessment. The list of MCs analyzed at the three areas of interest for the WFF Project 07 is provided below.

Pyrotechnics Burn Area

- Explosive constituents (TNT and TNT breakdown products {1,3,5-TNB, 1,3-DNB, 2,4,6-TNT, 2-amino-4,6-DNT, 4-amino-2,6-DNT, NB, 2,6-DNT})
- Metals (aluminum, antimony, barium, iron, lead, magnesium, and zinc)[1]

[1]Aluminum, barium, magnesium, and iron are not classified as hazardous substances under CERCLA. As per USACE guidance regarding non-CERCLA hazardous substances, the screening results for these metals will not be used as the sole basis for determining an RI/FS recommendation for WFF Project 07.

- PAHs (acenaphthene, acenaphthylene, anthracene, benzo[a]anthracene, benzo[b]fluoranthene, benzo[k]fluoranthene, benzo[g,h,i]perylene, benzo[a]pyrene, chrysene, dibenzo[a,h]anthracene, fluoranthene, fluorene, indeno[1,2,3-cd]pyrene, naphthalene, phenanthrene, and pyrene)
- Perchlorate

Gun Butts No. 1 and 2[2]

- Explosive constituents (DNT and DNT breakdown products {2,4-DNT, 2,6-DNT, 2-amino-4,6-DNT, 2-nitrotoluene, 3-nitrotoluene, 4-amino-2,6-DNT, and 4-nitrotoluene}, TNT and TNT breakdown products {1,3,5-TNB, 1,3-DNB, 2,4,6-TNT, 2-amino-4,6-DNT, 4-amino-2,6-DNT, NB}, NG, RDX, and tetryl)
- Metals (antimony, copper, iron, lead, and nickel)[1]
- Perchlorate

South Bank of Boat Basin

- Explosive constituents (DNT and DNT breakdown products {2,4-DNT, 2,6-DNT, 2-amino-4,6-DNT, 2-nitrotoluene, 3-nitrotoluene, 4-amino-2,6-DNT, and 4-nitrotoluene}, TNT and TNT breakdown products {1,3,5-TNB, 1,3-DNB, 2,4,6-TNT, 2-amino-4,6-DNT, 4-amino-2,6-DNT, NB}, NG, RDX, and tetryl)
- Metals (antimony, copper, iron, lead, and nickel)[1]
- Perchlorate

5.1.2 Data Quality

5.1.2.1 All of the sampling data collected as part of this current SI effort were validated. The following summary provides details on media sampling conducted for this SI.

1. Twenty-one surface soil samples (collected 2-6 inches bgs)
2. Two duplicate[3] surface soil samples
3. Eleven subsurface soil samples (collected 12-24 inches bgs)
4. One duplicate subsurface soil sample
5. Five sediment samples (collected 0-6 inches bgs)
6. One duplicate sediment sample
7. Three background sediment samples

[2] For the purpose of this risk screening, Gun Butt No.1, Gun Butt No. 2 and the drainage area between Gun Butt No.1 and 2 were considered as a single area for Project 07.

[3] Duplicate samples were treated as discrete samples; duplicates were not averaged for the purpose of this risk screening.

8. One surface water sample
9. One duplicate surface water sample
10. Four groundwater samples
11. Two duplicate groundwater samples

5.1.2.2 The first step in the risk assessment screening process was the evaluation of the analytical data. Inclusion or exclusion of data in the risk-screening process on the basis of analytical qualifiers assigned during data validation was performed in accordance with USEPA risk assessment guidance (USEPA 1989). Accordingly, data with a J, K or L qualifier, which indicates an uncertainty in the reported concentration for the chemical, but not the assigned identity, were included in the risk screening at the reported concentrations. Data qualified with a U, UJ, or UL, indicating the chemical was not detected in the sample, were also retained in the risk-screening process. Analytes that were not detected in any of the samples for a particular medium within a subarea were eliminated from risk screening for that particular medium and subarea, as per the USEPA (1989) risk assessment guidance. However, an analysis of the adequacy of the reporting limits for these analytes not detected in any sample from a risk assessment perspective is presented in Section 5.1.4. The following provides a listing of the qualifiers in the validated analytical dataset and their treatment in the risk assessment process:

- Analytical results bearing the J qualifier (indicating that the reported value was estimated) were retained in the dataset. The estimated concentration provided by the laboratory was used for these samples.
- Analytical results bearing the K qualifier (indicating that the analyte is present and that the reported value may be biased high) were retained in the dataset. The reported concentration provided by the laboratory was used for these samples.
- Analytical results bearing the L qualifier (indicating that the analyte is present and that the reported value may be biased low) were retained in the dataset. The reported concentration provided by the laboratory was used for these samples.
- Analytical results bearing the B qualifier (indicating that the analyte was detected in the associated method blank at a level that is similar to the sample result) were retained in the dataset. These samples were treated as non-detected samples.
- Analytical results bearing the U qualifier (indicating that the analyte was not detected at the given detection limit) were retained in the dataset. The reporting limit (RL) was used for non-detected samples.
- Analytical results bearing the UJ qualifier (indicating that the analyte was not detected and the quantitation limit may be inaccurate or imprecise) were retained in the dataset. The RL was used for non-detected samples.

- Analytical results bearing the UL qualifier (indicating that the analyte was not detected and the quantitation limit may actually be higher) were retained in the dataset. The RL was used for non-detected samples.
- Analytical results bearing the R qualifier (indicating that the result was not usable) were excluded from the dataset.

5.1.3 Screening Values

5.1.3.1 Screening concentrations were used in the HHRA and SLERA to support risk-based conclusions and recommendations regarding MRS 7. Maximum MRS 7 concentrations for relevant MCs were compared to the risk-based concentrations as part of the selection process for chemicals of potential concern (COPCs) for the HHRA and chemicals of potential ecological concern (COPECs) for the SLERA.

5.1.3.2 For the HHRA, with the exception of perchlorate, USEPA regional screening levels (SLs) for residential soil, industrial soil, and tap water were selected as the basis for the screening criteria to select COPCs (USEPA 2012). The SLs are referred to as "regional SLs" throughout the remainder of this section. The regional SLs are developed from toxicity values and standard exposure factors to estimate contaminant concentrations that are protective of humans, including sensitive subgroups, over a lifetime. The USEPA interim drinking water health advisory for perchlorate, which was adopted as the DoD level of concern, was selected as the basis for the screening criterion to determine if perchlorate was a COPC in surface water and groundwater, and is discussed in further detail in Section 5.1.3.7. Although future land use plans do not include residential reuse, stakeholders have requested that residents be included as potential future receptors and that COPCs be compared against USEPA regional SLs for residential soil to evaluate the upper bound for potential site risks. However, future residential use of MRS 7 is not expected due to the unlikely closure of NASA WFF.

5.1.3.3 The regional SLs for residential and industrial soils consider exposures through direct contact (e.g., ingestion, dermal contact, and inhalation of particulates and vapors). Incidental ingestion, inhalation, and dermal contact are identified as pathways of exposure in the SS-WP Addendum (TPMC 2011) for surface and subsurface soils that could occur at the FUDS (i.e., potentially complete pathways). For surface soil, indirect exposures, including ingestion of plants and animals exposed to MCs, were also identified as potentially complete pathways for human receptors. These indirect pathways are anticipated to result in significantly lower exposures compared to those described above, in which humans come into direct contact with soil. Therefore, the regional SLs for residential and industrial soils are determined to be appropriate screening tools for surface and subsurface soils for the HHRA.

5.1.3.4 For sediment, potentially complete pathways identified in the SS-WP Addendum for human receptors included incidental ingestion of, and dermal contact with MCs present in sediment, as well as ingestion of benthos exposed to MCs in sediment. Regional SLs or similar values are not available for screening risks from human exposure to sediments, and soil SLs are not directly applicable for screening sediment for human receptors, given the likelihood of reduced exposure to sediment relative to soil. Therefore, for use in screening sediment concentrations of MCs in the HHRA, soil SLs were adjusted to account for the relatively lower exposure levels for human receptors to sediment. The adjustment is described in Section 5.1.3.10.

5.1.3.5 Potentially complete pathways identified for human receptors to surface water include dermal contact and incidental ingestion of MCs in surface water, and ingestion of fish exposed to MCs via surface water (TPMC 2011). The availability of screening values that specifically account for these exposures is limited. Regional tap water SLs available for screening groundwater reflect potential exposures via ingestion of drinking water and inhalation of volatile organic chemicals released during use of contaminated groundwater. The intake of MCs in surface water by human receptors via the potentially complete pathways for this FUDS are likely to be significantly less than the intake received from drinking two liters assumed in the derivation of the regional SLs for tap water. Therefore, the tap water SLs were adjusted to account for the anticipated differences in intake of surface water compared to tap water. The adjustment is described in Section 5.1.3.10.

5.1.3.6 As described above, regional tap water SLs available for screening groundwater reflect potential exposures via ingestion of drinking water and inhalation of volatile organic chemicals released during use of contaminated groundwater. Potentially complete transfer mechanisms identified for MCs in groundwater to humans included ingestion, incidental ingestion, and dermal contact (TPMC 2011). Because the regional tap water SLs do not consider dermal contact, they do not reflect every potentially complete exposure identified for human receptors at MRS 7. Nevertheless, the tap water SLs are considered health protective for use at MRS 7 because the drinking water rate assumed in their derivation (i.e., two liters per day, based on an upper end estimate for residential use) is significantly greater than the potential intake for the current human receptors at MRS 7 (i.e., visitor/trespassers, construction workers, and employees) and therefore offsets the omission of the dermal contact exposure pathway. For future residents, the use of these tap water SLs are appropriate because they reflect the drinking water ingestion pathway, which is the most risk significant exposure pathway.

5.1.3.7 For perchlorate, the USEPA interim drinking water health advisory of 15 µg/L, adopted as the DoD level of concern for managing perchlorate in drinking water (USEPA 2008, DoD 2009), provided the basis for the surface water and groundwater screening criteria used in the HHRA. The health advisory level represents a safe level of perchlorate in drinking water and was derived using conservative exposure assumptions regarding residential groundwater ingestion appropriate for protecting the most sensitive population. It also incorporates an assumption that individuals will be exposed to perchlorate through ingestion of food; therefore, exposure to the allowable levels in water alone would not result in adverse health effects. Similar to the regional SLs for tap water discussed above, the perchlorate standard considers exposure via drinking water but not dermal contact, which was identified as a potentially complete pathway in the SS-WP Addendum. However, the DoD level of concern for managing perchlorate includes a groundwater ingestion rate of two liters per day, which is significantly higher than the potential ingestion rate for human receptors defined for MRS 7, with respect to surface water exposures. Therefore, the perchlorate screening level was increased by a factor of ten to account for the significantly greater exposure assumed for the drinking water level of concern versus the incidental contact anticipated at MRS 7 for surface water exposures. A factor of ten reduction was applied to this modified perchorate surface water SL to account for cumulative risks. Similarly, for groundwater exposures to human receptors, the DoD level of concern was reduced by a factor of ten to reflect cumulative risks from simultaneous exposure to multiple MC in drinking water. Overall, the use of the perchlorate drinking water health advisory as a basis for the screening criteria in this HHRA is considered a conservative approach for evaluating potential surface water and groundwater exposures at WFF Project 07.

5.1.3.8 In some cases, SLs are based on the toxicity, or relative toxicity, of related compounds. The regional SLs for 2-amino-4,6-DNT and 4-amino-2,6-DNT are based on toxicity information for 2,4-DNT. Because the amino-DNT isomers may behave differently from 2,4-DNT, the use of the regional SLs for these MCs may result in some uncertainty in the risk assessment. The SLs for the PAHs benzo(a)anthracene, benzo(b)fluoranthene, benzo(k)fluoranthene, chrysene, dibenzo(a,h)anthracene, and indeno(1,2,3-cd)pyrene are derived using a toxicity equivalency factor (TEF) that scales the relative potency of each PAH against the toxicity of benzo(a)pyrene. Because the toxicity of each individual PAH has not been comprehensively characterized, the use of these SLs may also result in some uncertainty in the risk assessment.

5.1.3.9 The regional SLs for direct contact with soil and tap water correspond to typical risk thresholds of a one-in-one million (1E-06) cancer risk or a non-carcinogenic hazard quotient (HQ) of 1.0. The HHRA screening levels for the explosive constituents 2,4,6-TNT, 2,4-DNT, 2-nitrotoluene, 4-nitrotoluene, NB, and RDX; and for the PAHs benzo(a)anthracene,

benzo(b)fluoranthene, benzo(k)fluoranthene, benzo(a)pyrene, chrysene, dibenzo(a,h)anthracene, indeno(1,2,3-cd)pyrene, and naphthalene are based on carcinogenic endpoints. The HHRA screening levels for perchlorate, and the explosive constituents 1,3,5-TNB, 2,6-DNT, 2-amino-4,6-DNT, 3-nitrotoluene, 4-amino-2,6-DNT, NG, and tetryl; as well as for the metals aluminum, antimony, barium, copper, iron, lead, nickel, and zinc; and for the PAHs acenaphthene, anthracene, fluoranthene, fluorene, and pyrene are based on non-carcinogenic endpoints. The toxicological endpoint for all of these non-carcinogenic MCs is not the same. Rather these MCs act at various different target organs, including the spleen, kidney, GI, and liver (USEPA 2011a, USEPA 1997).

5.1.3.10 As discussed in the SS-WP Addendum (TPMC 2011), the regional SLs derived from non-carcinogenic endpoints were divided by ten to provide a means to account for potential occurrence of adverse non-carcinogenic health effects due to exposure to multiple non-carcinogens. Following this adjustment, the soil screening values used for the HHRA were multiplied by a factor of ten for application as sediment screening values to account for lower incidence of exposure to sediments relative to soils. Similarly, tap water screening values were multiplied by a factor of ten for application as surface water screening values to account for lower incidence of incidental exposure to surface water relative to tap water. These adjustments to the residential screening values used in the HHRA account for the potential cumulative effect of simultaneous exposures to multiple non-carcinogens. The exception to the adjustments described is for lead. In the case of lead, regional SLs are based on a blood lead level rather than a chronic daily intake, as is used for other non-carcinogens. Therefore, no adjustments were made to the lead regional SLs for use in evaluating soils, sediments, surface water, or groundwater.

5.1.3.11 The majority of the MCs had screening values available for application in the HHRA. The application of HHRA screening values is described in Sections 5.1.3.20 and 5.1.3.21. Results of the HHRA are discussed in Section 5.4, and are presented in Tables 5-1 through 5-4.

5.1.3.12 Screening for ecological-based COPECs was conducted by calculating an HQ, which represents the ratio of the maximum detected chemical concentration in an environmental medium to a medium-specific ecological screening level. SLs derived from studies in specific media and environmentally similar conditions to those at MRS 7 are the most relevant and appropriate for screening. In cases where screening values derived from environmentally-specific testing environments are not available, alternative screening values may offer a sufficient screening tool.

5.1.3.13 Ecological soil screening levels (eco-SSLs) were used to screen for COPECs in soil. Eco-SSLs are screening level benchmark concentrations for contaminants in soil that have been determined to be protective of terrestrial-based ecological receptors that commonly come into contact with soil, or ingest biota that live in, or on, the soil. These benchmark concentrations are generally used for screening level purposes to identify COPECs in upland soils that may require further evaluation. Eco-SSLs are derived using information on toxicity and estimated ingestion exposure doses for terrestrial-based ecological receptors. As described in the SS-WP Addendum CSM diagram for the WFF Project 07, potentially complete transfer pathways for ecological receptors to surface soils at MRS 7 include incidental ingestion of, and dermal contact with MCs in surface soil, inhalation of particulates from surface soil, and ingestion of vegetation and game exposed to MCs in surface soil. USEPA guidance (USEPA 2005a) states that the dermal pathway is generally less significant compared to ingestion, and does not warrant inclusion in the derivation of eco-SSLs. Therefore, the eco-SSLs derived using exposure assumptions for ingestion only are determined to be adequate for the purposes of the SLERA.

5.1.3.14 USEPA sanctioned sediment screening values were adopted for the SLERA where available. In cases where no USEPA supported value was available, screening values were obtained from peer-reviewed literature and other regulatory and advisory programs. The WFF Project 07 is characterized as a freshwater environment; therefore, freshwater sediment screening values were adopted where available. In the case that no freshwater sediment benchmark was available, a sediment screening value derived in marine/estuarine environments was adopted for use in the SLERA. In the instance where no sediment screening values were available, eco-SSLs were used to screen for COPECs in sediment. USEPA states that eco-SSLs may provide utility for screening wetland soils, like those found at MRS 7 (USEPA 2005a). The appropriateness of their use generally is determined by comparing the soil properties evaluated to the sediment properties at the site of interest, and the degree of flooding estimated to occur at the marsh. In general, USEPA considers the eco-SSLs to be conservative with respect to their use for wetlands, given that wetland sediments generally have conditions which limit bioavailability relative to upland soils (e.g., relatively higher total organic carbon present in sediments). Potentially complete pathways identified for ecological receptors to sediment at the WFF Project 07 include incidental ingestion of, and dermal contact with MCs in sediment, as well as ingestion of benthos exposed to MCs in sediment. The sediment screening values and eco-SSLs described above were derived using assumptions of exposure via ingestion pathways. As described in Section 5.1.3.13, exposures via the dermal pathway are generally less significant when compared to the ingestion pathway. Therefore, the sediment screening values and eco-SSLs derived using exposure assumptions for ingestion only are determined to be adequate for the purposes of sediment screening in the SLERA.

5.1.3.15 National Ambient Water Quality Criteria (AWQC) were used for screening COPECs in surface water. AWQC are derived from the results of laboratory tests completed under controlled conditions. Guidelines require that toxicity tests be complete on plants, invertebrates, and fish species. Species are normally submerged in freshwater or marine media, and, therefore, are exposed to the test chemical via multiple pathways (USEPA 1994). Second tier AWQC are derived using methods identical to those in the federal guidelines; however, they are rated as second tier because they have not been tested on the full suite of taxonomic groups specified under federal guidelines. Given that toxicity results for fewer taxonomic groups are available, uncertainty factors[4] are applied in determining the final screening value. The WFF Project 07 is characterized as a freshwater environment. Therefore, freshwater AWQCs were selected for screening criteria when available. In the case that no freshwater value was available, a value derived for marine/estuarine organisms was adopted. As discussed in the SS-WP Addendum, potentially complete transfer mechanisms for ecological receptors to MCs in surface water include incidental ingestion, and dermal contact with MCs in surface water, and ingestion of fish exposed to MCs in surface water. Given that test organisms are submerged in media and exposed to chemicals via multiple routes of exposure, the use of AWQC is determined to be appropriate for screening surface water in the SLERA.

5.1.3.16 For the ecological soil screening, eco-SSLs developed by USEPA were adopted for screening the PAHs and the metals aluminum, antimony, barium, copper, lead, nickel, and zinc. For PAHs, USEPA derives generic eco-SSLs to be applied for categories of low and high molecular weight (MW) PAHs (USEPA 2007d). Data from chemicals which fall within each of these categories is considered in their derivation. While grouping the data together increases the number of studies that are considered in deriving the eco-SSLs, it may limit the preciseness of the screening value for screening individual analytes. No eco-SSL was available from USEPA for the metals iron or magnesium, or for any of the explosive constituents being evaluated. Consistent with previous SLERAs completed under this program, screening values were obtained from Talmage et al. (1999) for 2,4,6-TNT, 2,4-DNT, 2,6-DNT, 2-amino-4,6-DNT, 2-nitrotoulene, 3-nitrotoluene, 4-amino-2,6-DNT, 4-nitrotoluene, RDX, and tetryl. The eco-SSL for NB was obtained from Efroymson et al. (1997). No eco-SSLs, or appropriate alternative screening values, were available for the explosive constituents 1,3,5-TNB, or NG; or for the metals iron and magnesium.

[4] Uncertainty factors are commonly applied in risk assessment practice to account for gaps in the data, and assure that uncertainties are dealt with in a conservative manner and that health protective measures are derived.

5.1.3.17 In some cases, eco-SSLs are based on the toxicity or relative toxicity of related compounds. The eco-SSL of 30 mg/kg for 2,4-DNT, 2,6-DNT, 2-nitrotoluene, 3-nitrotoluene, and 4-nitrotoluene is based on toxicity data for 2,4,6-TNT. There is no conclusive evidence regarding the dominant process by which 2,4,6-TNT is reduced in soil. One study indicated that bacterial degradation of 2,4,6-TNT to breakdown products of TNT (specifically, 2-amino-4,6-DNT and 4-amino-2,6-DNT) occurs under aerobic and anaerobic conditions (Vorbeck et al. 1998). An *in vitro* study completed in a *Pseudomonas bacterium* species suggests that 2,4,6-TNT breaks down to 2,4-DNT (Haïdour and Ramos 1996). Laboratory studies support the observations of Haïdour and Ramos (1996) that bacteria strains can generate 2,4-DNT from TNT (Martin et al. 1997). These findings provide some support for the use of 2,4,6-TNT as a surrogate for TNT breakdown products. In addition, the eco-SSL of 80 mg/kg for 4-amino-2,6-DNT is based on data for the chemical isomer 2-amino-4,6-DNT. There is some uncertainty associated with adopting surrogate screening values for MCs based on 2,4,6-TNT and 2-amino-4,6-DNT. In addition, some screening values are based on limited data. A limited amount of data were available for the derivation of the eco-SSLs for 2-amino-4,6-DNT, RDX, and tetryl. Each of these eco-SSLs was derived using data from a single study in plants.

5.1.3.18 For the sediment screening, sediment-specific screening values derived for freshwater organisms were available for the explosive constituent 1,3,5-TNB, and the metals aluminum, copper, iron, lead, nickel, and zinc. In the absence of freshwater values, marine-based screening levels were adopted for nitrobenzene and antimony. With the exception of the explosive constituent 1,3,5-TNB mentioned above, no sediment screening values were available for any of the explosive constituents being evaluated, or for the metal barium. Interim eco-SSLs were used for these MCs in the absence of sediment-specific screening values. For barium, an interim eco-SSL derived by USEPA (2005c) was used. Interim eco-SSLs derived by Talmage et al. (1999) were used for 2,4,6-TNT, 2,4-DNT, 2,6-DNT, 2-amino-4,6-DNT, 2-nitrotoluene, 3-nitrotoluene, 4-amino-2,6-DNT, 4-nitrotoluene, RDX, and tetryl. Although the use of eco-SSLs for screening sediments introduces some uncertainty into the SLERA, as discussed in Section 5.1.3.14, the use of soil screening values for wetland soils is likely to result in a conservative evaluation and; therefore, is considered an adequate screening tool for the SLERA. No sediment SLs, or appropriate alternative screening values, were available for the explosive constituent NG, or for the metals iron or magnesium.

5.1.3.19 The application of the ecological screening values is described in Sections 5.1.3.20 and 5.1.3.22. Results of the SLERA are discussed in Section 5.4, and are presented in Tables 5-1 through 5-3.

5.1.3.20 Consistent with USEPA Guidance (1989), the following screening process was utilized.

1. The maximum concentration of each chemical detected in each medium was identified.

2. If a chemical was detected in at least one sample in a specific medium, it was retained for consideration in the screening of COPCs/COPECs.

3. If the maximum concentration of a specific chemical exceeded its screening value, and its mean or maximum concentration was above the respective mean or maximum background concentration, the chemical was retained as a COPC/COPEC.

4. If a screening concentration was not available for a specific chemical in a particular medium, the screening concentration for a structurally similar compound was used, if warranted. The screening tables list any surrogates that were used.

5. An analyte was eliminated from the list of COPCs/COPECs if it was an essential nutrient of low toxicity, and its reported maximum concentration was unlikely to be associated with adverse health impacts.

5.1.3.21 For the HHRA, the maximum detected concentrations for each detected MC were compared to the screening criteria determined for use in the HHRA. If the maximum concentration was less than the screening value(s), the target analyte was eliminated from consideration. If the maximum concentration exceeded the screening value, the analyte was retained as a COPC.

5.1.3.22 Under the SLERA, an HQ analysis was completed for each detected analyte. An HQ is defined as the measured concentration divided by the screening criteria. If the maximum concentration was less than the screening value (HQ < 1.0), the analyte was eliminated from consideration as a COPEC. If the maximum concentration exceeded the screening value (HQ > 1.0), the analyte was retained as a COPEC.

5.1.3.23 For both the HHRA and SLERA, in cases in which no screening criteria are available, any available information regarding the potential for the MCs to present a risk to receptors is presented.

5.1.4 Comparison of Screening Levels with Detection Limits for Non-Detected Analytes

5.1.4.1 The usability of the analytical data for making conclusions regarding risk was evaluated by comparing the RLs for samples that were not detected in any sample to their respective screening values used for human health (Table 5-5) and ecological (Table 5-6) risk screening. If a chemical was not detected in any of the samples collected, but the RL was higher than the screening value, then the MQO for sensitivity was not met. Such non-detects are not usable for determining whether chemical is greater or less than the screening value. Where no screening values are available, no conclusions can be drawn regarding the adequacy of the RLs for screening risk, and as a result, uncertainty is introduced into the risk assessment. In these instances, a weight-of-evidence (WOE) approach is used in making risk-based decisions. The WOE approach used in the absence of screening values includes an assessment of the fate and transport of the chemical and the frequency of detection of MCs that are likely to have been co-derived from a munitions source.

5.1.4.2 Table 5-5 shows a comparison of the RLs and human health screening values for analytes not detected in surface soil, subsurface soil, sediment, surface water, and groundwater at WFF Project 07 by media.

5.1.4.3 In surface soil, none of the explosive constituents or the PAHs acenaphthene, acenaphthylene, dibenzo(a,h)anthracene, fluorene, indeno(1,2,3-cd)pyrene, or naphthalene were detected above their respective RLs at WFF Project 07. Acenaphthylene was detected in one out of three site samples, and naphthalene was detected in three out of three site samples, but these two analytes were also detected in the associated method blank. The concentrations in the site samples were less than five times the maximum amount detected in any blank. Therefore, following USEPA guidance (USEPA 1989), these two site samples were treated as non-detects and the values reported by the laboratory were used as the reported concentrations. In surface soil, with the exception of NG, the RLs for the non-detected explosive constituents, and the above named PAHs, were lower than the respective soil screening criteria adopted for the HHRA. The maximum RL of 2 mg/kg for NG exceeds the residential soil screening value of 0.61 mg/kg. The MQO for sensitivity for NG was not met and any reported non-detects (<RL) do not demonstrate that NG contamination is less than the selected screening criterion. However, as described in Section 5.1.3.10, the residential screening value used in the HHRA is adjusted to account for the potential cumulative effect of simultaneous exposures to multiple non-carcinogens. Under the methodology employed in the HHRA for cumulative non-carcinogenic risk, ten chemicals are assumed to elicit toxic effects on the same target organ. At the WFF Project 07, a total of 38 MCs were identified for surface soil, and the vast majority of these were non-detects with RL that were well below their respective SLs. Additionally, most of the MCs

are not anticipated to act by the same non-carcinogenic mode of action or at the same target organ as NG. Thus, the adjusted screening value used in this HHRA for NG, which was developed by reducing the USEPA regional SL by a factor of ten, is likely to be overly conservative. Moreover, the difference between the adjusted screening value of 0.61 mg/kg and the maximum RL of 2 mg/kg is relatively small. Considering these factors, the RL for NG is determined to be adequate for the HHRA screening at the WFF Project 07. No soil screening value was available for acenaphthylene. Therefore, no conclusions regarding the adequacy of the RL obtained for these MCs can be made.

5.1.4.4 In subsurface soil, the explosive constituents analyzed and antimony were not detected above their respective RLs at WFF Project 07. For this medium, with the exception of NG, the RLs for non-detected explosive constituents were lower than their respective soil screening criteria adopted for the HHRA. As described in Section 5.1.4.3, the maximum RL of 2 mg/kg for NG exceeds the residential soil screening value of 0.61 mg/kg and the MQO for sensitivity for NG was not met. Any reported non-detects (<RL) do not demonstrate that NG contamination is less than the selected screening criterion. However, as described in Section 5.1.4.3, the RL for NG is determined to be adequate for the HHRA screening at the WFF Project 07.

5.1.4.5 As described in Section 5.1.3.8, the regional SLs for 2-amino-4,6-DNT and 4-amino-2,6-DNT are based on toxicity data for 2,4-DNT. The maximum RL of 0.1 mg/kg in soil (surface and subsurface) for the two amino-DNT isomers is well below the residential and industrial screening criteria developed from regional SLs for use in the HHRA (15 and 200 mg/kg for 2-amino-4,6-DNT, respectively; and 15 and 190 mg/kg for 4-amino-2,6-DNT, respectively). Any uncertainties in the application of these screening levels to the risk assessment are, therefore, determined not to be significant for the HHRA.

5.1.4.6 In sediment, the explosive constituents analyzed and antimony were not detected above their respective RLs at WFF Project 07. RLs for non-detected MCs were lower than the respective sediment screening criteria adopted for the HHRA.

5.1.4.7 As described in Section 5.1.3.8, the regional SLs for 2-amino-4,6-DNT and 4-amino-2,6-DNT are based on toxicity data for 2,4-DNT. The maximum RL of 0.1 mg/kg in sediment for the amino-DNT isomers is well below the residential and industrial screening criteria developed from regional SLs for use in the HHRA (150 and 2,000 mg/kg for 2-amino-4,6-DNT, respectively; and 150 and 1,900 mg/kg for 4-amino-2,6-DNT, respectively). Therefore, any uncertainties in the application of these screening levels to the risk assessment are determined not to be significant for the HHRA.

5.1.4.8 In surface water, none of the explosive constituents analyzed or perchlorate were detected above their respective RLs at WFF Project 07. With the exception of NG, the RLs for non-detected MCs were below the respective surface water screening criteria adopted for the HHRA. The RL of 3 µg/L for NG exceeds the surface water screening value of 1.5 µg/L adopted for the HHRA and the MQO for sensitivity for NG was not met. Any reported non-detects (<RL) do not demonstrate that NG contamination is less than the selected screening criterion. However, as described in Section 5.1.3.10, the regional tap water SL for NG was adjusted to account for potential cumulative effects of simultaneous exposure to multiple non-carcinogens. At the WFF Project 07, a maximum of 14 MCs were identified in surface water. As described in Section 5.1.3.10, each of these MCs is not anticipated to act by the same non-carcinogenic mode of action or at the same target organ. Further, the difference between the RL and screening criterion for NG is relatively small. Based on these considerations, the RL for NG is considered adequate for the HHRA.

5.1.4.9 As described in Section 5.1.3.8, the regional SLs for 2-amino-4,6-DNT and 4-amino-2,6-DNT are based on the toxicity of 2,4-DNT. The maximum RL of 0.2 µg/L for these MCs is well below the screening criteria of 30 µg/L developed from regional tap water SLs for use in the HHRA. Any uncertainties regarding the application of these screening levels to the HHRA are determined not to be significant.

5.1.4.10 In groundwater, perchlorate, the explosive constituents, and the metals antimony and copper were not detected above their respective RLs. With the exception of NG and antimony, the RLs for non-detected MCs were below the respective groundwater screening criteria adopted for the HHRA. The RL of 3 µg/L for NG exceeds the groundwater screening value of 0.15 µg/L, and the RL of 6 µg/L for antimony exceeds the groundwater screening value of 0.6 µg/L adopted for the HHRA. Therefore, the MQO for sensitivity was not met for NG or antimony. Any reported non-detects (<RL) do not demonstrate that contamination from these MCs is less than the selected screening criteria. However, as described in Section 5.1.3.10, the regional tap water SLs for antimony and NG were adjusted to account for the potential cumulative effect of simultaneous exposure to multiple non-carcinogens. At the WFF Project 07, 23 MCs were identified in groundwater. As described in Section 5.1.3.10, each of these MCs is not anticipated to act by the same non-carcinogenic mode of action or at the same target organ. Therefore, the RLs for antimony and NG are considered adequate for the HHRA screening at the WFF Project 07.

5.1.4.11 As described in Section 5.1.3.8, the regional SLs for 2-amino-4,6-DNT and 4-amino-2,6-DNT are based on the toxicity of 2,4-DNT. The maximum RL of 0.2 µg/L for these MCs is below the screening criteria of 3 µg/L developed from regional tap water SLs for use in the HHRA. Any uncertainties regarding the application of these screening levels to the HHRA are determined not to be significant.

5.1.4.12 Table 5-6 shows a comparison of the RLs and ecological screening values for analytes not detected in surface soil, sediment, and surface water at WFF Project 07 by media.

5.1.4.13 In surface soil, none of the explosive constituents or the PAHs acenaphthene, acenaphthylene, dibenzo(a,h)anthracene, fluorene, indeno(1,2,3-cd)pyrene, or naphthalene were detected above their respective RLs at WFF Project 07. Acenaphthylene was detected in one out of three site samples, and naphthalene was detected in three out of three site samples, but these two analytes were also detected in the associated method blank. The concentrations in the site samples were less than five times the maximum amount detected in any blank. Therefore, following USEPA guidance (USEPA 1989), these two site samples were treated as non-detects and the values reported by the laboratory were used as the reported concentrations. In surface soil, the RLs for the non-detected MCs for which eco-SSLs were available were lower than the respective screening criteria adopted for the SLERA.

5.1.4.14 As described in Section 5.1.3.17, the adoption of screening values from surrogates introduces some uncertainty into the SLERA. The eco-SSL for 2,4,6-TNT was adopted for 2,4-DNT, 2,6-DNT, 2-nitrotoluene, 3-nitrotoluene, and 4-nitrotoluene. The maximum RLs of 0.1 mg/kg for 2,4-DNT and 2,6-DNT, and 0.2 mg/kg for the nitrotoluene isomers are well below the eco-SSL of 30 mg/kg adopted for these MCs in the SLERA. In addition, the eco-SSL for 2-amino-4,6-DNT was adopted for 4-amino-2,6-DNT. The maximum RL of 0.1 mg/kg for 4-amino-2,6-DNT is well below the ecological soil screening value of 80 mg/kg adopted for this MC in the SLERA. Therefore, any uncertainties associated with the use of 2,4,6-TNT and 2-amino-4,6-DNT as surrogates for the explosive MCs are determined not to be significant for the SLERA. No eco-SSL was available for 1,3,5-TNB or NG. Therefore, no conclusions regarding the adequacy of the RLs obtained for these MCs can be made.

5.1.4.15 In sediment, none of the explosive constituents analyzed or antimony were detected above their respective RLs. With the exception of 1,3,5-TNB and NB, the RLs for all non-detected MCs for which eco-SSLs were available were lower than the respective screening criteria adopted for the SLERA. The maximum RLs for 1,3,5-TNB and NB were above the respective screening values selected for the SLERA (1,3,5-TNB: maximum is 0.1 mg/kg, SL is

0.0024 mg/kg; NB: maximum RL is 0.3 mg/kg, SL is 0.021 mg/kg). Therefore, the MQO for sensitivity was not met for these analytes, and any reported non-detects do not demonstrate that contamination is less than the selected screening criteria. No ecological sediment screening value was available for NG. Therefore, no conclusions regarding the adequacy of the RL obtained for this MC can be made.

5.1.4.16 As described in Section 5.1.3.17, the use of surrogates for ecological screening values introduces some uncertainty into the SLERA. The sediment screening criteria for 2,4-DNT, 2,6-DNT, 2-nitrotoluene, 3-nitrotoluene, and 4-nitrotoluene are based on toxicity data for 2,4,6-TNT. The RLs of 0.1 mg/kg for 2,4-DNT and 2,6-DNT, and 0.2 mg/kg for the 2-nitrotoluene, 3-nitrotoluene, and 4-nitrotoluene are well below the ecological sediment screening value of 30 mg/kg adopted for these MCs in the SLERA. In addition, the screening value for 4-amino-2,6-DNT is based on information for 2-amino-2,4-DNT. The RL of 0.1 mg/kg for 4-amino-2,6-DNT is well below the ecological sediment screening value of 80 mg/kg adopted for this MC in the SLERA. Therefore, any uncertainties associated with the use of 2,4,6-TNT and 2-amino-4,6-DNT as surrogates for the explosive MCs are determined not to be significant for the SLERA.

5.1.4.17 In surface water, none of the explosive constituents analyzed or perchlorate were detected above their respective RLs. The RLs for all non-detected MCs f or which eco-SSLs were available were lower than the respective screening criteria adopted for the SLERA. No ecological sediment screening values were available for tetryl or perchlorate. Therefore, no conclusions regarding the adequacy of the RLs obtained for these MCs can be made.

5.2 Conceptual Site Model

5.2.0.1 The CSM diagram for the WFF Project 07 is provided in Appendix J. The CSM defines the source(s) (e.g., the secondary source/media), interaction (e.g., secondary release mechanism, tertiary source, exposure route), and receptors at MRS 7 and provides an overview of complete, potentially complete, and incomplete pathways. The CSM is limited to those areas potentially impacted by MECs and/or MCs based on the site use and history. These areas are shown in Figure 2-2. In this SI Report, the CSM has been revised from the version presented in the SS-WP Addendum to reflect the results of the analytical samples collected and the human and ecological risk screening.

5.2.0.2 Current and future potential human receptors for the WFF Project 07 are expected to be visitors/trespassers, construction workers, employees, and residents (future only) as depicted in the CSM diagram in Appendix J. Potentially complete pathways for human receptors exist for surface and subsurface soil, groundwater, surface water, and sediment. In the HHRA, the soil

and sediment screening values used for visitors/trespassers and residents were based on regional SLs for direct contact with residential soil, while the screening values used for construction workers and employees were based on the regional SLs for direct contact with industrial soil. The groundwater and surface water screening values were based on the tap water SLs.

5.2.0.3 The ecological receptors of concern for the WFF Project 07 are plants, soil and benthic invertebrates, terrestrial- and aquatic-feeding mammals, and terrestrial- and aquatic-feeding birds. Potentially complete pathways were identified for surface soil, sediment, and surface water. Screening values selected for the SLERA were applied uniformly to every ecological receptor.

5.2.0.4 Potentially complete pathways for human and ecological receptors are based on the presence of MECs/MCs and interactions, including transport and release mechanisms, and receptor use patterns.

5.2.0.5 Under the MMRP program, a pathway is complete for this SI if all of the following conditions are present:

1. Source and mechanism of chemical release (e.g., a munitions-related organic chemical is detected or a munitions-related inorganic chemical is detected and the levels exceed maximum and/or mean site background sample concentrations)[5].
2. Transfer mechanisms (e.g., overland flow of contaminants into an adjacent stream, advection of contaminants with groundwater flow).
3. Point of contact (exposure point, e.g., drinking water, soil).
4. Exposure route to receptor (e.g., ingestion, inhalation, etc.).

5.2.0.6 Comparisons of maximum detected site concentrations to risk-based screening values are used to determine if an MC is a COPC or COPEC, depending on the risk screening being conducted (human health or ecological, respectively). In the case that complete pathways exist between media and receptors, and a COPC and/or COPEC is identified, a WOE approach may be used to further evaluate the potential risk. The WOE approach considers multiple aspects of the MCs present, including the frequency of detection, magnitude, and comparison to background, as well as the applicability of the screening criteria selected to the specific receptor groups and exposures that are likely to occur at MRS 7. The WOE evaluation is shown after select COPCs and COPECs in Section 5.4. An RI/FS may be recommended for MCs where COPCs and/or

[5] In the case that an MC is not detected in any of the samples collected for a given medium and the MQO for sensitivity is not met (i.e., the RL is greater than the respective screening level for human or ecological receptors), the pathway remains potentially complete.

COPECs are determined to represent the potential for risks to an exposed receptor population. An NDAI designation may be recommended for MCs if no COPCs or COPECs are identified through the risk screening process, or if the WOE evaluation indicates that COPCs/COPECs do not pose an unacceptable risk to the exposed receptors.

5.2.0.7 In conclusion, pathway completeness will result in a RI/FS recommendation for MCs only in the instance where risk screening criteria exceedances occur. A pathway can be complete but a RI/FS is not recommended if there are no exceedances of risk screening criteria, or if identified risks are determined to be at acceptable risk levels. When a pathway is incomplete, a RI/FS recommendation is not made.

5.3 Background Data Evaluation

5.3.0.1 Background comparisons were conducted for MC that were identified as COPCs/COPECs in Tables 5-1 through 5-4. Two background data sets were available for this evaluation. One was a background soil and groundwater investigation conducted for the Main Base Area of WFF by NASA (2004). The NASA background data were derived from samples that were collected from areas upgradient or outside the influence of areas with known or suspected NASA or DoD activities. The samples were primarily used to represent native background conditions; however, some locations were considered to be potentially influenced by anthropogenic activities. Summary tables of descriptive statistics from the NASA report were used to develop the background data shown in Tables 5-7 through 5-9. Separate surface and subsurface background datasets were developed to conform to the report conclusions that concentration distributions in these two soil horizons were different. Only samples collected from the Molena soil type were included in the summary as they are most representative of the soils within the areas of interest for the WFF Project 07. The other background data set was a collection of three sediment samples collected during the recent WFF Project 07 SI sampling effort. These sediment samples were collected from areas from within the FUDS boundary, but outside MRS 7. The analytical results for these three background sediment samples are presented in Table 5-2 under sample names WFF-MBBG-SD-01 through WFF-MBBG-SD-03.

5.3.0.2 Background comparisons for COPCs/COPECS in the soil and groundwater of the Pyrotechnics Burn Area are shown in Table 5-7. For surface soil, copper, lead, and zinc, site concentrations were elevated relative to background surface soil concentrations, but iron was not. No comparison could be made for antimony in surface soil due to the absence of valid detections in the NASA background study. In subsurface soil, the site aluminum detections were elevated relative to background concentrations, but iron was not. Iron in groundwater was also not elevated relative to background concentrations.

5.3.0.3 The background comparison for COPCs/COPECs in the soil and groundwater of the Gun Butt No. 1 and 2 Area are shown in Table 5-8. For surface soil, site concentrations of copper were elevated relative to background surface soil, but iron and lead were not. Similarly, the site concentrations of iron in subsurface soil were not elevated relative to background. However, in groundwater, the site iron concentrations were elevated relative to background.

5.3.0.4 The background comparison for COPCs/COPECs in the South Bank of Boat Basin are shown in Table 5-9. The surface soil comparison is of limited utility because only a single site sample was collected from the area. For copper, the site concentration in surface soils was greater than the maximum observed in the background data. Conversely, the iron concentration from this site area was below the maximum observed in the background data. The background comparison for copper in sediment was also of limited utility because only three background samples were collected. The sediment copper concentrations in the site area were elevated relative to background.

5.4 Human and Ecological Risk Screening Results

5.4.0.1 As discussed in Section 5.1.1.2, the WFF Project 07 was separated into the following three distinct areas of interest for the purpose of the risk assessment: Pyrotechnics Burn Area; Gun Butt No. 1 and 2 Area; and South Bank of Boat Basin. For each sampled media, the selection of COPCs/COPECs was based on a comparison of the maximum MC concentration identified within the WFF Project 07 to the relevant risk-based screening level values. The MC concentration distribution specific within each of the three areas of interest was then reviewed to determine the COPC/COPEC risk significance on an area-specific basis. The risk assessment discussion is grouped by media and begins by identifying COPCs/COPECs for the WFF Project 07, followed by an analysis of the risk conclusions for each of the three areas of interest.

5.4.0.2 MCs analyzed at the WFF Project 07 varied between the three areas but included explosive constituents (DNT and DNT breakdown products, TNT and TNT breakdown products, NG, RDX, and tetryl), metals (aluminum, antimony, barium, copper, iron, lead, magnesium, nickel, and zinc), PAHs (acenaphthene, acenaphthylene, anthracene, benzo[a]anthracene, benzo[b]fluoranthene, benzo[k]fluoranthene, benzo[g,h,i]perylene, benzo[a]pyrene, chrysene, dibenzo[a,h]anthracene, fluoranthene, fluorene, indeno[1,2,3-cd]pyrene, naphthalene, phenanthrene, and pyrene), and perchlorate. Surface soil, subsurface soil, groundwater, sediment and surface water were identified as media of concern for MRS 7.

5.4.1 Surface Soil Pathway and Screening Results

5.4.1.1 In the SS-WP, surface soil was identified as a medium with potentially complete pathways for human and ecological receptors at the WFF Project 07. A total of 23 surface soil samples were collected from within the WFF Project 07 during this SI effort. Table 5-1 presents the analytical results for these surface soil samples, along with the human health and ecological screening values described previously in Section 5.1.3. Potentially complete pathways were identified for incidental ingestion and dermal contact with surface soil, inhalation of particulates from surface soil, and ingestion of vegetation and game exposed to MCs in surface soil for human and ecological receptors at this site. The only COPC identified for surface soil was iron. COPECs in surface soil included antimony, copper, lead and zinc.

5.4.1.2 Pyrotechnics Burn Area. Within the Pyrotechnics Burn Area, iron was identified as a COPC, and antimony, copper, lead and zinc were identified as COPECs. The risk significance of these designations within the Pyrotechnics Burn Area is discussed below.

- Iron as a COPC

  One of five surface soil samples exceeded the HHRA SL for iron. The iron SL reflects an added margin of safety to account for simultaneous exposure to multiple non-carcinogenic compounds through contact with surface soils. This is an overly conservative assumption given the lack of other COPCs in the surface soil of this area. None of the site iron surface soil concentrations exceed the USEPA regional SL for iron in residential soil. Furthermore, site iron concentrations were not elevated relative to background, so there is no indication of human health risk impacts from FUDS related activities. No adverse human health impacts are expected for iron in surface soil based on the WOE evaluation.
- Antimony as a COPEC

  Antimony concentrations in four of the five surface soil samples exceeded the eco-SSL. The maximum concentration exceeded the eco-SSL by a factor of 7. No background comparison could be made for antimony due to the absence of detections in the background dataset. Antimony is assumed to represent a potential risk to ecological receptors in this area.
- Copper as a COPEC

  Copper concentrations in two of the five surface soil samples exceeded the eco-SSL. The maximum concentration exceeded the eco-SSL by a factor of 1.4. The copper concentrations in this area were elevated relative to background concentrations. Copper is not assumed to represent a potential risk to ecological

receptors because of the site concentrations exceed the eco-SSL infrequently and by a negligible amount.

- Lead as a COPEC

  All five lead concentrations in the surface soil exceeded the eco-SSL. The maximum concentration exceeded the eco-SSL by a factor of 26. The lead concentrations from this area were also elevated relative to the background samples. Lead is assumed to represent a potential risk to ecological receptors in this area.

- Zinc as a COPEC

  All five zinc concentrations in the surface soil exceed the eco-SSL. The maximum concentration exceeded the eco-SSL by a factor of 41; however, the maximum concentration is an estimated value, which introduces a degree of uncertainty in the SLERA. The next two highest zinc concentrations from this area had no such qualifier and still exceeded the eco-SSL by a factor of ten. The zinc concentrations from this area were also elevated relative to the background samples. Zinc is assumed to represent a potential risk to ecological receptors in this area.

5.4.1.3 Gun Butt No. 1 and 2 Area. Within the Gun Butt No. 1 and 2 Area, iron was identified as a COPC, while copper and lead were identified as COPECs. The risk significance of these designations within the Gun Butt No. 1 and 2 Area is discussed below. Antimony was not above human or ecological SLs, however, antimony results were rejected and therefore not included in the HHRA/SLERA for ten of the fifteen surface soil samples from this area. At the five sampling locations with valid antimony results other analytes were above their respective human or ecological SLs but antimony was not. None of the MC analytes were above their SLs at three of the sampling locations with rejected antimony results. The only risk issue at five of the other locations with rejected antimony results was iron as a COPC, which was not considered risk significant because of the conservatism in the iron HHRA SL. Ultimately, the uncertainty introduced by this antimony data gap is not considered significant enough to change the risk conclusions for antimony.

- Iron as a COPC

  Nine of the fifteen concentrations of iron in surface soil samples for this area exceeded the HHRA SL. As discussed previously, the iron SL reflects an added margin of safety applied to the USEPA regional SL to account for simultaneous exposure to multiple non-carcinogenic compounds through contact with surface soils. This is an overly conservative assumption given the lack of other COPCs in

the surface soil of this area. None of the site iron surface soil concentrations exceed the unadjusted USEPA regional SL for iron in residential soil. Furthermore, site iron detections were not elevated relative to background concentrations, so there is no indication of human health risk impacts from FUDS related activities. No adverse human health impacts are expected for iron in surface soil based on the WOE evaluation.

- Copper as a COPEC

  Copper concentrations in three of the fifteen surface soil samples exceeded the eco-SSL. The maximum concentration exceeded the eco-SSL by a factor of 3.3. Copper detections were elevated relative to background concentrations. Copper is not expected to present a potential risk to ecological receptors because the site concentrations exceeded the eco-SSL infrequently and by a negligible amount.

- Lead as a COPEC

  Five of the fifteen lead concentrations in the surface soil exceeded the eco-SSL. The maximum concentration exceeded the eco-SSL by a factor of 4. The lead concentrations in the surface soil are not expected to represent an unacceptable risk to ecological receptors since the exceedance were infrequent and by a negligible amount. Furthermore, the lead detections from this area did not exceed relative to the background concentrations. Therefore, there is no additional risk to ecological receptors from FUDS related activities. Lead is not assumed to represent a risk to ecological receptors for this area based on the WOE evaluation.

5.4.1.4 South Bank of Boat Basin Area. Within the South Bank of Boat Basin Area, iron was identified as a COPC, and copper was identified as a COPEC. The risk significance of these designations within the South Bank of Boat Basin Area is discussed below.

- Iron as a COPC

  The iron concentration in the single surface soil sample collected from this area exceeded the HHRA SL. As discussed previously, the iron SL reflects an added margin of safety applied to the USEPA regional SL to account for simultaneous exposure to multiple non-carcinogenic compounds through contact with surface soils. This is an overly conservative assumption given the lack of other COPCs in this surface soil sample. The iron surface soil concentration in this area does not exceed the unadjusted USEPA regional SL for iron in residential soil. No meaningful background comparison could be made because only a single sample was collected in this area. However, no adverse human health impacts are expected for iron in surface soil based on the WOE evaluation.

- Copper as a COPEC

  The copper concentration in the single surface soil sample exceeded the eco-SSL. The maximum concentration exceeded the eco-SSL by a factor of 2.7. No meaningful background comparison could be made because only a single sample was collected in this area. Copper is assumed to represent a potential risk to ecological receptors because the only sample for the area exceeds the eco-SSL.

5.4.2 Subsurface Soil Pathway and Screening Results

5.4.2.1 Subsurface soil was identified as a medium with potentially complete pathways for human receptors at the WFF Project 07. A total of twelve subsurface soil samples were collected from within the WFF Project 07 during this SI effort. Table 5-1 presents the analytical results for these subsurface soil samples, along with the human health screening values described previously in Section 5.1.3. Potentially complete pathways were identified for incidental ingestion, dermal contact, and inhalation of particulates from subsurface soil for human and ecological receptors at this site. Aluminum and iron were the only COPCs identified for subsurface soil at the WFF Project 07.

5.4.2.2 Pyrotechnics Burn Area. Within the Pyrotechnics Burn Area, aluminum and iron were identified as COPCs. The risk significance of these designations within the Pyrotechnics Burn Area is discussed below.

- Aluminum as a COPC

  Two of the four subsurface soil samples exceeded the HHRA SL for aluminum. The aluminum SL reflects an added margin of safety applied to the USEPA regional SL to account for simultaneous exposure to multiple non-carcinogenic compounds through contact with subsurface soils. This is an overly conservative assumption given the limited number of COPCs in the subsurface soil of this area. None of the aluminum subsurface soil concentrations exceed the unadjusted USEPA regional SL for aluminum in residential soil. Site aluminum concentrations were elevated relative to background. However, no adverse human health impacts are expected for aluminum in subsurface soil based on the conservatism in the HHRA SL used to identify aluminum as a COPC.

- Iron as a COPC

  Two of the four subsurface soil samples exceeded the HHRA SL for iron. The iron SL reflects an added margin of safety applied to the USEPA regional SL to account for simultaneous exposure to multiple non-carcinogenic compounds

through contact with subsurface soils. This is an overly conservative assumption given the limited number of COPCs in the subsurface soil of this area. None of the iron subsurface soil concentrations exceed the unadjusted USEPA regional SL in residential soil. Furthermore, site iron concentrations were not elevated relative to background, so there is no indication of human health risk impacts from FUDS related activities.

5.4.2.3 Gun Butt No. 1 and 2 Area. Within the Gun Butt No. 1 and 2 Area, iron was identified as a COPC. The risk significance of this designation within the Gun Butt No. 1 and 2 Area is discussed below.

- Iron as a COPC

  Two of the seven subsurface soil samples exceeded the HHRA SL for iron. The iron SL reflects an added margin of safety applied to the USEPA regional SL to account for simultaneous exposure to multiple non-carcinogenic compounds through contact with subsurface soils. This is an overly conservative assumption given the lack of other COPCs in the subsurface soil of this area. None of the iron subsurface soil concentrations exceeded the unadjusted USEPA regional SL in residential soil. Furthermore, site iron concentrations were not elevated relative to background, so there is no indication of human health risk impacts from FUDS related activities.

5.4.2.4 South Bank of Boat Basin Area. No COPCs were identified within the South Bank of Boat Basin Area.

5.4.3 Sediment Pathway and Screening Results

5.4.3.1 Sediment was identified as a medium with potentially complete pathways for human and ecological receptors at the WFF Project 07. A total of six sediment samples were collected from within the WFF Project 07 during this SI effort. Table 5-2 presents the analytical results for these sediment samples, along with the human health and ecological screening values described previously in Section 5.1.3. Potentially complete pathways were identified for incidental ingestion, dermal contact, and inhalation of particulates from sediment for human and ecological receptors at this site. However, sediment was not present within the Pyrotechnics Burn Area or Gun Butt No. 1 or 2 (including the area between the Gun Butts); therefore, sediment samples were not collected from these areas. However, sediment was present and collected from the South Bank of the Boat Basin. No COPCs were identified for sediment and copper was the only COPEC identified for sediment at the WFF Project 07. One of the six antimony samples

collected at WFF Project 07 was rejected. This data gap is considered to be insignificant because antimony was not detected in the other five samples and the RLs were well below risk-based screening levels.

5.4.3.2 South Bank of Boat Basin Area. Within the South Bank of Boat Basin Area, only copper was identified as a COPEC. The risk significance of this designation within the South Bank of Boat Basin is discussed below.

- Copper as a COPEC

  Only one of the six sediment samples exceeded the ecological SL for copper. The maximum concentration exceeds the ecological SL by a factor of 2.6. The site sediment concentrations for copper are elevated with respect to the background concentrations. However, adverse impacts to ecological receptors are not expected from exposure to copper in sediments based on the very low frequency and magnitude with which site concentrations exceeded the ecological SL.

5.4.4 Surface Water Pathway and Screening Results

5.4.4.1 Surface water was identified as a medium with potentially complete pathways for human and ecological receptors at the WFF Project 07. A total of two surface water samples were collected from within the WFF Project 07 during this SI effort. Table 5-3 presents the analytical results for these surface water samples, along with the human health and ecological screening values described previously in Section 5.1.3. Potentially complete pathways were identified for incidental ingestion of and dermal contact with MC in surface water, in addition to ingestion of fish exposed to MC in surface water, for human and ecological receptors at this site. No COPCs or COPECs were identified for surface water collected from within the Boat Basin

5.4.5 Groundwater Pathway and Screening Results

5.4.5.1 Groundwater was identified as a medium with potentially complete pathways for human receptors at the WFF Project 07. A total of six groundwater samples were collected from within the WFF Project 07 during this SI effort. Table 5-4 presents the analytical results for these groundwater samples, along with the human health screening values described previously in Section 5.1.3. Potentially complete pathways were identified for ingestion of, dermal contact with MC in groundwater for human receptors at this site. Antimony and iron were the only COPCs identified for groundwater at the site.

5.4.5.2 Pyrotechnics Burn Area. Within the Pyrotechnics Burn Area, antimony and iron were

identified as COPCs. The risk significance of these designations within the Pyrotechnics Burn Area is discussed below.

- Antimony as a COPC

  All three of the groundwater samples exceeded the HHRA SL for antimony. The antimony HHRA SL reflects an added margin of safety to the USEPA regional SL tap water concentration to account for simultaneous exposure to multiple non-carcinogenic compounds through groundwater exposure. This is an overly conservative assumption given the limited number of COPCs in the groundwater of this area. None of the antimony groundwater concentrations exceed the unadjusted USEPA regional SL for antimony in tap water. No adverse human health impacts are expected for antimony in groundwater based on the conservatism in the HHRA SL used to identify antimony as a COPC.
- Iron as a COPC

  One of the three groundwater samples exceeded the HHRA SL for iron. The iron HHRA SL reflects an added margin of safety to the USEPA regional SL tap water concentration to account for simultaneous exposure to multiple non-carcinogenic compounds through groundwater exposure. This is an overly conservative assumption given the limited number of COPCs in the groundwater of this area. None of the iron groundwater concentrations exceed the unadjusted USEPA regional SL for iron in tap water. Furthermore, site iron concentrations were not elevated relative to background, so there is no indication of human health risk impacts from FUDS related activities.

5.4.2.3 Gun Butt No. 1 and 2 Area. Within the Gun Butt No. 1 and 2 Area, iron was identified as a COPC. The risk significance of this designation within the Gun Butt No. 1 and 2 Area is discussed below.

- Iron as a COPC

  All three groundwater samples exceeded the HHRA SL for iron. The iron SL reflects an added margin of safety to the USEPA regional SL tap water concentration to account for simultaneous exposure to multiple non-carcinogenic compounds through contact with subsurface soils. This is an overly conservative assumption given the limited number of COPCs in the groundwater of this area. However, two of the three groundwater concentrations exceed the unadjusted USEPA regional SL for iron in tap water. Furthermore, site iron concentrations

were elevated relative to background. There is a potential for adverse human health impacts from iron in groundwater based on the WOE evaluation.

Table 5-1 Summary of Soil Analytical Results

			Screening Values for Visitor/Trespasser [a,b]	Screening Values for Construction Worker, Employee [a,b]	Screening Values for Biota										
		Sample Name:				WFF-MRS7-SS-01-01	WFF-MRS7-SS-DUP3	WFF-MRS7-SS-01-02	WFF-MRS7-SS-01-03	WFF-MRS7-SS-01-04	WFF-MRS7-SB-02-01	WFF-MRS7-SB-02-02	WFF-MRS7-SB-02-03	WFF-MRS7-SB-02-04	WFF-MRS7-SS-01-05
		Sample Date:				12/14/2011	12/14/2011	12/14/2011	12/14/2011	12/14/2011	12/14/2011	12/14/2011	12/14/2011	12/14/2011	12/12/2011
		Parent Name:					WFF-MRS7-SS-01-01								
		Area:				Pyrotechnics Burn Area	Pyrotechnics Burn Area	Pyrotechnics Burn Area	Pyrotechnics Burn Area	Pyrotechnics Burn Area	Pyrotechnics Burn Area	Pyrotechnics Burn Area	Pyrotechnics Burn Area	Pyrotechnics Burn Area	Gun Butt No. 1 and 2
Analyte	**CAS**	**Unit**													
Explosives															
1,3,5-TRINITROBENZENE	99-35-4	mg/kg	220	2,700	NSL	0.10 U	0.09 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U
2,4,6-TRINITROTOLUENE	118-96-7	mg/kg	19	79	30 [c]	0.10 U	0.09 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U
2,4-DINITROTOLUENE	121-14-2	mg/kg	1.6	5.5	30 [c,d]	--	--	--	--	--	--	--	--	--	--
2,6-DINITROTOLUENE	606-20-2	mg/kg	6.1	62	30 [c,d]	0.10 U	0.09 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U
2-AMINO-4,6-DINITROTOLUENE	35572-78-2	mg/kg	15 [e]	200 [e]	80 [c]	0.10 U	0.09 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U
2-NITROTOLUENE	88-72-2	mg/kg	2.9	13	30 [c,d]	--	--	--	--	--	--	--	--	--	--
3-NITROTOLUENE	99-08-1	mg/kg	0.61	6.2	30 [c,d]	--	--	--	--	--	--	--	--	--	--
4-AMINO-2,6-DINITROTOLUENE	19406-51-0	mg/kg	15 [e]	190 [e]	80 [c,f]	0.10 U	0.09 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U
4-NITROTOLUENE	99-99-0	mg/kg	30	110	30 [c,d]	--	--	--	--	--	--	--	--	--	--
NITROBENZENE	98-95-3	mg/kg	4.8	24	40 [g]	0.29 U	0.28 U	0.29 U	0.29 U	0.29 U	0.28 U	0.29 U	0.30 U	0.29 U	0.29 U
NITROGLYCERINE	55-63-0	mg/kg	0.61	6.2	NSL	--	--	--	--	--	--	--	--	--	--
RDX	121-82-4	mg/kg	5.6	24	100 [c]	--	--	--	--	--	--	--	--	--	0.20 U
TETRYL	479-45-8	mg/kg	24	250	25 [c]	--	--	--	--	--	--	--	--	--	0.20 U
Metals															
ALUMINUM	7429-90-5	mg/kg	7,700	99,000	pH < 5.5 [h]	2,200.00	1,700.00	7,000.00	5,200.00 J	7,400.00	**30,000.00**	1,100.00	**29,000.00**	4,000.00	--
ANTIMONY	7440-36-0	mg/kg	3.1	41	0.27 [i]	*1.90*	*1.50 L*	0.11 J	*0.51 L*	*0.31 L*	0.03 J	0.06 J	0.03 L	0.02 L	-- R
BARIUM	7440-39-3	mg/kg	1,500	19,000	330 [j]	3.80	4.80 K	14.00	6.60 K	25.00 K	34.00	3.40	46.00 K	69.00 K	--
COPPER	7440-50-8	mg/kg	310	4,100	28 [k]	*32.00*	15.00	19.00	16.00	*39.00*	20.00	3.10	32.00	22.00	2.70
IRON	7439-89-6	mg/kg	5,500	72,000	NSL	1,900.00	1,100.00	5,000.00	3,500.00 J	**7,800.00**	**11,000.00**	460.00	**15,000.00**	840.00	3,600.00
LEAD	7439-92-1	mg/kg	400	800	11 [l]	*81.00*	*57.00 L*	*70.00*	*31.00 L*	*290.00 L*	15.00	10.00	21.00 L	47.00 L	2.60 L
MAGNESIUM	7439-95-4	mg/kg	NSL	NSL	NSL	1,800.00	880.00	810.00	3,400.00	910.00	4,300.00	170.00	5,400.00	370.00	--
NICKEL	7440-02-0	mg/kg	150	2,000	38 [m]	2.10	*1.50*	3.70	2.10	5.30	13.00	0.78	16.00	3.00	3.80
ZINC	7440-66-6	mg/kg	2,300	31,000	46 [n]	*460.00*	*500.00*	*83.00*	*1,900.00 J*	*130.00*	260.00	18.00	66.00	110.00	--
Polycyclic Aromatic Hydrocarbons (PAHs)															
ACENAPHTHENE	83-32-9	µg/kg	340,000	3,300,000	29,000 [o]	10.00 U	8.80 U	--	7.70 U	--	--	--	--	--	--
ACENAPHTHYLENE	208-96-8	µg/kg	NSL	NSL	29,000 [o]	0.77 B	8.80 U	--	7.70 U	--	--	--	--	--	--
ANTHRACENE	120-12-7	µg/kg	1,700,000	17,000,000	29,000 [o]	3.30 J	8.80 U	--	7.70 U	--	--	--	--	--	--
BENZO[a]ANTHRACENE	56-55-3	µg/kg	150	2,100	1,100 [o]	2.50 J	1.60 J	--	7.70 U	--	--	--	--	--	--
BENZO[a]PYRENE	50-32-8	µg/kg	15	210	1,100 [o]	2.50 J	2.60 J	--	1.20 J	--	--	--	--	--	--
BENZO[b]FLUORANTHENE	205-99-2	µg/kg	150	2,100	1,100 [o]	6.50 J	6.60 J	--	2.20 J	--	--	--	--	--	--
BENZO[g,h,i]PERYLENE	191-24-2	µg/kg	NSL	NSL	1,100 [o]	2.40 J	2.20 J	--	7.70 U	--	--	--	--	--	--
BENZO[k]FLUORANTHENE	207-08-9	µg/kg	1,500	21,000	1,100 [o]	2.40 J	8.80 U	--	7.70 U	--	--	--	--	--	--
CHRYSENE	218-01-9	µg/kg	15,000	210,000	1,100 [o]	7.20 J	4.50 J	--	1.50 J	--	--	--	--	--	--
DIBENZO[a,h]ANTHRACENE	53-70-3	µg/kg	15	210	1,100 [o]	10.00 U	8.80 U	--	7.70 U	--	--	--	--	--	--
FLUORANTHENE	206-44-0	µg/kg	230,000	2,200,000	29,000 [o]	5.70 J	2.30 J	--	7.70 U	--	--	--	--	--	--
FLUORENE	86-73-7	µg/kg	230,000	2,200,000	29,000 [o]	10.00 U	8.80 U	--	7.70 U	--	--	--	--	--	--
INDENO[1,2,3-cd]PYRENE	193-39-5	µg/kg	150	2,100	1,100 [o]	10.00 U	8.80 U	--	7.70 U	--	--	--	--	--	--
NAPHTHALENE	91-20-3	µg/kg	3,600	18,000	29,000 [o]	1.60 B	0.87 B	--	0.67 B	--	--	--	--	--	--
PHENANTHRENE	85-01-8	µg/kg	NSL	NSL	29,000 [o]	3.00 J	8.80 U	--	7.70 U	--	--	--	--	--	--
PYRENE	129-00-0	µg/kg	170,000	1,700,000	1,100 [o]	5.00 J	2.20 J	--	7.70 U	--	--	--	--	--	--

Table 5-1 Summary of Soil Analytical Results (Continued)

			Screening Values for Visitor/Trespasser [a,b]	Screening Values for Construction Worker, Employee [a,b]	Screening Values for Biota										
		Sample Name:				WFF-MRS7-SS-01-06	WFF-MRS7-SS-01-07	WFF-MRS7-SS-01-08	WFF-MRS7-SS-01-09	WFF-MRS7-SS-01-10	WFF-MRS7-SS-01-12	WFF-MRS7-SS-01-13	WFF-MRS7-SS-01-14	WFF-MRS7-SS-01-15	WFF-MRS7-SS-01-16
		Sample Date:				12/12/2011	12/12/2011	12/12/2011	12/12/2011	12/12/2011	12/12/2011	12/12/2011	12/12/2011	12/12/2011	12/12/2011
		Parent Name:													
		Area:				Gun Butt No. 1 and 2	Gun Butt No. 1 and 2	Gun Butt No. 1 and 2	Gun Butt No. 1 and 2	Gun Butt No. 1 and 2	Gun Butt No. 1 and 2	Gun Butt No. 1 and 2	Gun Butt No. 1 and 2	Gun Butt No. 1 and 2	Gun Butt No. 1 and 2
Analyte	**CAS**	**Unit**													
Explosives															
1,3,5-TRINITROBENZENE	99-35-4	mg/kg	220	2,700	NSL	0.09 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U
2,4,6-TRINITROTOLUENE	118-96-7	mg/kg	19	79	30 [c]	0.09 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U
2,4-DINITROTOLUENE	121-14-2	mg/kg	1.6	5.5	30 [c,d]	--	--	--	--	--	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U
2,6-DINITROTOLUENE	606-20-2	mg/kg	6.1	62	30 [c,d]	0.09 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U
2-AMINO-4,6-DINITROTOLUENE	35572-78-2	mg/kg	15 [e]	200 [e]	80 [c]	0.09 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U
2-NITROTOLUENE	88-72-2	mg/kg	2.9	13	30 [c,d]	--	--	--	--	--	0.20 U	0.19 U	0.20 U	0.19 U	0.19 U
3-NITROTOLUENE	99-08-1	mg/kg	0.61	6.2	30 [c,d]	--	--	--	--	--	0.20 U	0.19 U	0.20 U	0.19 U	0.19 U
4-AMINO-2,6-DINITROTOLUENE	19406-51-0	mg/kg	15 [e]	190 [e]	80 [c,f]	0.09 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U
4-NITROTOLUENE	99-99-0	mg/kg	30	110	30 [c,d]	--	--	--	--	--	0.20 U	0.19 U	0.20 U	0.19 U	0.19 U
NITROBENZENE	98-95-3	mg/kg	4.8	24	40 [g]	0.27 U	0.30 U	0.30 U	0.29 U	0.30 U	0.29 U	0.29 U	0.30 U	0.29 U	0.29 U
NITROGLYCERINE	55-63-0	mg/kg	0.61	6.2	NSL	--	--	--	--	--	2.00 U	1.90 U	2.00 U	0.29 J	1.90 U
RDX	121-82-4	mg/kg	5.6	24	100 [c]	0.18 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.19 U	0.20 U	0.19 U	0.19 U
TETRYL	479-45-8	mg/kg	24	250	25 [c]	0.18 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.19 U	0.20 U	0.19 U	0.19 U
Metals															
ALUMINUM	7429-90-5	mg/kg	7,700	99,000	pH < 5.5 [h]	--	--	--	--	--	--	--	--	--	--
ANTIMONY	7440-36-0	mg/kg	3.1	41	0.27 [i]	0.05 L	-- R	-- R	-- R	0.04 L	-- R	-- R	--	0.05 L	0.04 L
BARIUM	7440-39-3	mg/kg	1,500	19,000	330 [j]	--	--	--	--	--	--	--	--	--	--
COPPER	7440-50-8	mg/kg	310	4,100	28 [k]	21.00	25.00	*43.00*	21.00	24.00	10.00	5.00	--	27.00	*34.00*
IRON	7439-89-6	mg/kg	5,500	72,000	NSL	2,100.00	3,300.00	**10,000.00**	**5,800.00**	5,300.00 J	4,800.00	**8,500.00**	--	**9,300.00**	**6,100.00**
LEAD	7439-92-1	mg/kg	400	800	11 [l]	*23.00 L*	5.60 L	5.60 L	7.00 L	*25.00 L*	5.10 L	6.20 L	--	*46.00 L*	*22.00 L*
MAGNESIUM	7439-95-4	mg/kg	NSL	NSL	NSL	--	--	--	--	--	--	--	--	--	--
NICKEL	7440-02-0	mg/kg	150	2,000	38 [m]	3.00	3.10	4.30	4.30	4.10	4.50	5.30	--	7.30	4.60
ZINC	7440-66-6	mg/kg	2,300	31,000	46 [n]	--	--	--	--	--	--	--	--	--	--
Polycyclic Aromatic Hydrocarbons (PAHs)															
ACENAPHTHENE	83-32-9	µg/kg	340,000	3,300,000	29,000 [o]	--	--	--	--	--	--	--	--	--	--
ACENAPHTHYLENE	208-96-8	µg/kg	NSL	NSL	29,000 [o]	--	--	--	--	--	--	--	--	--	--
ANTHRACENE	120-12-7	µg/kg	1,700,000	17,000,000	29,000 [o]	--	--	--	--	--	--	--	--	--	--
BENZO[a]ANTHRACENE	56-55-3	µg/kg	150	2,100	1,100 [o]	--	--	--	--	--	--	--	--	--	--
BENZO[a]PYRENE	50-32-8	µg/kg	15	210	1,100 [o]	--	--	--	--	--	--	--	--	--	--
BENZO[b]FLUORANTHENE	205-99-2	µg/kg	150	2,100	1,100 [o]	--	--	--	--	--	--	--	--	--	--
BENZO[g,h,i]PERYLENE	191-24-2	µg/kg	NSL	NSL	1,100 [o]	--	--	--	--	--	--	--	--	--	--
BENZO[k]FLUORANTHENE	207-08-9	µg/kg	1,500	21,000	1,100 [o]	--	--	--	--	--	--	--	--	--	--
CHRYSENE	218-01-9	µg/kg	15,000	210,000	1,100 [o]	--	--	--	--	--	--	--	--	--	--
DIBENZO[a,h]ANTHRACENE	53-70-3	µg/kg	15	210	1,100 [o]	--	--	--	--	--	--	--	--	--	--
FLUORANTHENE	206-44-0	µg/kg	230,000	2,200,000	29,000 [o]	--	--	--	--	--	--	--	--	--	--
FLUORENE	86-73-7	µg/kg	230,000	2,200,000	29,000 [o]	--	--	--	--	--	--	--	--	--	--
INDENO[1,2,3-cd]PYRENE	193-39-5	µg/kg	150	2,100	1,100 [o]	--	--	--	--	--	--	--	--	--	--
NAPHTHALENE	91-20-3	µg/kg	3,600	18,000	29,000 [o]	--	--	--	--	--	--	--	--	--	--
PHENANTHRENE	85-01-8	µg/kg	NSL	NSL	29,000 [o]	--	--	--	--	--	--	--	--	--	--
PYRENE	129-00-0	µg/kg	170,000	1,700,000	1,100 [o]	--	--	--	--	--	--	--	--	--	--

Table 5-1 Summary of Soil Analytical Results (Continued)

			Screening Values for Visitor/Trespasser [a,b]	Screening Values for Construction Worker, Employee [a,b]	Screening Values for Biota										
		Sample Name:				WFF-MRS7-SS-01-17	WFF-MRS7-SS-01-18	WFF-MRS7-SS-01-19	WFF-MRS7-SS-01-20	WFF-MRS7-SS-DUP2	WFF-MRS7-SS-01-21	WFF-MRS7-SB-02-05	WFF-MRS7-SB-02-06	WFF-MRS7-SB-02-07	WFF-MRS7-SB-DUP1
		Sample Date:				12/12/2011	12/12/2011	12/12/2011	12/12/2011	12/12/2011	12/12/2011	12/12/2011	12/12/2011	12/12/2011	12/12/2011
		Parent Name:								WFF-MRS7-SS-01-20					WFF-MRS7-SB-02-07
		Area:				Gun Butt No. 1 and 2	Gun Butt No. 1 and 2	Gun Butt No. 1 and 2	Gun Butt No. 1 and 2	Gun Butt No. 1 and 2	Gun Butt No. 1 and 2	Gun Butt No. 1 and 2	Gun Butt No. 1 and 2	Gun Butt No. 1 and 2	Gun Butt No. 1 and 2
Analyte	**CAS**	**Unit**													
Explosives															
1,3,5-TRINITROBENZENE	99-35-4	mg/kg	220	2,700	NSL	0.10 U	0.10 U	0.09 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.09 U	0.10 U
2,4,6-TRINITROTOLUENE	118-96-7	mg/kg	19	79	30 [c]	0.10 U	0.10 U	0.09 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.09 U	0.10 U
2,4-DINITROTOLUENE	121-14-2	mg/kg	1.6	5.5	30 [c,d]	0.10 U	--	--	0.10 U	0.10 U	0.10 U	--	--	--	--
2,6-DINITROTOLUENE	606-20-2	mg/kg	6.1	62	30 [c,d]	0.10 U	0.10 U	0.09 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.09 U	0.10 U
2-AMINO-4,6-DINITROTOLUENE	35572-78-2	mg/kg	15 [e]	200 [e]	80 [c]	0.10 U	0.10 U	0.09 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.09 U	0.10 U
2-NITROTOLUENE	88-72-2	mg/kg	2.9	13	30 [c,d]	0.20 U	--	--	0.20 U	0.20 U	0.19 U	--	--	--	--
3-NITROTOLUENE	99-08-1	mg/kg	0.61	6.2	30 [c,d]	0.20 U	--	--	0.20 U	0.20 U	0.19 U	--	--	--	--
4-AMINO-2,6-DINITROTOLUENE	19406-51-0	mg/kg	15 [e]	190 [e]	80 [c,f]	0.10 U	0.10 U	0.09 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.09 U	0.10 U
4-NITROTOLUENE	99-99-0	mg/kg	30	110	30 [c,d]	0.20 U	--	--	0.20 U	0.20 U	0.19 U	--	--	--	--
NITROBENZENE	98-95-3	mg/kg	4.8	24	40 [g]	0.30 U	0.29 U	0.28 U	0.29 U	0.30 U	0.29 U	0.29 U	0.29 U	0.28 U	0.29 U
NITROGLYCERINE	55-63-0	mg/kg	0.61	6.2	NSL	2.00 U	--	--	2.00 U	2.00 U	1.90 U	--	--	--	--
RDX	121-82-4	mg/kg	5.6	24	100 [c]	0.20 U	0.19 U	0.19 U	0.20 U	0.20 U	0.19 U	0.19 U	0.20 U	0.19 U	0.19 U
TETRYL	479-45-8	mg/kg	24	250	25 [c]	0.20 U	0.19 U	0.19 U	0.20 U	0.20 U	0.19 U	0.19 U	0.20 U	0.19 U	0.19 U
Metals															
ALUMINUM	7429-90-5	mg/kg	7,700	99,000	pH < 5.5 [h]	--	--	--	--	--	--	--	--	--	--
ANTIMONY	7440-36-0	mg/kg	3.1	41	0.27 [i]	--	-- R	0.05 L	-- R	-- R	-- R	-- R	-- R	-- R	0.18 U
BARIUM	7440-39-3	mg/kg	1,500	19,000	330 [j]	--	--	--	--	--	--	--	--	--	--
COPPER	7440-50-8	mg/kg	310	4,100	28 [k]	--	*92.00*	20.00	5.20	5.60	6.50	4.30	1.30 J	2.10 J	3.50
IRON	7439-89-6	mg/kg	5,500	72,000	NSL	--	**6,800.00**	4,400.00	**6,100.00**	**6,400.00**	**6,100.00 J**	3,700.00	1,100.00	4,900.00	4,300.00
LEAD	7439-92-1	mg/kg	400	800	11 [l]	--	6.00 L	*26.00 L*	4.90	5.30	6.40	2.40 L	1.10 L	2.40 L	2.20
MAGNESIUM	7439-95-4	mg/kg	NSL	NSL	NSL	--	--	--	--	--	--	--	--	--	--
NICKEL	7440-02-0	mg/kg	150	2,000	38 [m]	--	4.40	4.60	4.80	5.10	4.40	3.90	2.30	3.70	3.30
ZINC	7440-66-6	mg/kg	2,300	31,000	46 [n]	--	--	--	--	--	--	--	--	--	--
Polycyclic Aromatic Hydrocarbons (PAHs)															
ACENAPHTHENE	83-32-9	µg/kg	340,000	3,300,000	29,000 [o]	--	--	--	--	--	--	--	--	--	--
ACENAPHTHYLENE	208-96-8	µg/kg	NSL	NSL	29,000 [o]	--	--	--	--	--	--	--	--	--	--
ANTHRACENE	120-12-7	µg/kg	1,700,000	17,000,000	29,000 [o]	--	--	--	--	--	--	--	--	--	--
BENZO[a]ANTHRACENE	56-55-3	µg/kg	150	2,100	1,100 [o]	--	--	--	--	--	--	--	--	--	--
BENZO[a]PYRENE	50-32-8	µg/kg	15	210	1,100 [o]	--	--	--	--	--	--	--	--	--	--
BENZO[b]FLUORANTHENE	205-99-2	µg/kg	150	2,100	1,100 [o]	--	--	--	--	--	--	--	--	--	--
BENZO[g,h,i]PERYLENE	191-24-2	µg/kg	NSL	NSL	1,100 [o]	--	--	--	--	--	--	--	--	--	--
BENZO[k]FLUORANTHENE	207-08-9	µg/kg	1,500	21,000	1,100 [o]	--	--	--	--	--	--	--	--	--	--
CHRYSENE	218-01-9	µg/kg	15,000	210,000	1,100 [o]	--	--	--	--	--	--	--	--	--	--
DIBENZO[a,h]ANTHRACENE	53-70-3	µg/kg	15	210	1,100 [o]	--	--	--	--	--	--	--	--	--	--
FLUORANTHENE	206-44-0	µg/kg	230,000	2,200,000	29,000 [o]	--	--	--	--	--	--	--	--	--	--
FLUORENE	86-73-7	µg/kg	230,000	2,200,000	29,000 [o]	--	--	--	--	--	--	--	--	--	--
INDENO[1,2,3-cd]PYRENE	193-39-5	µg/kg	150	2,100	1,100 [o]	--	--	--	--	--	--	--	--	--	--
NAPHTHALENE	91-20-3	µg/kg	3,600	18,000	29,000 [o]	--	--	--	--	--	--	--	--	--	--
PHENANTHRENE	85-01-8	µg/kg	NSL	NSL	29,000 [o]	--	--	--	--	--	--	--	--	--	--
PYRENE	129-00-0	µg/kg	170,000	1,700,000	1,100 [o]	--	--	--	--	--	--	--	--	--	--

Table 5-1 Summary of Soil Analytical Results (Continued)

			Screening Values for Visitor/Trespasser [a,b]	Screening Values for Construction Worker, Employee [a,b]	Screening Values for Biota					
		Sample Name:				WFF-MRS7-SB-02-08	WFF-MRS7-SB-02-09	WFF-MRS7-SB-02-10	WFF-MRS7-SS-01-11	WFF-MRS7-SB-02-11
		Sample Date:				12/12/2011	12/12/2011	12/12/2011	12/13/2011	12/13/2011
		Parent Name:								
		Area:				Gun Butt No. 1 and 2	Gun Butt No. 1 and 2	Gun Butt No. 1 and 2	South Bank of Boat Basin	South Bank of Boat Basin
Analyte	**CAS**	**Unit**								
Explosives										
1,3,5-TRINITROBENZENE	99-35-4	mg/kg	220	2,700	NSL	0.10 U	0.09 U	0.10 U	0.09 U	0.09 U
2,4,6-TRINITROTOLUENE	118-96-7	mg/kg	19	79	30 [c]	0.10 U	0.09 U	0.10 U	0.09 U	0.09 U
2,4-DINITROTOLUENE	121-14-2	mg/kg	1.6	5.5	30 [c,d]	--	--	--	0.09 U	0.09 U
2,6-DINITROTOLUENE	606-20-2	mg/kg	6.1	62	30 [c,d]	0.10 U	0.09 U	0.10 U	0.09 U	0.09 U
2-AMINO-4,6-DINITROTOLUENE	35572-78-2	mg/kg	15 [e]	200 [e]	80 [c]	0.10 U	0.09 U	0.10 U	0.04 J	0.09 U
2-NITROTOLUENE	88-72-2	mg/kg	2.9	13	30 [c,d]	--	--	--	0.19 U	0.19 U
3-NITROTOLUENE	99-08-1	mg/kg	0.61	6.2	30 [c,d]	--	--	--	0.19 U	0.19 U
4-AMINO-2,6-DINITROTOLUENE	19406-51-0	mg/kg	15 [e]	190 [e]	80 [c,f]	0.10 U	0.09 U	0.10 U	0.09 U	0.09 U
4-NITROTOLUENE	99-99-0	mg/kg	30	110	30 [c,d]	--	--	--	0.19 U	0.19 U
NITROBENZENE	98-95-3	mg/kg	4.8	24	40 [g]	0.29 U	0.28 U	0.29 U	0.16 J	0.28 U
NITROGLYCERINE	55-63-0	mg/kg	0.61	6.2	NSL	--	--	--	1.90 U	1.90 U
RDX	121-82-4	mg/kg	5.6	24	100 [c]	0.20 U	0.19 U	0.20 U	0.19 U	0.19 U
TETRYL	479-45-8	mg/kg	24	250	25 [c]	0.20 U	0.19 U	0.20 U	0.35 J	0.19 U
Metals										
ALUMINUM	7429-90-5	mg/kg	7,700	99,000	pH < 5.5 [h]	--	--	--	--	--
ANTIMONY	7440-36-0	mg/kg	3.1	41	0.27 [i]	-- R	-- R	-- R	0.02 J	0.21 U
BARIUM	7440-39-3	mg/kg	1,500	19,000	330 [j]	--	--	--	--	--
COPPER	7440-50-8	mg/kg	310	4,100	28 [k]	2.30 J	7.30	5.00	*75.00*	43.00
IRON	7439-89-6	mg/kg	5,500	72,000	NSL	5,200.00	**8,200.00**	**7,900.00**	**6,200.00**	5,000.00
LEAD	7439-92-1	mg/kg	400	800	11 [l]	3.20 L	5.90 L	6.60 L	7.20	12.00
MAGNESIUM	7439-95-4	mg/kg	NSL	NSL	NSL	--	--	--	--	--
NICKEL	7440-02-0	mg/kg	150	2,000	38 [m]	3.90	6.70	7.90	1.60	6.00
ZINC	7440-66-6	mg/kg	2,300	31,000	46 [n]	--	--	--	--	--
Polycyclic Aromatic Hydrocarbons (PAHs)										
ACENAPHTHENE	83-32-9	µg/kg	340,000	3,300,000	29,000 [o]	--	--	--	--	--
ACENAPHTHYLENE	208-96-8	µg/kg	NSL	NSL	29,000 [o]	--	--	--	--	--
ANTHRACENE	120-12-7	µg/kg	1,700,000	17,000,000	29,000 [o]	--	--	--	--	--
BENZO[a]ANTHRACENE	56-55-3	µg/kg	150	2,100	1,100 [o]	--	--	--	--	--
BENZO[a]PYRENE	50-32-8	µg/kg	15	210	1,100 [o]	--	--	--	--	--
BENZO[b]FLUORANTHENE	205-99-2	µg/kg	150	2,100	1,100 [o]	--	--	--	--	--
BENZO[g,h,i]PERYLENE	191-24-2	µg/kg	NSL	NSL	1,100 [o]	--	--	--	--	--
BENZO[k]FLUORANTHENE	207-08-9	µg/kg	1,500	21,000	1,100 [o]	--	--	--	--	--
CHRYSENE	218-01-9	µg/kg	15,000	210,000	1,100 [o]	--	--	--	--	--
DIBENZO[a,h]ANTHRACENE	53-70-3	µg/kg	15	210	1,100 [o]	--	--	--	--	--
FLUORANTHENE	206-44-0	µg/kg	230,000	2,200,000	29,000 [o]	--	--	--	--	--
FLUORENE	86-73-7	µg/kg	230,000	2,200,000	29,000 [o]	--	--	--	--	--
INDENO[1,2,3-cd]PYRENE	193-39-5	µg/kg	150	2,100	1,100 [o]	--	--	--	--	--
NAPHTHALENE	91-20-3	µg/kg	3,600	18,000	29,000 [o]	--	--	--	--	--
PHENANTHRENE	85-01-8	µg/kg	NSL	NSL	29,000 [o]	--	--	--	--	--
PYRENE	129-00-0	µg/kg	170,000	1,700,000	1,100 [o]	--	--	--	--	--

[a] Soil screening values used for visitors/trespassers were based on USEPA (2011) regional screening levels for direct contact with residential soils, while the soil screening values used for construction workers and employees were based on regional screening levels for direct contact with industrial soils. Regional screening levels are available from http://www.epa.gov/reg3hwmd/risk/human/rb-concentration_table/Generic_Tables/index.htm.
[b] For non-carcinogens, with the exception of lead, screening levels were divided by 10 to account for potential exposure to multiple non-carcinogens. No adjustment was made for carcinogens or lead.
[c] Talmage et al. 1999. Talmage, S.S., D.M. Opresko, C.J. Maxwell, C.J.E. Welsh, M. Cretella, P.H. Reno, and F.B. Daniel. Nitroaromatic munition compounds: environmental effects and screening values. Rev. Environ. Contam. Toxicol. 161: 1-156.
[d] Screening level based on 2,4,6-trinitrotoluene.
[e] Screening level based on 2,4-dinitrotoluene.
[f] Screening level based on 2-amino-4,6-dinitrotoluene.
[g] Efroymson, R.A., M.E. Will, and G.W. Suter II. 1997. Toxicological benchmarks for contaminants of potential concern for effects on soil and litter invertebrates and heterotrophic processes: 1997 revision. ES/ER/TM-126/R2. U.S. Department of Energy, Oak Ridge National Laboratory, Oak Ridge,
[h] USEPA. 2003. Ecological Soil Screening Level for Aluminum. Available at: www.epa.gov/ecotox/ecossl/pdf/eco-ssl_aluminum.pdf.
[i] USEPA. 2005b. Ecological Soil Screening Level for Antimony. Available at: www.epa.gov/ecotox/ecossl/pdf/eco-ssl_antimony.pdf.
[j] USEPA. 2005c. Ecological Soil Screening Level for Barium. Available at: www.epa.gov/ecotox/ecossl/pdf/eco-ssl_barium.pdf.
[k] USEPA. 2007a. Ecological Soil Screening Level for Copper. Available at: www.epa.gov/ecotox/ecossl/pdf/eco-ssl_copper.pdf.
[l] USEPA. 2005d. Ecological Soil Screening Level for Lead. Available at: www.epa.gov/ecotox/ecossl/pdf/eco-ssl_lead.pdf.
[m] USEPA. 2007b. Ecological Soil Screening Level for Nickel. Available at: www.epa.gov/ecotox/ecossl/pdf/eco-ssl_nickel.pdf.
[n] USEPA. 2007c. Ecological Soil Screening Level for Zinc. Available at: www.epa.gov/ecotox/ecossl/pdf/eco-ssl_zinc.pdf.
[o] USEPA. 2007d. Ecological Soil Screening Level for Polycyclic Aromatic Hydrocarbons (PAHs). Available at: www.epa.gov/ecotox/ecossl/pdf/eco-ssl_pah.pdf.

B = The analyte was found in the associated method blank at a level that is similar to the sample result.
CAS = Chemical Abstract Service.
J = The associated value is an estimated quantity.
K = Analyte present. Reported value may be biased high. Actual value is expected to be lower.
L = Analyte present. Reported value may be biased low. Actual value is expected to be higher.
µg/kg = Microgram per kilogram.
mg/kg = Milligram per kilogram.
NSL = No screening level.
R = Rejected data. Unreliable result. Analyte may or may not be present in the sample.
U = Not detected. Values listed are reporting limits (RLs).
USEPA = United States Environmental Protection Agency.
-- = Not analyzed if no qualifier is shown. If an R qualifier is shown, the analyte was analyzed but the value was rejected during data validation.

Screening level exceedances were only identified for receptors for which the medium had a potentially completed pathway identified in the SS-WP Addendum.
Shaded and bold values represent detected values that exceed human health screening criteria.
Shaded and italicized values represent detected values that exceed ecological screening criteria.

Table 5-2 Summary of Sediment Analytical Results

			Screening Values for Visitor/Trespasser [a,b]	Screening Values for Construction Worker, Employee [a,b]	Screening Values for Biota [c]									
		Sample Name:				WFF-MRS7-SD-01-01	WFF-MRS7-SD-DUP1	WFF-MRS7-SD-01-02	WFF-MRS7-SD-01-03	WFF-MRS7-SD-01-04	WFF-MRS7-SD-01-05	WFF-MBBG-SD-01	WFF-MBBG-SD-02	WFF-MBBG-SD-03
		Sample Date:				12/13/2010	12/12/2010	12/13/2010	12/13/2010	12/13/2010	12/13/2010	12/14/2011	12/14/2011	12/14/2011
		Parent Name:					WFF-MRS7-SD-01-01							
		Area:				South Bank of Boat Basin	South Bank of Boat Basin	South Bank of Boat Basin	South Bank of Boat Basin	South Bank of Boat Basin	South Bank of Boat Basin			
Analyte	**CAS**	**Unit**												
Explosives														
1,3,5-TRINITROBENZENE	99-35-4	mg/kg	2,200	27,000	0.0024 [d]	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.09 U	--	--	--
2,4,6-TRINITROTOLUENE	118-96-7	mg/kg	190	790	30 [d]	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.09 U	--	--	--
2,4-DINITROTOLUENE	121-14-2	mg/kg	16	55	30 [d]	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.09 U	--	--	--
2,6-DINITROTOLUENE	606-20-2	mg/kg	61	620	30 [d]	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.09 U	--	--	--
2-AMINO-4,6-DINITROTOLUENE	35572-78-2	mg/kg	150 [e]	2,000 [e]	80 [d]	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.09 U	--	--	--
2-NITROTOLUENE	88-72-2	mg/kg	29	130	30 [d]	0.19 U	0.20 U	0.20 U	0.19 U	0.19 U	0.19 U	--	--	--
3-NITROTOLUENE	99-08-1	mg/kg	6.1	62	30 [d]	0.19 U	0.20 U	0.20 U	0.19 U	0.19 U	0.19 U	--	--	--
4-AMINO-2,6-DINITROTOLUENE	19406-51-0	mg/kg	150 [e]	1,900 [e]	80 [d]	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.09 U	--	--	--
4-NITROTOLUENE	99-99-0	mg/kg	300	1,100	30 [d]	0.19 U	0.20 U	0.20 U	0.19 U	0.19 U	0.19 U	--	--	--
NITROBENZENE	98-95-3	mg/kg	48	240	0.021 [f]	0.29 U	0.29 U	0.29 U	0.29 U	0.29 U	0.28 U	--	--	--
NITROGLYCERINE	55-63-0	mg/kg	6.1	62	NSL	1.90 U	2.00 U	2.00 U	1.90 U	1.90 U	1.90 U	--	--	--
RDX	121-82-4	mg/kg	56	240	100 [d]	0.19 U	0.20 U	0.20 U	0.19 U	0.19 U	0.19 U	--	--	--
TETRYL	479-45-8	mg/kg	240	2,500	25 [d]	0.19 U	0.20 U	0.20 U	0.19 U	0.19 U	0.19 U	--	--	--
Metals														
ALUMINUM	7429-90-5	mg/kg	77,000	990,000	58,000 [g]	--	--	--	--	--	--	20,000.00	3,600.00	8,900.00
ANTIMONY	7440-36-0	mg/kg	31	410	2.0 [h]	0.21 U	-- R	0.29 U	0.23 U	0.63 U	0.22 U	0.07 L	0.23 U	1.10 UL
BARIUM	7440-39-3	mg/kg	15,000	190,000	330 [i]	--	--	--	--	--	--	27.00 K	14.00	16.00 K
COPPER	7440-50-8	mg/kg	3,100	41,000	16 [j]	1.80 J	4.50	6.70	4.40	*42.00*	4.60	8.00 J	1.90 J	--
IRON	7439-89-6	mg/kg	55,000	720,000	20,000 [j]	2,400.00	2,200.00	2,400.00	5,500.00	5,600.00	3,500.00	*22,000.00*	3,300.00	4,700.00
LEAD	7439-92-1	mg/kg	400	800	36 [k]	5.20	5.50	9.40	10.00	10.00	8.00	20.00 L	7.50	19.00 L
MAGNESIUM	7439-95-4	mg/kg	NSL	NSL	NSL	--	--	--	--	--	--	7,500.00	450.00	6,300.00
NICKEL	7440-02-0	mg/kg	1,500	20,000	16 [j]	3.80	2.60	3.90	4.10	7.90	5.30	9.20	2.30	--
ZINC	7440-66-6	mg/kg	23,000	310,000	120 [k]	--	--	--	--	--	--	36.00	19.00	16.00

[a] Screening levels for human receptors are derived from USEPA (2011) Regional Screening Levels. Available from http://www.epa.gov/reg3hwmd/risk/human/rb-concentration_table/Generic_Tables/index.htm.

[b] For non-carcinogens, screening levels for soils were divided by 10 to account for potential exposure to multiple non-carcinogens. No initial adjustment was made for carcinogens. The resulting values were multiplied by 10 to account for reduced exposures to sediment compared to soil.

[c] Ecological screening levels are for freshwater environments, except for nitrobenzene and antimony. Freshwater screening levels for nitrobenzene and antimony were not available; therefore, marine screening levels were applied for these analytes.

[d] Talmage et al. 1999. Talmage, S.S., D.M. Opresko, C.J. Maxwell, C.J.E. Welsh, M. Cretella, P.H. Reno, and F.B. Daniel. Nitroaromatic munition compounds: environmental effects and screening values. Rev. Environ. Contam. Toxicol. 161: 1-156.

[e] Screening level based on 2,4-dinitrotoluene.

[f] Buchman, M.F. 2008. Screening Quick Reference Tables (SQuiRTs), NOAA OR&R Report 08-1, Seattle, WA, Office of Response and Restoration Division, National Oceanographic and Atmospheric Administration. 34p.

[g] USEPA. 1996. Calculation and evaluation of sediment effect concentrations for the amphipod Hyalella azteca and the midge Chironomus riparius. EPA 905/R96/008. U.S. Environmental Protection Agency, Great Lakes National Program Office, Chicago, IL.

[h] Long, E.R., and L.G. Morgan. 1990. The potential for biological effects of sediment-sorbed contaminants tested in the national status and trends program. NOAA Technical Memorandum NOS OMA 52.

[i] USEPA. 2005c. Ecological Soil Screening Level for Barium. Available at: www.epa.gov/ecotox/ecossl/pdf/eco-ssl_barium.pdf.

[j] Persaud, D. , R. Jaagumagi, and A. Hayton. 1993. Guidelines for the protection and management of aquatic sediment quality in Ontario. Ontario Ministry of the Environment and Energy. August. ISBN 0-7729-9248-7.

[k] MacDonald, D.D., C.G. Ingersoll, and T.A. Berger. 2000. Development and evaluation of consensus-based sediment quality guidelines for freshwater ecosystems. Arch. Environ. Contam. Toxicol. 39: 20-31.

B = The analyte was found in the associated method blank at a level that is similar to the sample result.
CAS = Chemical Abstract Service.
J = The associated value is an estimated quantity.
K = Analyte present. Reported value may be biased high. Actual value is expected to be lower.
L = Analyte present. Reported value may be biased low. Actual value is expected to be higher.
mg/kg = Milligram per kilogram.
NSL = No screening level.
R = Rejected data. Unreliable result. Analyte may or may not be present in the sample.
U = Not detected. Values listed are reporting limits (RLs).
UL = Not detected. Quantitation limit may be higher.
USEPA = United States Environmental Protection Agency.
-- = Not analyzed if no qualifier is shown. If an R qualifier is shown, the analyte was analyzed but the value was rejected during data validation.

Screening level exceedances were only identified for receptors for which the medium had a potentially completed pathway identified in the SS-WP Addendum.

Shaded and italicized values represent detected values that exceed ecological screening criteria.

Table 5-3 Summary of Surface Water Analytical Results

			Screening Value Human Receptors [a,b]	Screening Value Biota [c]		
		Sample Name:			WFF-MRS7-SW-00-01	WFF-MRS7-SW-DUP1
		Sample Date:			12/13/2011	12/13/2011
		Parent Name:				WFF-MRS7-SW-00-01
		Area:			South Bank of Boat Basin	South Bank of Boat Basin
Analyte	**CAS**	**Unit**				
Explosives						
1,3,5-TRINITROBENZENE	99-35-4	µg/L	460	11 [d]	0.98 U	1.00 U
2,4,6-TRINITROTOLUENE	118-96-7	µg/L	22	90 [d]	0.39 U	0.40 U
2,4-DINITROTOLUENE	121-14-2	µg/L	2.0	310 [e]	0.39 U	0.40 U
2,6-DINITROTOLUENE	606-20-2	µg/L	15	310 [e,f]	0.20 U	0.20 U
2-AMINO-4,6-DINITROTOLUENE	35572-78-2	µg/L	30 [f]	20 [d]	0.20 U	0.20 U
2-NITROTOLUENE	88-72-2	µg/L	2.7	440 [g]	0.39 U	0.40 U
3-NITROTOLUENE	99-08-1	µg/L	1.3	380 [g]	0.39 U	0.40 U
4-AMINO-2,6-DINITROTOLUENE	19406-51-0	µg/L	30 [f]	20 [d,h]	0.20 U	0.20 U
4-NITROTOLUENE	99-99-0	µg/L	37	950 [g]	0.98 U	1.00 U
NITROBENZENE	98-95-3	µg/L	1.2	270 [e]	0.39 U	0.40 U
NITROGLYCERINE	55-63-0	µg/L	1.5	69 [g]	2.90 U	3.00 U
RDX	121-82-4	µg/L	6.1	190 [d]	0.20 U	0.20 U
TETRYL	479-45-8	µg/L	63	NSL	0.24 U	0.24 U
PERCHLORATE	14797-73-0	µg/L	15	NSL	0.50 U	0.50 U

[a] With the exception of perchlorate, screening values for human receptors are derived from USEPA (2011) Regional Screening Levels. Available from http://www.epa.gov/reg3hwmd/risk/human/rb-concentration_table/Generic_Tables/index.htm. The screening value for perchlorate was derived from Department of Defense (DoD). 2009. Perchlorate Release Management Policy. Memorandum from W. Arny to Assistant Secretaries of the Army, Navy, and Air Force, and Director of DLA Enterprise Support. Dated April 22, 2009. Department of Defense, Washington, DC.

[b] For non-carcinogens, screening levels for tap water were divided by 10 to account for potential exposure to multiple non-carcinogens. All values were multiplied by 10 to account for reduced exposures to surface water compared to tap water.

[c] Ecological screening values are for fresh water environments.

[d] Talmage, S.S., D.M. Opresko, C.J. Maxwell, C.J.E. Welsh, M. Cretella, P.H. Reno, and F.B. Daniel. Nitroaromatic munition compounds: environmental effects and screening values. Rev. Environ. Contam. Toxicol. 161: 1-156.

[e] USEPA. 2001. Supplemental Guidance to RAGS: Region 4 Bulletins, Ecological Risk Assessment. Originally published November 1995. Website version last updated November 30, 2001: http://www.epa.gov/region4/waste/ots/ecolbul.htm

[f] Screening value based on 2,4-dinitrotoluene.

[g] TNRCC (Texas Natural Resources Conservation Commission). 2006. Guidance for conducting ecological risk assessments at remediation sites in Texas. RG-263. January 2006 version. 83 pp.

[h] Screening value based on 2-amino-4,6-dinitrotoluene.

CAS = Chemical Abstract Service.
µg/L = Microgram per liter.
U = Not detected. Values listed are reporting limits (RLs).
USEPA = United States Environmental Protection Agency.

Table 5-4 Summary of Groundwater Analytical Results

			Screening Value Human Receptors [a,b]						
		Sample Name:		WFF-MRS7-GW-00-01	WFF-MRS7-GW-00-02	WFF-MRS7-GW-DUP2	WFF-MRS7-GW-00-03	WFF-MRS7-GW-DUP1	WFF-MRS7-GW-00-04
		Sample Date:		12/14/2011	12/14/2011	12/14/2011	12/13/2011	12/13/2011	12/13/2011
		Parent Name:				WFF-MRS7-GW-00-02		WFF-MRS7-GW-00-03	
		Area:		Pyrotechnics Burn Area	Pyrotechnics Burn Area	Pyrotechnics Burn Area	Gun Butt No. 1 and 2	Gun Butt No. 1 and 2	Gun Butt No. 1 and 2
Analyte	**CAS**	**Unit**							
Explosives									
1,3,5-TRINITROBENZENE	99-35-4	µg/L	46	1.00 UJ	1.00 UJ	1.00 UJ	1.10 U	1.10 U	1.10 U
2,4,6-TRINITROTOLUENE	118-96-7	µg/L	2.2	0.42 UJ	0.40 UJ	0.41 UJ	0.44 U	0.44 U	0.44 U
2,4-DINITROTOLUENE	121-14-2	µg/L	0.2	--	--	--	0.44 U	0.44 U	0.44 U
2,6-DINITROTOLUENE	606-20-2	µg/L	1.5	0.21 UJ	0.20 UJ	0.21 UJ	0.22 U	0.22 U	0.22 U
2-AMINO-4,6-DINITROTOLUENE	35572-78-2	µg/L	3.0 [c]	0.21 UJ	0.20 UJ	0.21 UJ	0.22 U	0.22 U	0.22 U
2-NITROTOLUENE	88-72-2	µg/L	0.27	--	--	--	0.44 U	0.44 U	0.44 U
3-NITROTOLUENE	99-08-1	µg/L	0.13	--	--	--	0.44 U	0.44 U	0.44 U
4-AMINO-2,6-DINITROTOLUENE	19406-51-0	µg/L	3.0 [c]	0.21 UJ	0.20 UJ	0.21 UJ	0.22 U	0.22 U	0.22 U
4-NITROTOLUENE	99-99-0	µg/L	3.7	--	--	--	1.10 U	1.10 U	1.10 U
NITROBENZENE	98-95-3	µg/L	0.12	0.42 UJ	0.40 UJ	0.41 UJ	0.44 U	0.44 U	0.44 U
NITROGLYCERINE	55-63-0	µg/L	0.15	--	--	--	3.30 U	3.30 U	3.30 U
RDX	121-82-4	µg/L	0.61	--	--	--	0.22 U	0.22 U	0.22 U
TETRYL	479-45-8	µg/L	6.3	--	--	--	0.26 U	0.27 U	0.27 U
PERCHLORATE	14797-73-0	µg/L	1.5	0.50 U	0.50 U	0.50 U	0.05 U	0.05 U	0.05 U
Metals									
ALUMINUM	7429-90-5	µg/L	1,600	220.00 J	41.00 L	37.00 J	--	--	--
ANTIMONY	7440-36-0	µg/L	0.6	**1.30 J**	**5.70 L**	**4.70 J**	6.00 U	6.00 U	6.00 U
BARIUM	7440-39-3	µg/L	290	55.00	100.00 L	120.00 J	--	--	--
COPPER	7440-50-8	µg/L	62	10.00 U	2.00 UL	10.00 U	0.77 J	3.70 J	1.30 J
IRON	7439-89-6	µg/L	1,100	**2,500.00 J**	39.00 J	40.00 J	**35,000.00 J**	**65,000.00**	**9,000.00**
LEAD	7439-92-1	µg/L	15	2.00 J	1.20 L	1.20 J	1.50 J	4.70 J	1.80 J
MAGNESIUM	7439-95-4	µg/L	NSL	1,200,000.00	1,200,000.00 J	1,300,000.00	--	--	--
NICKEL	7440-02-0	µg/L	30	1.50 J	0.50 B	1.70 J	1.10 J	4.80 J	2.60 J
ZINC	7440-66-6	µg/L	470	43.00 J	4.20 L	15.00 J	--	--	--

[a] With the exception of perchlorate, screening values for human receptors are derived from USEPA (2011) Regional Screening Levels. Available from http://www.epa.gov/reg3hwmd/risk/human/rb-concentration_table/Generic_Tables/index.htm. The screening value for perchlorate was derived from Department of Defense (DoD). 2009. Perchlorate Release Management Policy. Memorandum from W. Arny to Assistant Secretaries of the Army, Navy, and Air Force, and Director of DLA Enterprise Support. Dated April 22, 2009. Department of Defense, Washington, DC.

[b] For non-carcinogens, screening levels for tap water were divided by 10 to account for potential exposure to multiple non-carcinogens. No adjustments were made for carcinogens.

[c] Screening value based on 2,4-dinitrotoluene.

B = The analyte was found in the associated method blank at a level that is similar to the sample result.
CAS = Chemical Abstract Service.
J = Analyte is present. Reported value may not be accurate or precise.
L = Analyte present. Reported value may be biased low. Actual value is expected to be higher.
NSL = No screening level.
U = Not detected. Values listed are reporting limits (RLs).
µg/L = Microgram per liter.
UJ = Not detected. The associated detection limit is an estimate and may be inaccurate or imprecise. Values listed are reporting limits (RLs).
UL = Not detected. Quantitation limit may be higher.
USEPA = United States Environmental Protection Agency.
-- = Not analyzed.

Screening level exceedances were only identified for receptors for which the medium had a potentially completed pathway identified in the SS-WP Addendum.
Shaded and bold values represent detected values that exceed human health screening criteria.

Table 5-5. Non-Detection Concentrations and Screening Values for Human Receptors for Never-Detected Analytes [a]

Analyte	CAS	Units	Minimum Non-Detect Concentration [b]	Maximum Non-Detect Concentration [b]	Screening Value - Visitor/Trespasser [c]	Screening Value - Employee, Construction Worker [c]
Surface Soil						
1,3,5-TRINITROBENZENE	99-35-4	mg/kg	0.09	0.1	220	2,700
2,4,6-TRINITROTOLUENE	118-96-7	mg/kg	0.09	0.1	19	79
2,4-DINITROTOLUENE	121-14-2	mg/kg	0.09	0.1	1.6	5.5
2,6-DINITROTOLUENE	606-20-2	mg/kg	0.09	0.1	6.1	62
2-AMINO-4,6-DINITROTOLUENE	35572-78-2	mg/kg	0.09	0.1	15	200
2-NITROTOLUENE	88-72-2	mg/kg	0.2	0.2	2.9	13
3-NITROTOLUENE	99-08-1	mg/kg	0.2	0.2	0.61	6.2
4-AMINO-2,6-DINITROTOLUENE	19406-51-0	mg/kg	0.09	0.1	15	190
4-NITROTOLUENE	99-99-0	mg/kg	0.2	0.2	30	110
NITROBENZENE	98-95-3	mg/kg	0.3	0.3	4.8	24
NITROGLYCERINE	55-63-0	mg/kg	2	2	0.61	6.2
RDX	121-82-4	mg/kg	0.2	0.2	5.6	24
TETRYL	479-45-8	mg/kg	0.2	0.2	24	250
ACENAPHTHENE	83-32-9	µg/kg	8	10	340,000	3,300,000
ACENAPHTHYLENE	208-96-8	µg/kg	0.8	9	NSL	NSL
DIBENZO[a,h]ANTHRACENE	53-70-3	µg/kg	8	10	15	210
FLUORENE	86-73-7	µg/kg	8	10	230,000	2,200,000
INDENO[1,2,3-cd]PYRENE	193-39-5	µg/kg	8	10	150	2,100
NAPHTHALENE	91-20-3	µg/kg	0.7	2	3,600	18,000
Subsurface Soil						
1,3,5-TRINITROBENZENE	99-35-4	mg/kg	0.09	0.1	220	2,700
2,4,6-TRINITROTOLUENE	118-96-7	mg/kg	0.09	0.1	19	79
2,4-DINITROTOLUENE	121-14-2	mg/kg	0.09	0.09	1.6	5.5
2,6-DINITROTOLUENE	606-20-2	mg/kg	0.09	0.1	6.1	62
2-AMINO-4,6-DINITROTOLUENE	35572-78-2	mg/kg	0.09	0.1	15	200
2-NITROTOLUENE	88-72-2	mg/kg	0.2	0.2	2.9	13
3-NITROTOLUENE	99-08-1	mg/kg	0.2	0.2	0.61	6.2
4-AMINO-2,6-DINITROTOLUENE	19406-51-0	mg/kg	0.09	0.1	15	190
4-NITROTOLUENE	99-99-0	mg/kg	0.2	0.2	30	110
NITROBENZENE	98-95-3	mg/kg	0.3	0.3	4.8	24
NITROGLYCERINE	55-63-0	mg/kg	2	2	0.61	6.2
RDX	121-82-4	mg/kg	0.2	0.2	5.6	24
TETRYL	479-45-8	mg/kg	0.2	0.2	24	250
ANTIMONY	7440-36-0	mg/kg	0.20	0.20	31	410

Table 5-5. Non-Detection Concentrations and Screening Values for Human Receptors for Never-Detected Analytes [a] (continued)

Analyte	CAS	Units	Minimum Non-Detect Concentration [b]	Maximum Non-Detect Concentration [b]	Screening Value - Visitor/Trespasser [c]	Screening Value - Employee, Construction Worker [c]
Sediment						
1,3,5-TRINITROBENZENE	99-35-4	mg/kg	0.09	0.1	2,200	27,000
2,4,6-TRINITROTOLUENE	118-96-7	mg/kg	0.09	0.1	190	790
2,4-DINITROTOLUENE	121-14-2	mg/kg	0.09	0.1	16	55
2,6-DINITROTOLUENE	606-20-2	mg/kg	0.09	0.1	61	620
2-AMINO-4,6-DINITROTOLUENE	35572-78-2	mg/kg	0.09	0.1	150	2,000
2-NITROTOLUENE	88-72-2	mg/kg	0.2	0.2	29	130
3-NITROTOLUENE	99-08-1	mg/kg	0.2	0.2	6.1	62
4-AMINO-2,6-DINITROTOLUENE	19406-51-0	mg/kg	0.09	0.1	150	1,900
4-NITROTOLUENE	99-99-0	mg/kg	0.2	0.2	300	1,100
NITROBENZENE	98-95-3	mg/kg	0.3	0.3	48	240
NITROGLYCERINE	55-63-0	mg/kg	2	2	6.1	62
RDX	121-82-4	mg/kg	0.2	0.2	56	240
TETRYL	479-45-8	mg/kg	0.2	0.2	240	2,500
ANTIMONY	7440-36-0	mg/kg	0.2	0.6	31	410
Surface Water						
1,3,5-TRINITROBENZENE	99-35-4	µg/L	1	1	460	460
2,4,6-TRINITROTOLUENE	118-96-7	µg/L	0.4	0.4	22	22
2,4-DINITROTOLUENE	121-14-2	µg/L	0.4	0.4	2.0	2.0
2,6-DINITROTOLUENE	606-20-2	µg/L	0.2	0.2	15	15
2-AMINO-4,6-DINITROTOLUENE	35572-78-2	µg/L	0.2	0.2	30	30
2-NITROTOLUENE	88-72-2	µg/L	0.4	0.4	2.7	2.7
3-NITROTOLUENE	99-08-1	µg/L	0.4	0.4	1.3	1.3
4-AMINO-2,6-DINITROTOLUENE	19406-51-0	µg/L	0.2	0.2	30	30
4-NITROTOLUENE	99-99-0	µg/L	1	1	37	37
NITROBENZENE	98-95-3	µg/L	0.4	0.4	1.2	1.2
NITROGLYCERINE	55-63-0	µg/L	3	3	1.5	1.5
RDX	121-82-4	µg/L	0.2	0.2	6.1	6.1
TETRYL	479-45-8	µg/L	0.2	0.2	63	63
PERCHLORATE	14797-73-0	µg/L	0.5	0.5	15.0	15.0
Groundwater						
1,3,5-TRINITROBENZENE	99-35-4	µg/L	1	1	46	46
2,4,6-TRINITROTOLUENE	118-96-7	µg/L	0.4	0.4	2.2	2.2
2,4-DINITROTOLUENE	121-14-2	µg/L	0.4	0.4	0.2	0.2
2,6-DINITROTOLUENE	606-20-2	µg/L	0.2	0.2	1.5	1.5
2-AMINO-4,6-DINITROTOLUENE	35572-78-2	µg/L	0.2	0.2	3.0	3.0
2-NITROTOLUENE	88-72-2	µg/L	0.4	0.4	0.27	0.27
3-NITROTOLUENE	99-08-1	µg/L	0.4	0.4	0.13	0.13
4-AMINO-2,6-DINITROTOLUENE	19406-51-0	µg/L	0.2	0.2	3.0	3.0
4-NITROTOLUENE	99-99-0	µg/L	1	1	3.7	3.7
NITROBENZENE	98-95-3	µg/L	0.4	0.4	0.12	0.12
NITROGLYCERINE	55-63-0	µg/L	3	3	0.15	0.15
RDX	121-82-4	µg/L	0.2	0.2	0.61	0.61
TETRYL	479-45-8	µg/L	0.3	0.3	6.3	6.3
PERCHLORATE	14797-73-0	µg/L	0.05	0.5	1.5	1.5
ANTIMONY	7440-36-0	µg/L	6	6	0.6	0.6
COPPER	7440-50-8	µg/L	2	10	62	62

[a] Analytes were not detected within any one or more subareas.
[b] Detection limits are reporting limits (RLs).
[c] Screening levels for human receptors are derived from USEPA (2011) Regional Screening Levels for residential and industrial soils. Available from http://www.epa.gov/reg3hwmd/risk/human/rb-concentration_table/Generic_Tables/index.htm.
Perchlorate value derived from Department of Defense (DoD). 2009. Perchlorate Release Management Policy. Memorandum from W. Arny to Assistant Secretaries of the Army, Navy, and Air Force, and Director of DLA Enterprise Support. Dated April 22, 2009. Department of Defense, Washington, DC.
For non-carcinogens, screening levels were divided by 10 to account for potential exposure to multiple non-carcinogens. No adjustment was made for carcinogens.
The USEPA screening levels for 2-amino-4,6-DNT and 4-amino-2,6-DNT are based on toxicity information for 2,4-DNT.

Shading indicates instances where the RL was greater than the screening value.

CAS = Chemical Abstract Service.
µg/kg = Microgram per kilogram.
mg/L = Microgram per liter.
mg/kg = Milligram per kilogram.
USEPA = United States Environmental Protection Agency.

Table 5-6. Non-Detection Concentrations and Screening Values for Ecological Receptors for Never-Detected Analytes [a]

Analyte	CAS	Units	Minimum Non-Detect Concentration [b]	Maximum Non-Detect Concentration [b]	Screening Value - Biota [c]
Surface Soil					
1,3,5-TRINITROBENZENE	99-35-4	mg/kg	0.09	0.1	NSL
2,4,6-TRINITROTOLUENE	118-96-7	mg/kg	0.09	0.1	30
2,4-DINITROTOLUENE	121-14-2	mg/kg	0.09	0.1	30
2,6-DINITROTOLUENE	606-20-2	mg/kg	0.09	0.1	30
2-AMINO-4,6-DINITROTOLUENE	35572-78-2	mg/kg	0.09	0.1	80
2-NITROTOLUENE	88-72-2	mg/kg	0.2	0.2	30
3-NITROTOLUENE	99-08-1	mg/kg	0.2	0.2	30
4-AMINO-2,6-DINITROTOLUENE	19406-51-0	mg/kg	0.09	0.1	80
4-NITROTOLUENE	99-99-0	mg/kg	0.2	0.2	30
NITROBENZENE	98-95-3	mg/kg	0.3	0.3	40
NITROGLYCERINE	55-63-0	mg/kg	2.0	2.00	NSL
RDX	121-82-4	mg/kg	0.2	0.2	100
TETRYL	479-45-8	mg/kg	0.2	0.2	25
ACENAPHTHENE	83-32-9	µg/kg	8	10	29,000
ACENAPHTHYLENE	208-96-8	µg/kg	0.8	9	29,000
DIBENZO[a,h]ANTHRACENE	53-70-3	µg/kg	8	10	1,100
FLUORENE	86-73-7	µg/kg	8	10	29,000
INDENO[1,2,3-cd]PYRENE	193-39-5	µg/kg	8	10	1,100
NAPHTHALENE	91-20-3	µg/kg	0.7	2	29,000
Sediment					
1,3,5-TRINITROBENZENE	99-35-4	mg/kg	0.09	0.1	0.0024
2,4,6-TRINITROTOLUENE	118-96-7	mg/kg	0.09	0.1	30
2,4-DINITROTOLUENE	121-14-2	mg/kg	0.09	0.1	30
2,6-DINITROTOLUENE	606-20-2	mg/kg	0.09	0.1	30
2-AMINO-4,6-DINITROTOLUENE	35572-78-2	mg/kg	0.09	0.1	80
2-NITROTOLUENE	88-72-2	mg/kg	0.2	0.2	30
3-NITROTOLUENE	99-08-1	mg/kg	0.2	0.2	30
4-AMINO-2,6-DINITROTOLUENE	19406-51-0	mg/kg	0.09	0.1	80
4-NITROTOLUENE	99-99-0	mg/kg	0.2	0.2	30
NITROBENZENE	98-95-3	mg/kg	0.3	0.3	0.021
NITROGLYCERINE	55-63-0	mg/kg	2	2	NSL
RDX	121-82-4	mg/kg	0.2	0.2	100
TETRYL	479-45-8	mg/kg	0.2	0.2	25
ANTIMONY	7440-36-0	mg/kg	0.2	0.6	2

Table 5-6. Non-Detection Concentrations and Screening Values for Ecological Receptors for Never-Detected Analytes [a] (continued)

Analyte	CAS	Units	Minimum Non-Detect Concentration [b]	Maximum Non-Detect Concentration [b]	Screening Value - Biota [c]
Surface Water					
1,3,5-TRINITROBENZENE	99-35-4	µg/L	1	1	11
2,4,6-TRINITROTOLUENE	118-96-7	µg/L	0.4	0.4	90
2,4-DINITROTOLUENE	121-14-2	µg/L	0.4	0.4	310
2,6-DINITROTOLUENE	606-20-2	µg/L	0.2	0.2	310
2-AMINO-4,6-DINITROTOLUENE	35572-78-2	µg/L	0.2	0.2	20
2-NITROTOLUENE	88-72-2	µg/L	0.4	0.4	440
3-NITROTOLUENE	99-08-1	µg/L	0.4	0.4	380
4-AMINO-2,6-DINITROTOLUENE	19406-51-0	µg/L	0.2	0.2	20
4-NITROTOLUENE	99-99-0	µg/L	1	1	950
NITROBENZENE	98-95-3	µg/L	0.4	0.4	270
NITROGLYCERINE	55-63-0	µg/L	3	3	69
RDX	121-82-4	µg/L	0.2	0.2	190
TETRYL	479-45-8	µg/L	0.2	0.2	NSL
PERCHLORATE	14797-73-0	µg/L	0.5	0.5	NSL

[a] Analytes were not detected within any one or more subareas.

[b] Detection limits are reporting limits (RLs).

[c] Screening values for biota are from the following sources:

Talmage et al. 1999. Talmage, S.S., D.M. Opresko, C.J. Maxwell, C.J.E. Welsh, M. Cretella, P.H. Reno, and F.B. Daniel. Nitroaromatic munition compounds: environmental effects and screening values. Rev. Environ. Contam. Toxicol. 161: 1-156.

Buchman, M.F. 2008. Screening Quick Reference Tables (SQuiRTs), NOAA OR&R Report 08-1, Seattle, WA, Office of Response and Restoration Division, National Oceanographic and Atmospheric Administration. 34p.

Efroymson et al. 1997. Efroymson, R.A., M.E. Will, and G.W. Suter II. 1997. Toxicological benchmarks for contaminants of potential concern for effects on soil and litter invertebrates and heterotrophic processes: 1997 revision. ES/ER/TM-126/R2. U.S. Department of Energy, Oak Ridge National Laboratory, Oak Ridge, TN.

Long, E.R., and L.G. Morgan. 1990. The potential for biological effects of sediment-sorbed contaminants tested in the national status and trends program. NOAA Technical Memorandum NOS OMA 52.

TNRCC (Texas Natural Resources Conservation Commission). 2006. Guidance for conducting ecological risk assessments at remediation sites in Texas. RG-263. January 2006 version. 83 pp.

USEPA. 2001. Supplemental Guidance to RAGS: Region 4 Bulletins, Ecological Risk Assessment. Originally published November 1995. Website version last updated November 30, 2001: http://www.epa.gov/region4/waste/ots/ecolbul.htm.

USEPA. 2007d. Ecological Soil Screening Level for Polycyclic Aromatic Hydrocarbons (PAHs). Available at: www.epa.gov/ecotox/ecossl/pdf/eco-ssl_pah.pdf.

Soil screening values for 2,4-dinitrotoluene, 2,6-dinitrotoluene, 2-nitrotoluene, 3-nitrotoluene, and 4-nitrotoluene are based on 2,4,6-trinitrotoluene.

The screening values for 4-amino-2,6-dinitrotoluene are based on 2-amino-4,6-dinitrotoluene.

The surface water screening value for 2,6-dinitrotoluene is based on 2,4-dinitrotolene.

CAS = Chemical Abstract Service.
µg/kg = Microgram per kilogram.
mg/L = Microgram per liter.
mg/kg = Milligram per kilogram.
NSL = No screening level.
USEPA = United States Environmental Protection Agency.

Table 5-7. Comparison of Onsite and Background Concentrations for Metals at the Pyrotechnics Burn Area within MRS 7 [a]

		Onsite: Pyrotechnics Burn Area				Background				Comparisons	
Chemical	Units	Detection Frequency	Minimum Concentration/ Qualifier [b]	Maximum Concentration/ Qualifier [c]	Mean Concentration [d]	Detection Frequency	Minimum Concentration/ Qualifier [b]	Maximum Concentration/ Qualifier [c]	Mean Concentration [d]	Site Maximum > Background Maximum	Site Mean > Background Mean
Surface Soil											
ANTIMONY	mg/kg	5/5	0.11 J	1.90	0.87	--	--	--	--	--	--
COPPER	mg/kg	5/5	15.0	39.0	24.2	9/9	2.10	33.0	8.91	YES	YES
IRON	mg/kg	5/5	1,100	7,800	3,860	10/10	1,740	10,900	7,590	NO	NO
LEAD	mg/kg	5/5	31.0 L	290 L	106	10/10	4.90	124	30.6	YES	YES
ZINC	mg/kg	5/5	83.0	1900 J	615	10/10	4.50	104	29.4	YES	YES
Subsurface Soil											
ALUMINUM	mg/kg	4/4	1,100	30,000	16,000	11/11	5,380	22,400	14,100	YES	YES
IRON	mg/kg	4/4	460	15,000	6,830	11/11	3,040	17,900	10,800	NO	NO
Groundwater											
IRON	µg/L	3/3	39 J	2500 J	860	11/12	452	50,000 J	11,800	NO	NO

[a] Historical background data was used for comparison to site samples (Tables 4.6, 4.24, 4.25; NASA 2004).
[b] Minimum concentration of analyte detected.
[c] Maximum concentration of analyte detected.
[d] Non-detects are carried forth as one-half of the reporting limit (RL) in the calculation of the mean concentration.

-- = Not available, no detected values. Chemical not detected in background, therefore comparison to site is not meaningful.
J = The associated value is an estimated quantity.
L = Analyte present. Reported value may be biased low. Actual value is expected to be higher.
µg/L = Microgram per liter.
mg/kg = Milligram per kilogram.
NASA. 2004. Background Soil and Groundwater Investigation Report for the Main Base. NASA Wallops Flight Facility, Wallops Islands, Virginia. National Aeronautics and Space Administration, Goddard Space Flight Center.

Table 5-8. Comparison of Onsite and Background Concentrations for Metals at Gun Butt No. 1 and 2 within MRS 7 [a]

		Onsite: Gun Butt No. 1 and 2				Background				Comparisons	
Chemical	Units	Detection Frequency	Minimum Concentration/ Qualifier [b]	Maximum Concentration/ Qualifier [c]	Mean Concentration [d]	Detection Frequency	Minimum Concentration/ Qualifier [b]	Maximum Concentration/ Qualifier [c]	Mean Concentration [d]	Site Maximum > Background Maximum	Site Mean > Background Mean
Surface Soil											
COPPER	mg/kg	15/15	2.70	92.0	22.8	9/9	2.10	33.0	8.91	YES	YES
IRON	mg/kg	15/15	2,100	10,000	5,910	10/10	1,740	10,900	7,590	NO	NO
LEAD	mg/kg	15/15	2.60	46.0	13.1	10/10	4.90	124	30.6	NO	NO
Subsurface Soil											
IRON	mg/kg	7/7	1,100	8,200	5,043	11/11	3,040	17,900	10,800	NO	NO
Groundwater											
IRON	µg/L	3/3	9,000	65,000	36,300	11/12	452	50,000 J	11,800	YES	YES

[a] Historical background data was used for comparison to site samples (Tables 4.6, 4.24, 4.25; NASA 2004).
[b] Minimum concentration of analyte detected.
[c] Maximum concentration of analyte detected.
[d] Non-detects are carried forth as one-half of the reporting limit (RL) in the calculation of the mean concentration.

J = The associated value is an estimated quantity.
L = Analyte present. Reported value may be biased low. Actual value is expected to be higher.
µg/L = Microgram per liter.
mg/kg = Milligram per kilogram.
NASA. 2004. Background Soil and Groundwater Investigation Report for the Main Base. NASA Wallops Flight Facility, Wallops Islands, Virginia. National Aeronautics and Space Administration, Goddard Space Flight Center.

Table 5-9. Comparison of Onsite and Background Concentrations for Metals at the South Bank of Boat Basin within MRS 7 [a]

		Onsite: South Bank of Boat Basin				Background				Comparisons	
Chemical	Units	Detection Frequency	Minimum Concentration/ Qualifier [b]	Maximum Concentration/ Qualifier [c]	Mean Concentration [d]	Detection Frequency	Minimum Concentration/ Qualifier [b]	Maximum Concentration/ Qualifier [c]	Mean Concentration [d]	Site Maximum > Background Maximum	Site Mean > Background Mean
Surface Soil											
COPPER	mg/kg	1/1	75.0	75.0	NA	9/9	2.10	33.0	8.91	YES	NA
IRON	mg/kg	1/1	6,200	6,200	NA	10/10	1,740	10,900	7,590	NO	NA
Sediment											
COPPER	mg/kg	6/6	1.80 J	42.0	10.7	2/2	1.90 J	8.00 J	4.95	YES	YES

[a] With the exception of sediment samples, historical surface soil background data was used for comparison to site surface soil samples (Table 4.24; NASA 2004).
[b] Minimum concentration of analyte detected.
[c] Maximum concentration of analyte detected.
[d] Non-detects are carried forth as one-half of the reporting limit (RL) in the calculation of the mean concentration.

J = The associated value is an estimated quantity.
mg/kg = Milligram per kilogram.
NA = Not applicable, only one site sample was obtained.
NASA. 2004. Background Soil and Groundwater Investigation Report for the Main Base. NASA Wallops Flight Facility, Wallops Islands, Virginia. National Aeronautics and Space Administration, Goddard Space Flight Center.

6. SUMMARY AND CONCLUSIONS

6.0.1 WFF Project 07 is located in Accomack County, VA and contains one MRS: MRS 7, Boat Basin/Visitors Information Center. MRS 7 is approximately 1.53 acres of land located at the Main Base Sector of WFF. MRS 7 was used by NAOTS between 1946 and 1959 and has four areas: Pyrotechnics Burn Area, Gun Butt No. 1, Gun Butt No. 2, and South Bank of Boat Basin. The South Bank of Boat Basin had no known munitions use; however, numerous munitions items have been observed in this area. The other areas were used for testing, firing, or disposing of munitions. A summary of the results and conclusions is presented below and is summarized in Table 6-1.

6.1 Boat Basin/Visitors Information Center (MRS 7)

6.1.1 Potential human receptors for the WFF Project 07 include visitors/trespassers, construction workers, and employees, and residents (future only). Potential ecological receptors are soil invertebrates, terrestrial-feeding mammals, and terrestrial-feeding birds.

6.1.2 Since military use of WFF Project 07 ceased by 1959, MD have been observed in the four areas within WFF Project 07. Only spent and inert MD have been observed historically, and no confirmed MEC was found during the SI field activities. However, MPPEH items were observed that could not be determined to not contain energetic material. Based on the confirmed known finds (inert) of the MD observed at MRS 7, and the condition of MPPEH items found during field activities (too rusty to determine), the possible presence of a MEC source is moderate. The human interaction, accessibility, and site stability categories are rated as moderate. Therefore the qualitative MEC hazard evaluation for MRS 7 is moderate.

6.1.3 In the SS-WP, surface soil, sediment, and surface water were media with potentially complete exposure pathways for human and ecological receptors at the WFF Project 07. In addition, subsurface soil and groundwater were identified as media with potentially complete exposure pathways for human receptors. Metal MCs were detected above background concentrations in surface and subsurface soil, sediment, and groundwater; therefore, the pathways are complete for these media. No MC were detected in surface water above background concentrations; however, since the RL for NG is higher than the human health screening level, the pathway is noted as being potentially complete.

6.2 Pyrotechnics Burn Area

6.2.1 In surface soil, no explosive constituents or PAHs were detected above their respective RLs. Iron was the only COPC identified for surface soil. Iron was detected below background concentrations; therefore, based on the limited data available for evaluation (samples could not be collected from within the fenced Pyrotechnics Burn Area), no risks to human receptors from FUDS-related activities were determined. Antimony, copper, lead, and zinc were the only COPECs identified in surface soil. Based on the infrequent and negligible exceedance of the eco-SSL for copper, it is not assumed to present a potential risk. Potential risks to ecological receptors from antimony, lead, and zinc in surface soil were identified.

6.2.2 In subsurface soil, explosive constituents were not detected above their respective RLs. Aluminum and iron were the only identified COPCs. Aluminum in subsurface soil is not expected to have an adverse impact on human receptors based on the conservatism in the HHRA SL used to identify aluminum as a COPC. Iron was detected below background concentrations; therefore, based on the limited data available for evaluation (samples could not be collected from within the fenced Pyrotechnics Burn Area), no risk to human receptors from FUDS-related activities were determined. Aluminum and iron are not CERCLA hazardous substances.

6.2.3 In groundwater, explosive constituents were not detected above their respective RLs. Antimony and iron were the only MC identified as COPCs. Iron was detected below background concentrations; therefore, based on the limited data available for evaluation (samples could not be collected from within the fenced Pyrotechnics Burn Area), no risks to human receptors from FUDS-related activities were determined. Based on the limited data available, the WOE evaluation for antimony indicated no potentially unacceptable risks.

6.3 Gun Butts No. 1 and 2

6.3.1 In surface and subsurface soil, explosive constituents were not detected above their respective RLs. Iron was identified as a COPC in surface and subsurface soil; however, iron detections were below background concentrations. Based on the data available, no risks from FUDS-related activities were determined in surface or subsurface soil for human receptors. Copper and lead were identified as COPECs in surface soil. Lead was detected below background concentrations (no FUDS-related risk) and is not expected to present a potential risk due to infrequent and negligible exceedance of the eco-SSL. Copper is not expected to present a potential risk to ecological receptors due to infrequent and negligible exceedance of eco-SSL.

6.3.2 In groundwater, explosive constituents were not detected above their respective RLs. Iron was the only COPC identified in groundwater and was assumed to represent a potentially

unacceptable risk in groundwater based on the WOE evaluation. However, iron is not a CERCLA hazardous substance.

6.4 South Bank of Boat Basin

6.4.1 In surface soil, explosive constituents were not detected above their respective SLs. Iron was the only COPC identified for surface soil; however, no unacceptable human health risks are expected based on the WOE evaluation. Therefore, based on the limited data available for evaluation, no risks from FUDS-related activities were determined for human receptors. Copper was identified as a COPEC in surface soil; however, it is not expected to present a potential risk due to infrequent and negligible exceedance of eco-SSL. In subsurface soil, none of the detected MCs exceeded their respective screening criteria selected for the HHRA; therefore, no COPCs were identified.

6.4.2 In sediment, explosive constituents were not detected above their respective RLs. None of the detected MCs in sediment exceeded their respective screening criteria selected for the HHRA; therefore, no COPCs were identified. Copper was identified as a COPEC in sediment. Based on the infrequent and negligible exceedance of the SL, no unacceptable risk from copper in sediment was determined for ecological receptors.

6.4.3 Surface water samples collected from the Boat Basin did not have detections of MC above the screening criteria selected for the HHRA or the SLERA; therefore, no COPCs or COPECs were identified.

Table 6-1
Summary of Human Health and Ecological Screening Level Risk Assessment Results at WFF - Project 07

	Pyrotechnics Burn Area		Gun Butt No. 1 and 2		South Bank of Boat Basin	
Medium	**Human Health COPCs (HHRA) [a]**	**Ecological COPECs (SLERA) [a]**	**Human Health COPCs (HHRA) [a]**	**Ecological COPECs (SLERA) [a]**	**Human Health COPCs (HHRA) [a]**	**Ecological COPECs (SLERA) [a]**
Surface Soil	Iron exceeds screening criterion. COPC. Iron does not exceed background. No risks from FUDS-related activities are determined.	Antimony, copper, lead and zinc exceed screening criterion. COPECs. Potentially unacceptable risk from antimony, lead and zinc based on WOE.	Iron exceeds screening criterion. COPC. Iron does not exceed background. No risks from FUDS-related activities are determined.	Copper and lead exceed screening criterion. COPECs. Lead does not exceed background. No lead risks from FUDS-related activities and no potentially unacceptable risk from copper based on WOE.	Iron exceeds screening criterion. COPC. No potentially unacceptable risk for iron based on WOE.	Copper exceeds screening criterion. COPEC. Potentially unacceptable risk for copper.
Subsurface Soil	Aluminum and iron exceeds screening criterion. COPCs. Iron does not exceed background. No iron risks from FUDS-related activities and no aluminum risks based on WOE.	--	Iron exceeds screening criterion. COPC. Iron does not exceed background. No risks from FUDS-related activities are determined.	--	No exceedance of screening criteria. No COPCs.	--
Sediment	--	--	--	--	No exceedance of screening criteria. No COPCs.	Copper exceeds screening criterion. COPEC. No potentially unacceptable risk for copper based on WOE.
Surface Water	--	--	--	--	No exceedance of screening criteria. No COPCs.	No exceedance of screening criteria. No COPECs.
Groundwater	Antimony and iron exceed screening criteria. COPCs. Iron does not exceed background. No iron risks from FUDS-related activities and no antimony risks based on WOE..	--	Iron exceeds screening criterion. COPC. Potentially unacceptable risk from iron.	--	--	--

[a] Sources and derivations of screening levels for all receptors and environmental media in the HHRA and SLERA are detailed in Tables 5-1

COPC = Chemical of potential concern.
COPEC = Chemical of potential environmental concern.
HHRA = Human health risk assessment.
MRS = Munitions Response Site.
SLERA = Screening level ecological risk assessment.

-- = Samples not analyzed for specific receptors within specific MRS, in accordance with CSM and SS-WP.

7. RECOMMENDATIONS FOR FURTHER ACTION

7.0.1 Based on the results and conclusions of this SI, the following recommendations are provided:

MRS 7 (Boat Basin/Visitors Information Center) Land Portion **–** An RI/FS is recommended for MRS 7. Additional studies should focus on MEC and MC. The qualitative MEC hazard was rated as moderate for MRS 7. No MEC is known to have been found historically and confirmed MEC was not observed during this SI; however, numerous MD is known to have been found at MRS 7 historically and during this SI. Numerous surface and 37 subsurface anomalies and five areas of concentrated subsurface anomalies (not individually counted) were detected at MRS 7 during the 2011 SI field event. Three MD and seven surface MPPEH (20mm, larger than 20mm, burnt pyrotechnic items) were observed during the SI field activities. The SI is a limited scope study and does not include the intrusive investigation of subsurface anomalies. Iron was detected in groundwater collected at Gun Butts No. 1 and 2 (COPC) above the background concentrations and may present a potentially unacceptable risk to human receptors at MRS 7; however, iron is not a CERCLA hazardous substance, so it was not used as the sole basis for an RI/FS recommendation. Antimony, copper, lead, and zinc were detected (COPECs) in surface soil and may present a potentially unacceptable risk to ecological receptors at the MRS 7. During field activities, samples were not collected within the Pyrotechnics Burn Area due to the high concentration of subsurface anomalies (i.e., an anomaly free sample location could not be identified). Therefore, samples could not be collected from the location most likely to contain the highest MC concentrations. This limitation, and that subsurface anomalies could not be investigated, were considered when recommending further work at MRS 7.

7.0.2 Neither a TCRA nor a NTCRA are recommended for WFF Project 07.

7.0.3 The Pyrotechnics Burn Area was found to be incorrectly positioned in the USACE-provided GIS. The correct location, as confirmed by visual evidence of burning contained within a deteriorated fence matching the description of the area cited in historical documents, was observed to be near the southwestern corner of the Pyrotechnic Burn Area. GPS coordinates were collected at each corner of the fence, which was approximately 500 square ft (20 ft by 25 ft). USACE should revise the MRS 7 GIS to reorient the Pyrotechnics Burn Area to encompass

the four GPS coordinates collected during the 2011 SI field activities, as shown on the figures and Table 3-1 in this SI.

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APPENDIX A – SCOPE OF WORK

Located on CD.

APPENDIX B – TECHNICAL PROJECT PLANNING MEMORANDUM

- Data Quality Objective Verification Worksheets
- Technical Project Planning (TPP) #1 Memorandum (Located on CD)
- TPP #2 Memorandum (Located on CD)
- Public Notice of Availability of Munitions Response Site Prioritization Protocol (MRSPP) (Located on CD)

Data Quality Objective Verification Worksheet			
Site: **Wallops Flight Facility Project 07**			
Project: FUDS MMRP SI Project Number **C03VA030107**			
DQO Statement Number: **1 of 4**			
DQO Element Description	**Site-Specific DQO Statement**	**Attained?**	**Required Corrective Action**
Intended Data Use(s):			
Project Objective(s) Satisfied	Determine if the site requires additional investigation through a remedial investigation/feasibility study (RI/FS) or if the site may be recommended for No Department of Defense Action Indicated (NDAI) designation based on the presence or absence of munitions and explosives of concern (MEC) and munitions constituents (MC).	Yes__X__ No ____	
Data Needs Requirements:			
Data User Perspective(s)	Risk-MEC and MC, Compliance	Yes__X__ No ____	
Contaminant or Characteristic of Interest	MEC or Material Potentially Presenting an Explosive Hazard (MPPEH) and MC.	Yes__X__ No ____	
Media of Interest	MEC: Surface and subsurface MC: Surface soil, Subsurface soil, Sediment, Surface Water and Groundwater (media varies per MRS, refer to the SS-WP for more detail)	Yes__X__ No ____	
Required Sampling Locations or Areas	MEC and MC: Areas where military munition-related operations occurred and/or where MEC or MPPEH has been identified historically based on existing documentation and interviews.	Yes__X__ No ____	
Number of Samples Required	MEC - Analog geophysical and visual reconnaissance data will be collected to accomplish this objective. These data will be collected using "meandering path" to and from the sampling points. The UXO Technician will collect data on an approximate 6-ft wide path using the geophysical equipment. The visual reach of observations is approximately 12 ft, and may be limited by the presence of vegetation. Once at the individual sampling point, the geophysical equipment will be used to assess an approximately 25-ft diameter circle for anomalies around the sampling point as site conditions permit. In some areas, there may be limitations to the ability to complete geophysical and visual observations. The total estimated area on the paths to/from the sampling locations is approximately 48,550 ft^2, and the area around the sampling locations is approximately 7,840 ft^2 (See Figure 8 in the SS-WP). MC –Collection of twelve surface soil samples, ten subsurface soil samples, seven sediment samples, one surface water sample and four groundwater samples (as well as appropriate QA/QC samples).	Yes__X__ No ____	

Data Quality Objective Verification Worksheet			
Site: **Wallops Flight Facility Project 07**			
Project: FUDS MMRP SI Project Number **C03VA030107**			
DQO Statement Number: **1 of 4**			
DQO Element Description	**Site-Specific DQO Statement**	**Attained?**	**Required Corrective Action**
Reference Concentration of Interest or Other Performance Criteria	MEC: If historical data indicate the presence of MEC and one anomaly classified as of MPPEH or confirmed MEC is found at the surface with the analog geophysical equipment, or if physical evidence indicating the presence of MEC is found during the visual inspection, then an RI/FS may be recommended. If no anomalies, MPPEH, or confirmed MEC are found, or if the UXO Technician indicates that there is no potential hazard from past use of munitions or MEC discoveries, then an NDAI designation may be recommended. In each of these instances, lines of evidence (e.g., historical data, field data, etc.) will be used to make a final recommendation for an NDAI designation or RI/FS. In both instances (RI/FS or NDAI designation), lines of evidence (e.g., historical data, field data, background concentration of metals, etc. for both MEC and MC) will be used to make a final recommendation for an NDAI designation or RI/FS.	Yes__X__ No ____	
	MC: If the maximum concentrations measured at the site exceed United States Environmental Protection Agency (USEPA) Regional Screening Levels based on current and future land use, or ecological risk screening values, or site-specific background levels (highest value), then an RI/FS may be recommended for the site. If the maximum concentrations measured at the site do not exceed the USEPA Regional Screening Levels or ecological risk screening values, then an NDAI designation may be recommended. In summary, lines of evidence including secondary lines of evidence, such as historical data, field data, and comparison to regional background concentration ranges for metals, may be used to make a final recommendation for an NDAI designation or RI/FS. Screening values selected for comparison at this site are specified in the chemical-specific measurement quality objective (MQO) tables.	Yes__X__ No ____	
Appropriate Sampling and Analysis Methods:			
Sampling Method and Depths	MEC: Geophysics will be conducted with handheld analog equipment, which is accurate to a depth of approximately 2 ft. The geophysical equipment does not have the capability to store data; therefore, Global Positioning System (GPS) equipment will be used to log locations of MEC items encountered. The data collected by the GPS is used to generate the figures in the SI Report. Visual observations will provide a continuous source of additional information which will be noted in the field log book with GPS coordinates. Photographs also will be used as an additional documentation method. Geophysical methods/procedures are described in detail in Section 3 of the SS-WP, and the Field Activities section of the programmatic field sampling plan (PFSP). MC: Sampling methods for MC are described in detail in Section 4 of the SS-WP and Field Activities section of the PFSP.	Yes__X__ No ____	

Data Quality Objective Verification Worksheet			
Site: **Wallops Flight Facility Project 07**			
Project: FUDS MMRP SI Project Number **C03VA030107**			
DQO Statement Number: **1 of 4**			
DQO Element Description	**Site-Specific DQO Statement**	**Attained?**	**Required Corrective Action**
Analytical Method	MEC: Analytical methods are not used with analog geophysics. However, trained UXO professionals, engineers, and scientists will review data (historical data and MEC field observations) to determine whether evidence gathered indicates the presence or absence of MEC. This MEC analysis will be subject to an internal review by other qualified personnel who are independent of the field team within TPMC, and by the USACE Baltimore District Design Center (CENAB), USACE North Atlantic Norfolk (CENAO), and USACE Center of Expertise. MC: The methods that can be used for analysis include the following: Polycyclic Aromatic Hydrocarbons (PAHs) Method–8270C, Method 6860 for perchlorate, Explosives Methods–8330A (reduced list), Methods 8330A (mod); Metals Methods–6010B (reduced) and 6020; Perchlorate Method–8312M; PAHs Prep Method - 3540C; Explosives Prep Methods - 8330A, 8330A (mod); Perchlorate Prep Method–8312M;Metals Prep Method – 3050B.	Yes__X__ No ____	

Data Quality Objective Verification Worksheet			
Site: **Wallops Flight Facility Project 07**			
Project: FUDS MMRP SI Project Number **C03VA030107**			
DQO Statement Number: **2 of 4**			
DQO Element Description	**Site-Specific DQO Statement**	**Attained?**	**Required Corrective Action**
Intended Data Use(s):			
Project Objective(s) Satisfied	Determine the potential need for a Time-Critical Removal Action (TCRA) for MEC and MC by collecting data from previous investigations/reports, conducting site visits, performing analog geophysical activities, and by collecting MC samples.	Yes__X__ No ____	
Data Needs Requirements:			
Data User Perspective(s)	Risk-MEC and MC, Compliance	Yes__X__ No ____	
Contaminant or Characteristic of Interest	MEC or Material Potentially Presenting an Explosive Hazard (MPPEH) and MC	Yes__X__ No ____	
Media of Interest	MEC: Surface and subsurface MC: Surface soil, Subsurface soil, Sediment, Surface Water and Groundwater (media varies per MRS, refer to the SS-WP for more detail)	Yes__X__ No ____	
Required Sampling Locations or Areas	Areas where military munitions-related operations occurred and/or where MEC or MPPEH has been identified historically based on existing documentation and interviews [*See Figure 8 of the SS-WP*].	Yes__X__ No ____	
Number of Samples Required	Refer to DQO 1 for MC/MEC sampling parameters.	Yes__X___ No _____	
Reference Concentration of Interest or Other Performance Criteria	If MC is reported in samples collected at the FUDS at concentrations exceeding screening criteria and those exceedances result in unacceptable risk and an imminent threat to receptors as identified through human health and ecological risk assessments or if one piece of confirmed MEC is found with the magnetometer or if physical evidence indicating the presence of MEC is found during the visual inspection, and if the item(s) is determined by a qualified UXO Technician, explosive ordnance disposal (EOD) unit, and/or the USACE to be an immediate or imminent threat, then one of two actions may be initiated:	Yes__X__ No ____	
	TCRA- If there is a complete pathway between source and receptor and the MEC and the situation is viewed as an "imminent danger threat posed by the release or threat of a release, where cleanup or stabilization actions must be initiated within six months to reduce risk to public health or the environment", TPMC/HFA will immediately notify the Military Munitions Design Center Project Manager at USACE and the property owner. USACE will determine, with input from TPMC/HFA and stakeholders, whether or not a TCRA will be implemented.	Yes__X__ No ____	
	Non-TCRA - A non-TCRA (NTCRA) may be initiated in response to a release or threat of release that poses a risk where more than six months planning time is available.	Yes__X__ No ____	
Appropriate Sampling and Analysis Methods:			
Sampling Method and Depths	MEC: Geophysical methods/procedures are described in detail in Section 3 of the SS-WP and the Field Activities section of the programmatic field sampling plan (PFSP). MC: Sampling methods for MC are described in detail in Section 4 of the SS-WP and Field Activities section of the PFSP.	Yes__X__ No ____	
Analytical Method	Refer to DQO 1 for MEC and MC analytical methods to be incorporated.	Yes__X__ No ____	

Data Quality Objective Verification Worksheet			
Site: **Wallops Flight Facility Project 07**			
Project: FUDS MMRP SI Project Number **C03VA030107**			
DQO Statement Number: **3 of 4**			
DQO Element Description	**Site-Specific DQO Statement**	**Attained?**	**Required Corrective Action**
Intended Data Use(s):			
Project Objective(s) Satisfied	Collect, or develop, additional data, as appropriate, in support of potential Hazard Ranking System (HRS) scoring by United States Environmental Protection Agency (USEPA).	Yes__X__ No ____	
Data Needs Requirements:			
Data User Perspective(s)	Risk MC, Compliance	Yes__X__ No ____	
Contaminant or Characteristic of Interest	Data for HRS worksheet parameters will be compiled by gathering basic identifying information, general site description, site type, waste description, demographics, water use, sensitive environments, and response actions.	Yes__X__ No ____	
Media of Interest	MEC: Surface and subsurface MC: Surface soil, Subsurface soil, Sediment, Surface Water and Groundwater (media varies per MRS, refer to the SS-WP for more detail)	Yes__X__ No ____	
Required Sampling Locations or Areas	Areas where MEC has been historically found, used, or disposed as documented in interviews or existing documentation.	Yes__X__ No ____	
Number of Samples Required	Refer to DQOs 1and 2.		
Reference Concentration of Interest or Other Performance Criteria	The HRS levels of contamination are Level I (concentrations that meet the criteria for actual contamination and are at or above media-specific benchmark levels), Level II (concentrations that either meet the criteria for actual contamination but are less than media-specific benchmarks, or meet the criteria for actual contamination based on direct observation), and Potential (no observed release is required but targets must be within the target distance limit). These levels are weighted for each target by USEPA (Level I carries the greatest weight) and scores of 28.5 or above are then eligible for listing on the National Priorities List (NPL).	Yes__X__ No ____	
Appropriate Sampling and Analysis Methods:			
Sampling Method and Depths	Methods associated with historic data field reconnaissance and sampling (see DQOs 1 and 2). Refer to NPL Characteristics Data Collection Form, Version 3.0 (USEPA 2001).	Yes__X__ No ____	
Analytical Method	Refer to DQOs 1and 2 for associated methods.		

Data Quality Objective Verification Worksheet			
Site: **Wallops Flight Facility Project 07**			
Project: FUDS MMRP SI Project Number **C03VA030107**			
DQO Statement Number: **4 of 4**			
DQO Element Description	**Site-Specific DQO Statement**	**Attained?**	**Required Corrective Action**
Intended Data Use(s):			
Project Objective(s) Satisfied	Collect the additional data necessary to the complete the Munitions Response Site Prioritization Protocol (MRSPP).	Yes__X__ No ____	
Data Needs Requirements:			
Data User Perspective(s)	Risk-MEC and MC, Compliance	Yes__X__ No ____	
Contaminant or Characteristic of Interest	Explosive Hazard Evaluation (EHE), Chemical Warfare Materiel Hazard Evaluation (CHE), and Health Hazard Evaluation (HHE). For the EHE and CHE modules, factors evaluated include the details of the hazard, accessibility to the Munitions Response Site (MRS), and receptor information. HHE factors include an evaluation of MC and any non-munitions-related incidental contaminants present, receptor information, and details pertaining to environmental migration pathways. Typical information compiled includes details pertaining to historical use, current/future use and ownership, cultural/ecological resources, and structures.	Yes__X__ No ____	
Media of Interest	MEC: Surface and subsurface MC: Surface soil, Subsurface soil, Sediment, Surface Water and Groundwater (media varies per MRS, refer to the SS-WP for more detail)	Yes__X__ No ____	
Required Sampling Locations or Areas	Areas where MEC has been identified historically and where sampling is recommended.	Yes__X__ No ____	
Number of Samples Required	Refer to DQOs 1 and 2 for related sampling required.		
Reference Concentration of Interest or Other Performance Criteria	An MRS priority is determined by USACE based on integrating the ratings from the EHE, CHE, and HHE modules. Refer to Federal Register/Vol. 70, No. 192/Wednesday, October 5, 2005/Rules and Regulations.	Yes__X__ No ____	
Appropriate Sampling and Analysis Methods:			
Sampling Method and Depths	Data gathering prior to field activities as well as additional data gathered during field reconnaissance and sampling (DoD 2005).	Yes__X__ No ____	
Analytical Method	Refer to DQOs 1and 2 for associated methods.		

APPENDIX C – INTERVIEW DOCUMENTATION

Appendix not used.

APPENDIX D – FIELD NOTES AND FORMS

- Daily Quality Control Reports
- Field Forms
- Logbook
- Chain of Custody

TERRANEARPMC, LLC/HUMAN FACTORS APPLICATIONS, INC.

DAILY QUALITY CONTROL REPORT

Report Number:	12-12-11-01		Date: 12 December 2011
Project Name:	Wallops Flight Facility (WFF) Project 07 (C03VA030107)		Contract Number: W912DY-04-D-0017
Location of Work:	WFF, Accomack County, Virginia		
Description of Work:	Geophysical reconnaissance and sampling		
Weather: Sunny	Rainfall: none	Temperature: Min. 37°F	Max. 51°F

1. Work performed today by TerranearPMC, LLC (TPMC)/Human Factors Applications, Inc. (HFA).

The TPMC/HFA field team (Temple Coffindaffer, UXO Technician; Steve Deeter, Sampling Technician; Sarah Moore, Field Team Lead/Sampling Technician) discussed objectives and health and safety concerns related to field work with David King (on-site USACE representative) upon arrival at MRS 7. Theodore J. "TJ" Meyer and Susan Dunn (National Aeronautics and Space Administration [NASA] property owner representatives) participated in a kickoff meeting with the field team at MRS 7 prior to beginning field activities. The field team also briefly met with Rodney Godwin (utilities representative for WFF) to confirm proposed sample locations for MRS 7 were not in vicinity of buried utilities. Changes to the field event were not required as a result of discussions with Mr. Godwin. Photographs were taken throughout the field event. Geophysical reconnaissance and sample collection were conducted as described below. Investigative Derived Waste (IDW) generated during field activities was containerized onsite in a 55-gallon drum and staged at a temporary location provided by NASA. The IDW was removed from WFF Project 07 on 23 February 2012.

Reconnaissance Acreage Discussion:

Geophysical reconnaissance using a Whites XLT was conducted in a meandering path within and near Gun Butts No. 1 and 2 at MRS 7 and for the purpose of clearing each sample location prior to collection. The area of the path covered by the Whites XLT was approximately 29,574 square feet (0.68 acres). Approximately 26 subsurface anomalies, two areas of concentrated subsurface anomalies, and two surface anomalies identified as munitions debris (MD) were detected during reconnaissance. In addition, the UXO Technician identified an intact 20-mm projectile located between Gun Butt No. 1 and Gun Butt No. 2 that possibly contained energetic material; however, the UXO Technician could not confirm this due to the rusty condition of the projectile. Mr. King notified the USACE PM of the item. The field team flagged and collected a GPS coordinate of the location of the item, and recommended to TJ Meyer that NASA contact a response team to remove the item as soon as possible. Although the area is accessible to the public when the Visitor Center is open, it was off season and no visitors were observed for the extent of the field work. NASA personnel arrived later to further mark the location of the item for removal.

Samples Collected:

Six collocated surface and subsurface soil samples and ten surface soil samples were collected within and between Gun Butt No. 1 and Gun Butt No. 2 at MRS 7. The surface soil samples were collected at depths of approximately 2- to 6-inches using disposable plastic trowels. The subsurface soil samples were collected at depths of approximately 12- to 24- inches using decontaminated hand augers. A 55-gallon drum was used to containerize IDW (i.e., excess soil, decontamination fluids) generated during the field activities. Laboratory and field QA/QC samples also were collected.

WFF-MRS7-SS-01-05	WFF-MRS7-SS-01-09	WFF-MRS7-SS-01-16
WFF-MRS7-SB-02-05	WFF-MRS7-SB-02-09	WFF-MRS7-SS-01-17
WFF-MRS7-SS-01-06	WFF-MRS7-SS-01-10	WFF-MRS7-SS-01-18
WFF-MRS7-SB-02-06	WFF-MRS7-SB-02-10	WFF-MRS7-SS-01-19
WFF-MRS7-SS-01-07	WFF-MRS7-SS-01-12	WFF-MRS7-SS-01-20
WFF-MRS7-SB-02-07	WFF-MRS7-SS-01-13	WFF-MRS7-SS-01-21
WFF-MRS7-SS-01-08	WFF-MRS7-SS-01-14	WFF-MRS7-SB-DUP1
WFF-MRS7-SB-02-08	WFF-MRS7-SS-01-15	WFF-MRS7-SS-DUP2

2. Work performed today by Subcontractors.
None.
3. Type and results of Control Phases and Inspection. (Indicate whether Preparatory – P, Initial – I, or Follow-Up – F and include satisfactory work completed or deficiencies with actions to be taken)
Preparatory phase inspections for field work were completed prior to mobilizing to WFF. Initial phase of inspections were completed upon site arrival. No follow-up inspections were completed today. Satisfactory work completed.
4. List type and location of tests performed and results of these tests.
Whites XLT and BHG-1 were checked prior to and throughout the field event and checked satisfactory.
GPS benchmark control point coordinates were collected in the morning and then again after completion of the fieldwork in the afternoon (see below). GPS readings were within one meter of the control point and deemed acceptable.
Benchmark coordinates: Northing 4198731.692 meters (m), Easting 463037.262 m (UTM, Zone 18N, Conus 1983). Benchmark is U.S. Coast and Geodetic Survey marker "QUEE", PID FW0827, located northwest of Chincoteague, approximately 0.1 mile west of bridge over Queen Sound Channel at reverse fork, south of Highway 175, USGS Quad Chincoteague West (1989).
Morning GPS reading: Northing 4198732.630 m, Easting 463037.123 m (UTM, Zone 18N, Conus 1983)
Post event GPS reading: Northing 4198732.531 m, Easting 463037.036 m (UTM, Zone 18N, Conus 1983)
5. List material and equipment received.
Soil and water bottle ware was provided by TestAmerica Laboratory, Arvada, CO. Trimble GeoXH GPS unit (provided by TPMC/HFA) with Zephyr antenna (provided by Eagle Instruments). Other equipment (e.g., sampling supplies) provided by TPMC/HFA. Additionally, a 55-gallon drum for onsite storage of IDW was provided by TPMC/HFA.
6. Submittals reviewed. (Include Transmittal No., Item No., Spec/Plan Reference, by whom, and any action.
None.
7. Off-site surveillance activities, including action taken.
None.
8. Job Safety. (Report safety violations observed and actions taken)
No health and safety issues and/or violations occurred during field work.
9. Remarks. (Instructions received or given. Conflicts in Plans or Specifications)
During the field event, samples were moved slightly to avoid subsurface anomalies. Mr. King provided concurrence in these instances, and the samples were moved accordingly. A hand-augured well was temporarily installed at the location proposed in the Final SS-WP for groundwater sample WFF-MRS7-GW-00-04; however, sufficient groundwater volume could not be obtained during today's field activities so this sample was not collected today. The field team will return to the location tomorrow to determine if sufficient recharge of the location occurs overnight.

TERRANEARPMC, LLC/HUMAN FACTORS APPLICATIONS, INC.

DAILY QUALITY CONTROL REPORT

TPMC/HFA Verification: On behalf of TPMC/HFA, I certify this report is complete and correct, and materials and equipment used and work performed during this reporting period are in compliance with the contract plans and specifications, to the best of my knowledge, except as noted above.

Curtis Mitchell
Quality Control System Manager

DAILY SITE SAFETY JOURNAL

Page 1 of 2

DATE: 12-12-11	PROJECT: WFF - Project 07
Field UXO Technician: TEMPLE CORRINDARPER	

AREA / ITEMS INSPECTED	SAT	UNSAT
Proper work attire (PPE)	✓	
Vehicle condition	✓	
Emergency equipment	✓	
Safe demolition procedures		
Field office, inside		
Field office grounds		

[ ] Last Work Days Events
[X] Site Description
[X] Work Area Description
[X] Work Area Hazards
[X] On-Site Emergency
[X] Site Evacuation Procedures
[X] Emergency Response Personnel
[X] Emergency Telephone Numbers
[ ] Directions to Hospital
[X] First Aid
[X] Heat / Cold Stress
[ ] Asbestos Awareness & ID
[ ] Ticks
[X] Safety Concerns
[X] Personnel Protective Equipment
[X] Safe Work Practices
[ ] Emergency Response Plan
[ ] Chemical Hazards
[X] Emergency Equipment, Location
[X] Emergency Equipment, by Type
[ ] Emergency Decontamination
[X] Safe Work Practices - General
[ ] Site specific OE Safety Precautions
[ ] Site specific OE Identification Features
[ ] Liquid Contaminates / Landfill Material
[ ] Other _____

Comments:

UXO Technician in Field SIGNATURE: [signature]

DAILY SITE SAFETY JOURNAL
MEETING ATTENDEES
DATE: 12-12-11
Page 2 of 2

	Name	Affiliation
1	TEMPLE CORRINDARRON	HFA/TPMC
2	SARAH MOORE	TPMC/HFA
3	STEVE DEETER	TPMC/HFA
4	DAVID KING	ACOE
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HEALTH AND SAFETY PLAN REVIEW RECORD

SITE: Project 07

TPMC/HFA ~~ALION~~ Project No. C03VA034107

I have read the Health and Safety Plan (s) and have been briefed on the nature, level, and degree of exposure likely as a result of participation of field activities. I agree to conform to all the requirements of this Plan.

Name	Signature	Affiliation	Date
Sarah Moore	SMoore	TPMC/HFA	12/12/11
Steve Deeter	[illegible]	TPMC	12/12/11
David King	[illegible]	USACE	12/12/11
Rodney Godwin	[illegible]	VT/GROUP	12/12/11
Susan Dunn	[illegible]	NRS/NASA	12/12/2011
TJ Meyer	[illegible]	NASA	12/12/2011
T. Coffindaffer	[illegible]	TPMC/HFA	12/12/2011
Steve Deeter	[illegible]	TPMC	12/12/11
T. Coffindaffer	[illegible]	TPMC/HFA	12/13/11
Sarah Moore	[illegible]	TPMC/HFA	12/13/11
David King	[illegible]	USACE Baltimore	12/13/2011
T. Coffindaffer	[illegible]	TPMC/HFA	12/14/11
David King	[illegible]	USACE	12/14/11
S Deeter	[illegible]	TPMC	12/14/11
Sarah Moore	SMoore	TPMC	12/14/11

SITE ENTRY AND EXIT LOG

Project/Site : Project 07

Project No.: C03VA030107

Date	Name	Representing	Time In	Time Out
12/12/11	Sarah Moore	TPMC/HFA	0730	1600
12/12/11	T. Coffindaffer	TPMC/HFA	0730	1600
12/12/11	David King	USACE	7:30	1600
12/12/11	[illegible]	TPMC	0730	1600
12/13/11	T. Coffindaffer	TPMC/HFA	0730	1630
12/13/11	[illegible]	TPMC	0730	1630
12/13/11	Sarah Moore	TPMC/HFA	0730	1630
12/13/11	David King	USACE	7:30	1630
12/14/11	T. Coffindaffer	TPMC/HFA	0730	1545
12/14/11	David King	USACE	0730	↓
12/14/11	[illegible]	TPMC	0730	↓
12/14/11	Sarah Moore	TPMC/HFA	0730	↓

TERRANEARPMC, LLC/HUMAN FACTORS APPLICATIONS, INC.

DAILY QUALITY CONTROL REPORT

Report Number:	12-13-11-01		Date: 13 December 2011
Project Name:	Wallops Flight Facility (WFF) Project 07 (C03VA030107)		Contract Number: W912DY-04-D-0017
Location of Work:	WFF, Accomack County, Virginia		
Description of Work:	Geophysical reconnaissance and sampling		
Weather: Sunny	Rainfall: none	Temperature: Min. 39°F	Max. 52°F

1. Work performed today by TerranearPMC, LLC (TPMC)/Human Factors Applications, Inc. (HFA).

The TPMC/HFA field team (Temple Coffindaffer, UXO Technician; Steve Deeter, Sampling Technician; Sarah Moore, Field Team Lead/Sampling Technician) discussed objectives and health and safety concerns related to field work with David King (on-site USACE representative) upon arrival at the Boat Basin portion of the WFF Project 07. Additionally, the field team discussed objectives and health and safety concerns related to field work with the boat captain, Mr. Mark Baylis of the Marine Science Consortium, prior to beginning field activities that required use of a boat. Photographs were taken throughout the field event. Geophysical reconnaissance and sample collection were conducted as described below. Investigative Derived Waste (IDW) was containerized onsite in a 55-gallon drum during the field activities and staged at a temporary location provided by NASA. The IDW was removed from WFF Project 07 on 23 February 2012.

Reconnaissance Acreage Discussion:

Geophysical reconnaissance using a Whites XLT was conducted in a meandering path at the land portion of the boat basin and for the purpose of clearing each sample location prior to collection. The area of the path covered by the Whites XLT around the land portion of the boat basin was approximately 37,280 square feet (0.86 acres). Approximately five subsurface anomalies and four surface anomalies (munitions debris [MD] and cultural debris) were detected during reconnaissance. Numerous (more than 50) rusty items identified as MD were observed in an area underwater on the bank of the boat basin. In addition, the UXO technician identified three munitions items as intact projectiles (larger than 20 mm) near a tree on the bank of the boat basin; however, the UXO technician could not confirm identification or if these items contained energetic material due to the rusty condition of the three projectiles. Mr. King notified the USACE PM of the items. The property owner, TJ Meyer of NASA, was notified of the items, and the UXO technician recommended that NASA notify a response team to remove the item as soon as possible. A fence that is kept locked is present at the entrance to the Boat Basin; therefore, this area is not open to the public. NASA and the Marine Science Consortium have access; however, the location of the three items is not in an area that would be disturbed when using the boats in the basin.

Additional geophysical reconnaissance was completed from a boat in the water portion of the Boat Basin using a Bore Hole Gradiometer (BHG). Approximately 13,636 square feet (0.31 acres) was covered in the water using the BHG-1. Two anomalies were detected during the water reconnaissance and both were near the dock and entrance to the Boat Basin.

Samples Collected:

One collocated surface and subsurface soil samples and five sediment samples were collected along and in the vicinity of the Boat Basin within MRS 7. Two of the sediment samples (-03 and -05) were collected above the water line and the other three sediment samples were collected below the water line. The surface soil and sediment samples were collected at depths of approximately 2- to 6-inches and 0- to 6-inches, respectively, using disposable plastic trowels. The subsurface soil sample was collected at a depth of approximately 12- to 24- inches using a decontaminated hand auger. The grab method was used to collect a surface water sample from the boat basin. In addition, two groundwater samples were collected from hand-augured temporary wells at the Gun Butts using designated tubing and a peristaltic pump. Laboratory and field QA/QC samples also were collected. A 55-gallon drum was used to containerize IDW (i.e., excess soil, decontamination fluids, purged groundwater) generated during the field activities.

WFF-MRS7-SD-01-01	WFF-MRS7-SD-01-05	WFF-MRS7-SW-DUP1
WFF-MRS7-SD-01-02	WFF-MRS7-SS-01-11	WFF-MRS7-GW-00-03
WFF-MRS7-SD-01-03	WFF-MRS7-SB-02-11	WFF-MRS7-GW-00-04

WFF-MRS7-SD-01-04	WFF-MRS7-SW-00-01	WFF-MRS7-GW-00-DUP1
WFF-MRS7-SD-DUP1		

2. Work performed today by Subcontractors.

Boat transportation to conduct underwater reconnaissance of the Boat Basin was provided by the Marine Science Consortium.

3. Type and results of Control Phases and Inspection. (Indicate whether Preparatory – P, Initial – I, or Follow-Up – F and include satisfactory work completed or deficiencies with actions to be taken)

Preparatory phase inspections for field work were completed prior to mobilizing to WFF. Initial phase of inspections were completed upon site arrival. No follow-up inspections were completed today. Satisfactory work completed.

4. List type and location of tests performed and results of these tests.

Whites XLT and BHG-1 were checked prior to and throughout the field event and checked satisfactory.

GPS benchmark control point coordinates were collected in the morning and then again after completion of the fieldwork in the afternoon (see below). GPS readings were within one meter of the control point and deemed acceptable.

Benchmark coordinates: Northing 4198731.692 meters (m), Easting 463037.262 m (UTM, Zone 18N, Conus 1983). Benchmark is U.S. Coast and Geodetic Survey marker "QUEE", PID FW0827, located northwest of Chincoteague, approximately 0.1 mile west of bridge over Queen Sound Channel at reverse fork, south of Highway 175, USGS Quad Chincoteague West (1989).

Morning GPS reading: Northing 4198732.656 m, Easting 463037.091 m (UTM, Zone 18N, Conus 1983)

Post event GPS reading: Northing 4198732.531 m, Easting 463037.077 m (UTM, Zone 18N, Conus 1983)

5. List material and equipment received.

Soil and water bottle ware was provided by TestAmerica Laboratory, Arvada, CO. Trimble GeoXH GPS unit (provided by TPMC/HFA) with Zephyr antenna (provided by Eagle Instruments). Other equipment (e.g., sampling supplies) provided by TPMC/HFA.

6. Submittals reviewed. (Include Transmittal No., Item No., Spec/Plan Reference, by whom, and any action.

None.

7. Off-site surveillance activities, including action taken.

None.

8. Job Safety. (Report safety violations observed and actions taken)

No health and safety issues and/or violations occurred during field work.

9. Remarks. (Instructions received or given. Conflicts in Plans or Specifications)

The coordinates for the sediment samples provided in the Final SS-WP for the South Bank of Boat Basin were located within the water of the Boat Basin. Mr. King provided concurrence to move the sediment samples south to be located on the South Bank of the Boat Basin, and the samples were moved accordingly.

The field team returned to the proposed location of groundwater sample WFF-MRS7-GW-00-04 noted in the Daily Quality Control Report for 12/12/11. Sufficient recharge of the well had not occurred overnight, so the field team determined that the location proposed in the Final SS-WP was not conducive to transmitting groundwater. Therefore, groundwater sample WFF-MRS7-GW-00-04 was moved slightly south of the former impact area Gun Butt No. 2. Mr. King spoke with CENAB and concurred with this adjustment.

TERRANEARPMC, LLC/HUMAN FACTORS APPLICATIONS, INC.

DAILY QUALITY CONTROL REPORT

TPMC/HFA Verification: On behalf of TPMC/HFA, I certify this report is complete and correct, and materials and equipment used and work performed during this reporting period are in compliance with the contract plans and specifications, to the best of my knowledge, except as noted above.

Curtis Mitchell
Quality Control System Manager

DAILY SITE SAFETY JOURNAL
Page 1 of 2

DATE: 12-13-11	PROJECT: WFF - Project 07
Field UXO Technician: TEMPLE COFFIN BARRON	

AREA / ITEMS INSPECTED	SAT	UNSAT
Proper work attire (PPE)	✓	
Vehicle condition	✓	
Emergency equipment	✓	
Safe demolition procedures		
Field office, inside		
Field office grounds		

- [x] Last Work Days Events
- [x] Site Description
- [x] Work Area Description
- [x] Work Area Hazards
- [x] On-Site Emergency
- [x] Site Evacuation Procedures
- [x] Emergency Response Personnel
- [x] Emergency Telephone Numbers
- [ ] Directions to Hospital
- [x] First Aid
- [x] Heat / Cold Stress
- [ ] Asbestos Awareness & ID
- [ ] Ticks
- [x] Safety Concerns
- [x] Personnel Protective Equipment
- [x] Safe Work Practices
- [ ] Emergency Response Plan
- [ ] Chemical Hazards
- [x] Emergency Equipment, Location
- [x] Emergency Equipment, by Type
- [ ] Emergency Decontamination
- [x] Safe Work Practices - General
- [ ] Site specific OE Safety Precautions
- [ ] Site specific OE Identification Features
- [ ] Liquid Contaminates / Landfill Material
- [ ] Other _____

Comments:

UXO Technician in Field SIGNATURE: [signature]

DAILY SITE SAFETY JOURNAL
MEETING ATTENDEES
DATE: 12/13/11
Page 2 of 2

	Name	Affiliation
1	TEMPLE CORRINDARROA	TPMC/HFA
2	SARAH MOORE	TPMC/HFA
3	STEVE DOETER	TPMC/HFA
4	DAVID KING	ACOE
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WELL PURGING AND SAMPLING RECORD

WELL ID WFF-MRS7-GW-ØØ-Ø3 SAMPLE NO. same as well ID

WELL/SITE DESCRIPTION Temporary well installed to ~10 ft. screened 5-10 ft.
1" PVC screen 0.010 slot

DATE 12 / 13 / 11 TIME 8:10 AIR TEMP. ~38°

WELL DEPTH Not Applicable (N/A) ft CASING HEIGHT N/A ft
WATER DEPTH N/A ft WELL DIAMETER N/A in
WATER COL. HEIGHT N/A ft SANDPACK DIAM. N/A in
EQUIVALENT VOLUME OF STANDING WATER N/A
(gal) (L)
PUMP RATE ~100 mL/per minute (gpm)
(LPM)
PUMP TIME ~55 minutes min
WELL WENT DRY? (✓ Yes (✓ No PUMP TIME N/A min
VOL. REMOVED ~2.5 (gal) (L) RECOVERY TIME N/A min
PURGE AGAIN? (N/A)Yes (✓ No TOTAL VOL. REMOVED N/A (gal) (L)

Date	Time	Volume Removed Unit:	pH	Cond.	Temp.	ORP	Turb.	DO	Depth to Water from TOC	Pump Rate	Sal.	TDS
12/13/11	8:10		5.68	.635	14.43	-69	999	4.73	N/A	~100 mL per min.	Ø	.41
	8:15		5.72	.550	14.16	-67	999	3.37			Ø	.33
	8:20		5.64	.423	13.99	-59	999	3.18			Ø	.27
	8:25		5.56	.389	13.96	-54	658	3.26			Ø	.25
	8:30	~1 gal	5.58	.381	14.02	-57	312	2.96			Ø	.25
	8:35		5.59	.376	14.12	-56	199	2.91			Ø	.24
	8:40	~2 gal	5.56	.484	14.37	-55	999	3.88			Ø	.32
	845		5.65	.553	14.65	-56	999	3.84			Ø	.36
	852	2½ gal	5.77	.682	15.28	-55	999	4.6			Ø	.44

Pumped dry

New location

WELL PURGING AND SAMPLING RECORD

WELL ID WFF-MRS7-GW-00-04 SAMPLE NO. same as well ID
2nd Attempt
WELL/SITE DESCRIPTION Temporary well installed to 10 ft
1" PVC Screen 0.010 slot

DATE 12 / 13 / 11 TIME 1240 AIR TEMP. _____

WELL DEPTH N/A ft CASING HEIGHT N/A ft
WATER DEPTH ~10 ft WELL DIAMETER N/A in
WATER COL. HEIGHT N/A ft SANDPACK DIAM. N/A in
EQUIVALENT VOLUME OF STANDING WATER N/A
(gal) (L)
PUMP RATE ~100 mL / per min (gpm) (LPM)
PUMP TIME ~20 min
WELL WENT DRY? (✓ Yes ( ) No PUMP TIME N/ min
VOL. REMOVED ~2 (gal) (L) RECOVERY TIME N/A min
PURGE AGAIN? N/A ( ) Yes (✓) No TOTAL VOL. REMOVED N/A (gal) (L)

Date	Time	Volume Removed Unit:	pH	Cond.	Temp.	ORP	Turb.	DO	Depth to Water from TOC	Pump Rate	Sal	TDS
12/13/11	1245		6.26	0.681	15.50	-50	622	2.89	N/A	~100 mL per min	0	.44
	1250		6.21	.674	15.22	-53	999	2.39			0	.43
	1258	DRY										
	1450		6.39	.709	14.88	-51	999	3.94		~100 mL per min	0	.46
	1455		6.37	.749	14.71	-62	999	2.99			0	.48
	1500		6.38	.748	15.00	768 → -66		3.39			0	.48
	1503	2gal	6.38	.742	15.08	-65	999	4.06			0	.47

OUT OF RANGE

1510 sample

TERRANEARPMC, LLC/HUMAN FACTORS APPLICATIONS, INC.

DAILY QUALITY CONTROL REPORT

Report Number:	12-14-11-01		Date: 14 December 2011
Project Name:	Wallops Flight Facility (WFF) Project 07 (C03VA030107)		Contract Number: W912DY-04-D-0017
Location of Work:	WFF, Accomack County, Virginia		
Description of Work:	Geophysical reconnaissance and sampling		
Weather: Sunny	Rainfall: none	Temperature: Min. 40°F	Max. 55°F

1. Work performed today by TerranearPMC, LLC (TPMC)/Human Factors Applications, Inc. (HFA).

The TPMC/HFA field team (Temple Coffindaffer, UXO Technician; Steve Deeter, Sampling Technician; Sarah Moore, Field Team Lead/Sampling Technician) discussed objectives and health and safety concerns related to field work with David King (on-site USACE representative) upon arrival at the Pyrotechnic Burn Area portion of WFF Project 07. Photographs were taken throughout the field event. Geophysical reconnaissance and sample collection were conducted as described below. Investigative Derived Waste (IDW) was containerized onsite in a 55-gallon drum during the field activities and staged at a temporary location provided by NASA. The IDW was removed from WFF Project 07 on 23 February 2012.

Reconnaissance Acreage Discussion:

Geophysical reconnaissance using a Whites XLT was conducted in a meandering path within and in the vicinity of the Pyrotechnics Burn Area and for the purpose of clearing each sample location prior to collection. The area of the path covered by the Whites XLT was approximately 9,648.9 square feet (0.22 acres). One pile of metal debris was observed, two areas containing numerous subsurface anomalies were identified, and approximately six subsurface anomalies were detected while completing reconnaissance outside of the Pyrotechnics Burn Area fence. The Pyrotechnics Burn Area within the fence was so heavily concentrated with subsurface anomalies that individual anomalies could not be demarcated and counted. A burn pile of approximately three munitions items, which the UXO technician identified as pyrotechnic or illumination flares, was observed within the fence. Due to the condition of these items, the UXO technician could not confirm that energetic material remained. Mr. King notified the USACE PM of the items. The property owner, TJ Meyer of NASA, was notified of the items, and the UXO technician recommended that NASA notify the response team to remove these items and the other items found during the past two days of field work as soon as possible. The Pyrotechnics Burn Area is not in an area that would be readily accessible to the public.

Samples Collected:

Four collocated surface and subsurface soil samples were collected from outside the fence corners of the Pyrotechnics Burn Area. Additionally, two groundwater samples were collected from hand-augured wells using designated tubing and a peristaltic pump. Surface samples were collected at depths of approximately 2- to 6-inches using disposable plastic trowels and the subsurface soil samples were collected at depths of approximately 12- to 24-inches using decontaminated hand auger. Laboratory and field QA/QC samples also were collected. A 55-gallon drum was used to containerize IDW (i.e., excess soil, decontamination fluids, purged groundwater) generated during the field activities. In addition, three background sediment samples were collected at 0- to 6-inch depth with disposable plastic trowels.

WFF-MRS7-SS-01-01	WFF-MRS7-SB-02-03	WFF-MRS7-GW-DUP2
WFF-MRS7-SB-02-01	WFF-MRS7-SS-01-04	WFF-MRS7-SS-DUP3
WFF-MRS7-SS-01-02	WFF-MRS7-SB-02-04	WFF-MBBG-SD-00-01
WFF-MRS7-SB-02-02	WFF-MRS7-GW-00-01	WFF-MBBG-SD-00-02
WFF-MRS7-SS-01-03	WFF-MRS7-GW-00-02	WFF-MBBG-SD-00-03
WFF-MRS7-EB1		

2. Work performed today by Subcontractors.

None.

3. Type and results of Control Phases and Inspection. (Indicate whether Preparatory – P, Initial – I, or Follow-Up – F and include satisfactory work completed or deficiencies with actions to be taken)
Preparatory phase inspections for field work were completed prior to mobilizing to WFF. Initial phase of inspections were completed upon site arrival. No follow-up inspections were completed today. Satisfactory work completed.
4. List type and location of tests performed and results of these tests.
Whites XLT and BHG-1 were checked prior to and throughout the field event and checked satisfactory..
GPS benchmark control point coordinates were collected in the morning and then again after completion of the fieldwork in the afternoon (see below). GPS readings were within one meter of the control point and deemed acceptable.
Benchmark coordinates: Northing 4198731.692 meters (m), Easting 463037.262 m (UTM, Zone 18N, Conus 1983). Benchmark is U.S. Coast and Geodetic Survey marker "QUEE", PID FW0827, located northwest of Chincoteague, approximately 0.1 mile west of bridge over Queen Sound Channel at reverse fork, south of Highway 175, USGS Quad Chincoteague West (1989).
Morning GPS reading: Northing 4198732.739 m, Easting 463036.900 m (UTM, Zone 18N, Conus 1983)
Post event GPS reading: Northing 4198732.595 m, Easting 463037.067 m (UTM, Zone 18N, Conus 1983)
5. List material and equipment received.
Soil and water bottle ware was provided by TestAmerica Laboratory, Arvada, CO. Trimble GeoXH GPS unit (provided by TPMC/HFA) with Zephyr antenna (provided by Eagle Instruments). Other equipment (e.g., sampling supplies) provided by TPMC/HFA.
6. Submittals reviewed. (Include Transmittal No., Item No., Spec/Plan Reference, by whom, and any action.
None.
7. Off-site surveillance activities, including action taken.
None.
8. Job Safety. (Report safety violations observed and actions taken)
No health and safety issues and/or violations occurred during field work.
9. Remarks. (Instructions received or given. Conflicts in Plans or Specifications)
The Pyrotechnics Burn Area portion of MRS 7 was found to be incorrectly positioned in the USACE-provided Geographic Information Systems (GIS) used for the Final SS-WP. The correct location, as confirmed by visual evidence of burning contained within a deteriorated fence matching the description of the area cited in historical documents, was observed to be near the southwestern corner of the Pyrotechnic Burn Area shown in the Final SS-WP. GPS coordinates were collected at each corner of the fence. The fenced area was observed to be approximately 500 square feet (20 feet by 25 feet). Mr. King verified with CENAB that the proposed samples for the Pyrotechnic Burn Area should be collected within the fenced area observed during field activities. However, due to a dense concentration of subsurface anomalies within the fenced area, the UXO Technician could not locate sample areas that were free of anomalies. Therefore, Mr. King verified with CENAB that samples should be collected just outside the fence where anomaly clearance could be obtained.

TERRANEARPMC, LLC/HUMAN FACTORS APPLICATIONS, INC.

DAILY QUALITY CONTROL REPORT

TPMC/HFA Verification: On behalf of TPMC/HFA, I certify this report is complete and correct, and materials and equipment used and work performed during this reporting period are in compliance with the contract plans and specifications, to the best of my knowledge, except as noted above.

Curtis Mitchell
Quality Control System Manager

DAILY SITE SAFETY JOURNAL

Page 1 of 2

DATE: 12-14-11	PROJECT:
Field UXO Technician: TEMPLE	CORRINDAFROX

AREA / ITEMS INSPECTED	SAT	UNSAT
Proper work attire (PPE)	✓	
Vehicle condition	✓	
Emergency equipment	✓	
Safe demolition procedures		
Field office, inside		
Field office grounds		

- [x] Last Work Days Events
- [x] Site Description
- [x] Work Area Description
- [x] Work Area Hazards
- [x] On-Site Emergency
- [x] Site Evacuation Procedures
- [x] Emergency Response Personnel
- [ ] Emergency Telephone Numbers
- [ ] Directions to Hospital
- [x] First Aid
- [x] Heat / Cold Stress
- [ ] Asbestos Awareness & ID
- [ ] Ticks
- [x] Safety Concerns
- [x] Personnel Protective Equipment
- [x] Safe Work Practices
- [ ] Emergency Response Plan
- [ ] Chemical Hazards
- [x] Emergency Equipment, Location
- [x] Emergency Equipment, by Type
- [ ] Emergency Decontamination
- [x] Safe Work Practices - General
- [ ] Site specific OE Safety Precautions
- [ ] Site specific OE Identification Features
- [ ] Liquid Contaminates / Landfill Material
- [ ] Other _____

Comments:

UXO Technician in Field SIGNATURE: [signature]

DAILY SITE SAFETY JOURNAL
MEETING ATTENDEES
DATE: 12-14-11
Page 2 of 2

	Name	Affiliation
1	TEMPLE CORRINDAFFOR	TPMC / HRA
2	SARAH MOORE	TPMC / HRA
3	STEVE DOBTER	TPMC / HRA
4	DAVID KING	ACOE
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WELL PURGING AND SAMPLING RECORD

WELL ID WFF-MRS7-GW-00-01 SAMPLE NO. same as well I.D

WELL/SITE DESCRIPTION Temporary well

DATE 12 / 14 / 11 TIME 1130 AIR TEMP. _____

WELL DEPTH ~5 ft 10 slot ft CASING HEIGHT N/A ft
WATER DEPTH N/A ft WELL DIAMETER _____ in
WATER COL. HEIGHT N/A ft SANDPACK DIAM. N/A in
EQUIVALENT VOLUME OF STANDING WATER _____
(gal) (L)
PUMP RATE ~125 mL per minute (gpm)
(LPM)
PUMP TIME ~40 minutes min
WELL WENT DRY? ( ) Yes (✓) No PUMP TIME N min
VOL. REMOVED ~3 (gal) (L) RECOVERY TIME _____ min
PURGE AGAIN? N/A( )Yes (✓) No TOTAL VOL. REMOVED N/A (gal) (L)

Date	Time	Volume Removed Unit:	pH	Cond.	Temp.	ORP	Turb.	DO	Depth to Water from TOC	Pump Rate	Sal	TDS
12/14/11	1135	~.5gal	6.49	50.1	9.94	-348	397	2.80	N/A	125 mL per min	3.2	30
	1140		6.41	50.0	9.62	-349	158	2.48	↓	↓	3.2	30
	1145	~1 gal	6.38	49.6	9.58	-351	72.8	2.40	↓	↓	3.2	30
	1150		6.36	49.2	9.57	-351	51.2	2.38	↓	↓	3.1	30
	1155	~2 gal	6.36	48.9	9.51	-350	53.4	2.40	↓	↓	3.1	30
	1200		6.36	48.8	9.43	-350	45.8	2.41	↓	↓	3.1	30
	1205	~3 gal	6.35	48.7	9.41	-348	35.8	2.42	↓	↓	3.1	30

Sample 1210

WELL PURGING AND SAMPLING RECORD

WELL ID WFF-MRS7-GW-00-02 SAMPLE NO. Sample as well I.D.

WELL/SITE DESCRIPTION Temporary well installed to ~5ft
1" PVC screen 0.010 slot (10 slot screen)

DATE 12 / 14 / 11 TIME 1039 AIR TEMP. _____

6 inch vegetation loose sand

WELL DEPTH ~5 feet ft CASING HEIGHT Not Applicable (N/A) ft
WATER DEPTH N/A ft WELL DIAMETER N/A in
WATER COL. HEIGHT N/A ft SANDPACK DIAM. N/A in
EQUIVALENT VOLUME OF STANDING WATER N/A (gal) (L)
PUMP RATE ~125 mL per minute (gpm) (LPM)
PUMP TIME ~30 minutes min
WELL WENT DRY? ( ) Yes (✓) No PUMP TIME N/A min
VOL. REMOVED ~3 (gal) (L) RECOVERY TIME N/A min
PURGE AGAIN? N/A ( ) Yes (✓) No TOTAL VOL. REMOVED N/A (gal) (L)

Date	Time	Volume Removed Unit:	pH	Cond.	Temp.	ORP	Turb.	DO	Depth to Water from TOC	Pump Rate	Sal	TDS
12/14/11	1041		6.27	48.8	9.25	-303	601	3.93	125 mL per min	←	3.1	30
	1046	~1 gal	6.38	51.3	8.67	-319	36.7	3.02	" "	←	3.3	31
	1052	~1.5 gal	6.44	56.6	8.90	-331	14.1	3.15	100 mL per min	←	3.3	31
	1058		6.41	51.9	8.82	-338	11.4	2.55	↓	←	3.3	31
	1103	~2.5 gal	6.42	51.9	8.82	-345	10.2	2.36	↓	←	3.3	31
	1108	~3 gal	6.42	51.5	8.75	-350	11.3	2.31	↓	←	3.3	31

1047 well started to run dry, slow pump 100 mL per minute

1115 Collect Sample

Wallops Flight Facility
Project Ø7
Project# CØ3VAØ3Ø1Ø7
Contract # W912DY-Ø4-ØØ17
Delivery Order # ØØ17ØØØ1

E L A N

Field Book
E 64-8x4 M

Name Jeff Case
Terranear PMC, LLC
Address 222 Valley Creek Blvd.
Suite 210 Exton, PA. 19341
Phone 610 862 5864

This book is published on a fine 50% cotton-content ledger paper, specially treated for maximum archival service, and protected by a water resistant surface sizing.

Projects Wallops Flight Facility
Project 07

ELAN Publishing Co., Inc.
Meredith, N.H. 03253

Projects (continued) .....

Signature Page

Print	Sign	Initials
Sarah Moore		
TEMPLE COORDINATOR		

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757.824.5636 Anne, Ali, Cindy

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WEATHER: Sunny, high low 50's
Clear, windy

0730 Meet NASA at gate of Visitor Center. Security ~~takes our~~ reviews identification and opens gate. TJ Meyer, Susan Dunn, (NASA), David King (USACE)

0800 H & S briefing with
Steve Deeter (TPMC)
Tempe Coffindaffer (TPMC, UXO)
Sarah Moore (TPMC tech)
David King (USACE)
Susan Dunn (NASA)
TJ Meyer (NASA)
Rodney Godwin (NASA, utilities)

0815 Rodney discusses utility lines (underground) & shows the markings for the test cell areas.

* A grounding grid may interfer with clearing Gun Butt No. 1 impact area sample locations. Since lines are throughout & marked at ~~at~~ surface.

* Note: During discussion of tower installation, MD was observed

flagged. Temple indicated that the listing of MD makes it difficult to confirm that it isn't ~~made~~ an HE round. Temple told TJ that he recommended NASA's H&S remove this item immediately.

0915 Set up for field work.
Go to benchmark &
0940 collect benchmark.
N.4198731.692(m) E.463037.262m
UTM 18N CONUS 1983 ~~NAD83~~
~~1300~~ "QUEE", PID FW0827
0955 Start walking GunButt2 conducting GPR and marking sample locations. The area just into test cell is saturated with subsurface anomalies. Start identifying areas instead of points.

Several potential MD identified at surface in the vicinity of tower. Structural debris observed (aluminum can &) aluminum can

Surface Anomalies:

Description of Field Observations	Northing (m)	Easting (m)
munitions item (20mm intact)	4198981.912	459876.690
MD	4198985.173	459874.800
MD	4198982.472	459884.713
3 munitions items (larger than 20mm)	4199205.002	460019.827
MD	4198984.821	459935.183
Marston matting	4199250.678	460078.139
Burn pile with burnt pyrotechnics	4199132.656	460106.078

SAMPLE ID. collected	Time
WAF-MRS-7	
SS-01-05	1425
SB-02-05	1430
SS-01-06	1445
SB-02-06	1450
SS-01-07	1435
SB-02-07	1438
SS-01-08	1215
SB-02-08	1250
SS-01-09	1300
SB-02-09	1305
SS-01-10	1310
SB-02-10	1318
SS-01-12	1455
SS-01-13	1500
SS-01-14	1505
SS-01-15	1200
SS-01-16	1208
SS-01-17	1158
SS-01-18	0911

1150 Collect WFF-MRS7-SS-01-17
at approximate location
of former firing point
Soil is silty clay fine sand
for Sample collected for TNT, DNT,
DNT & TNT breakdown, NG, RDX, Tetryl ~~& select metals~~
1200 WFF-MRS7-SS-01-15
Collected for select explosives &
metals
1208 Collect WFF-MRS7-SS-01-16
at Gun Butt No. 2
1215 Collect WFF-MRS7-SS-01-08
1220 Decon soil augers for
subsurface sampling
1250 Collect WFF-MRS7-SB-02-08
1300 Collect WFF-MRS7-SS-01-09
1305 Collect WFF-MRS7-SB-02-09
1310 Collect WFF-MRS7-SS-01-10
and Matrix Spike (MS)/MS Duplicate
1318 Collect WFF-MRS7-SB-02-10
1330 Attempt to collect
WFF-MRS7-GW-00-04
found water at approx. 3'

* Subsurface soil sample depths were between 18"-24"

Although water was found at
approximately 3 feet from
WFF-MRS7-GW-00-04, the
formation does not appear to
be conducive for producing
water. Leave for well to
recharge. Decon equipment. (1350)
1425 Collect WFF-MRS7-SS-01-05
1430 Collect WFF-MRS7-SB-02-05
and DUPLICATE (1435)
1445 Collect WFF-MRS7-SS-01-06
1450 Collect WFF-MRS7-SB-02-06
1435 Collect WFF-MRS7-SS-01-07
1438 Collect WFF-MRS7-SB-02-07
1455 Collect WFF-MRS7-SS-01-12
1500 Collect WFF-MRS7-SS-01-13
1505 Collect WFF-MRS7-SS-01-14
from approximate former
firing point at Gun Butt No. 1
Put temporary well in at
WFF-MRS[redacted]7-GW-00-03
Similiar formation as 04
location. Approximately
10 feet.

12/12/11

1525 Collect WFF-MRS7-SS-01-20 plus duplicate

1535 Collect WFF-MRS7-SS-01-19

1540 Collect WFF-MRS7-SS-01-21

1558 Collect WFF-MRS7-SS-01-18

* Note: Four sample locations between Gun Butt No. 1 and 2 were surface soil, not sediment. Discuss with David King talking to USACE regarding moving one bkgd sediment to be in similar background sediment as the sediment that we will find at Boat basin.

1610 Return to vehicles. Decon equipment and pack up for day.

1650 Leave site for day.

12/13/11

WEATHER: Windy, partly cloudy
H: low 50's, mid-upper 30's

0730 Meet at Visitor Center / Boat Basin. Temple Cofindaffer gives health and safety meeting.

0750 Set up and purge temporary well at WFF-MRS7-GW-00-04
Well purges dry quickly.

0805 Set up at WFF-MRS7GW00-03
Purge and collect water quality measurements.

0855 Well is dry. Mobilize to Boat Basin to complete QR & sample collection and allow well to recharge.

1135 Collect WFF-MRS7-GW-00-03 *see pg. 17 for well info.

* See page 15 for sample information from Boat Basin.

Numerous metal debris observed on South bank including MD. Identify an area during sampling to return during low tide for further access/inspection.

12/13/11

Collect Sample WFF-MRS7-SD-Ø1-Ø1, Ø2 & Ø4 below water line. Wait to collect Ø3 and Ø5 until low tide so that the shore is accessible.

1250 Meet Marine Science Consortium representatives to conduct analog geophics in boat basin waters from boat. Two spikes on BHG-1 at start. No other detections with BHG-1. in Boat Basin water.

1355 Return to dock & unload equipment.

Ali Redman and boat captain Mark Baylis.

1420 Collect WFF-MRS7-SD-Ø1-Ø3

1425 Collect WFF-MRS7-SD-Ø1-Ø5

Both Ø3 & Ø5 samples collected along shore above current water line (tide is lower than when samples where collected this morning)

Return to Gun Butts to collect Groundwater.

SAMPLE I.D.	Date	Time	location	Notes.
WFF-MRS7-SD-Ø1-Ø1	12/13/11	939	Boat Basin	DUP #3 Below H_2O line
WFF-MRS7-SD-Ø1-Ø2		1Ø35		
WFF-MRS7-SD-Ø1-Ø3		1420		Along shore (low tide)
WFF-MRS7-SD-Ø1-Ø4		955		Below H_2O line
WFF-MRS7-SD-Ø1-Ø5		1425		Along shore (Low tide)
WFF-MRS7-SS-Ø1-Ø1		1Ø05		
WFF-MRS7-SD-Ø2-11		1Ø1Ø		
WFF-MRS7-SW-ØØ-Ø1		1Ø2Ø		ms/msD & DUP Ø1
WFF-MRS7-GW-ØØ-Ø3		1135	Gun Butt No. 1	ms/MSD & DUP Ø1
WFF-MRS7-GW-ØØ-Ø4		1510	Gun Butt No. 2	

WFF-MRS7-GW-00-03 collected at 1135 ~~Collected MRS7 on 12/13/11~~ so move to new approved location for WFF-MRS7-GW-00-04.

1510 Collect WFF-MRS7-GW-00-04 (see pg. 18 for Purge info.)

1550 Put samples on ice & decon equipment

1630 Leave site for day

12/13/11

12/13/2011

12/13/11 PURGE INFORMATION FOR WFF-MRS7-GW-00-03

Time	pH	Conductivity	Temp.	ORP	Turb.	D.O	Salinity	TDS	Pump rate 100 mL/min	volume removed ~100 mL/min
8:10	5.68	.635	14.43	-69	999	4.73	0	.41		
8:15	5.72	.550	14.16	-67	999	3.37	0	.33		
8:20	5.64	.423	13.99	-59	999	3.18		.27		
8:25	5.56	.389	13.96	-54	658	3.26		.25		~1 gallon
8:30	5.58	.381	14.02	-57	312	2.96		.25		
8:35	5.59	.376	14.12	-56	197	2.91		.24		
8:40	5.56	.484	14.37	-55	999	3.08		.32		~2 gallon
8:45	5.65	.553	14.65	-56	999	3.84		.36		
8:52	5.77	.682	16.28	-55	999	4.6		.44		~2.5 gallon
pumped dry										

Sample time: 11:35

Pump Time: ~55 minutes

PURGE INFORMATION FOR WFF-MRS7-ØØ-Ø4 12/13/11

Time	PH	Conductivity	Temp.	ORP	Turb.	D.O.	Salinity	TDS	Pump rate ~100 mL per min	Volume removed
1249	6.26	Ø.681	15.50	-50	622	2.85	Ø	.44		
1250	6.21	Ø.674	15.22	-53	999	2.39	Ø	.49		
1258	DRY									
1450	6.39	Ø.709	14.88	-51	999	3.94	Ø	.46		
1455	6.37	Ø.749	14.71	-62	999	2.99	Ø	.48		
1500	6.38	Ø.748	15.00	-76	999	3.39	Ø	.48		
1503	6.38	Ø.742	15.08	-65	999	4.06	Ø	.47		~2 gallon
1510	Collect	sample.								

12/14/11

WEATHER: Sunny H: mid 50's L: 40°

Ø73Ø Arrive at gate of NASA Visitor Information Center.

Ø745 Call NASA to ~~notify~~ request access to WFF Project Ø7. PBA

Ø8ØØ Guard arrives to open gate. Set up to mobilize to the Pyrotechnics Burn Area. Temple Coffindaffer completes Health and Safety meeting for:
Steve Deeter (TPMC)
Sarah Moore (TPMC)
David King (USACE)

Ø835 Conduct qualitative reconnaissance at Pyrotechnics Burn Area. The fenced area is not correct in GIS used for SSWP. The correct location of the fenced (~20x25 ft.) Pyrotechnics Burn Area was confirmed visually and the fence corners (GPS'd) recorded in GIS.

Ø93Ø Collect Equipment Blank see pg. 25

12/14/11

Request to move samples within ~~fens~~ correct fenced Pyrotechnics Burn Area location.
Mr. King (USACE) provides concurrance after confirming w/ CENAB.
Start at eastern corner, just outside fence since inside fence can not be cleared. Subsurface anomalies throughout the area inside fence. UXO Tech clears an area just outside fence.
1038 Set up for sample collection. (see page #21 for sample information)
1040 See page #22 for groundwater purge information at WFF-MRS7-GW-00-02
See page #23 for groundwater purged information at WFF-MRS7-GW-00-01
The only items observed where within the fenced area in a burn pile (~ 3 pyrotechnic items)

continued on page 24

12/14/11

Sample I.D.	Date	Time	Notes
WFF-MRS7-SS-01-01	12/14/11	1220	+ PAHs, Dup#3 (1225) Time
WFF-MRS7-SB-02-01		1235	
WFF-MRS7-SS-01-02		1320	
WFF-MRS7-SB-02-02		1325	
WFF-MRS7-SS-01-03		1245	ms/msd
WFF-MRS7-SB-02-03		1255	
WFF-MRS7-SS-01-04		1305	
WFF-MRS7-SB-02-04		1310	
WFF-MRS7-GW-00-01		1210	see pg #23
WFF-MRS7-GW-00-02		1115	GW Dup#2 (1120) see pg # 22

12/14/11

WFF-MRS7-GW-00-02

12/14/11

Time	pH	Cond.	Temp.	ORP	Turb.	D.O.	Sal.	TDS	Pump rate	Volume removed
10:41	6.27	48.8	9.25	-303	601	3.93	3.1	30	125 mL per min	—
10:46	6.38	51.3	8.67	-319	36.7	3.02	3.3	31	↓	~1 gallon
10:52	6.44	51.6	8.90	-331	14.1	3.15	3.3	31	100 mL per min	~1.5 gal
10:58	6.41	51.9	8.82	-338	11.4	2.55	↓	31	↓	~2 gal
11:03	6.42	51.9	8:82	-345	10.2	2.36	↓	31	↓	~2.5 gal
11:08	6.42	51.5	8.75	-350	11.3	2.31	↓	31	↓	~3 gallon

10:47 - well started to run dry, slowed pump to ~ 100 mL per minute

1115 collected sample

12/14/11

12/14/11 WFF-MRS7-GW-00-01 pump rate ~125 mL per minute

Time	pH	Cond.	Temp.	ORP	Turb.	DO	Sal	TDS	~Volume Removed
1135	6.49	50.1	9.94	-348	397	2.80	3.2	30	~.5 gallon
1140	6.41	50.0	9.62	-349	158	2.48	↓	↓	~.75 gal
1145	6.38	49.6	9.58	-351	72.8	2.40	↓	↓	~1 gallon
1150	6.36	49.2	9.57	-351	51.2	2.38	3.1	↓	~1.5 gal
1155	↓	48.9	9.51	-350	53.4	2.40	↓	↓	~2 gallon
1200	↓	48.8	9.43	-350	45.8	2.41	↓	↓	~2.5 gallon
1205	6.35	48.7	9.41	-348	35.8	2.42	↓	↓	~3 gallon
Collect sample @ 1210									

12/14/11

12/14/11

continued from pg. 20.

Although the only items observed were within the pyrotechnics burn area, what appeared to be a burn area was observed at the northern fence line outside pyrotechnics burn area.

~Burn debris center coordinates:
N 4199132.66 E 460106.078

1330 Complete sampling. Pack up equipment and take back to vehicles at dock. Put samples on ice. Return to Visitor Information Center to decon equipment.

Walk T.J. Meyer (NASA) and Susan Dunn through Boat Basin and Pyrotechnics Burn Area so Temple can show items observed during SI for removal. Discuss background sediment locations with T.J. and pack up to collect three background sediment samples.

1545 leave for day

GIS Information 12/14/11

Fence corners (Pyrotechnics Burn Area):

1)	N 4199134.074	E 460109.983
2)	4199131.216	460104.376
3)	4199137.465	460100.867
4)	4199140.781	460105.867

Metal debris pile (~4 ft. diameter)
N 4199147.116 E. 460103.561
← Burn debris center (outside fence)

BACKGROUNG SEDIMENT SAMPLES:

WFF-MBBG-SD-01	Time 1510
WFF-MBBG-SD-02	1528
WFF-MBBG-SD 03	1500

collected in similar sediment as sediment on south bank of Boat Basin.

[redacted]

Chain of Custody Record

Sampler ID _____

Temperature on Receipt _____

Drinking Water? Yes ☐ No ☑

TestAmerica

THE LEADER IN ENVIRONMENTAL TESTING

~~[illegible]~~ GUN BUTTS

TAL-4124-280 (0508)

Client	Project Manager	Date	Chain of Custody Number
TPMC/HTA	Sarah Moore	12/15/11	149469
Address	**Telephone Number (Area Code)/Fax Number**	**Lab Number**	**Page 1 of 3**
5600 Herndon Parkway Suite 120	703-437-9635		

City	State	Zip Code	Site Contact	Lab Contact
Herndon	VA	20170	Sarah Moore	Elaine Walker

Project Name and Location (State)	Carrier/Waybill Number
Wallops Flight Facility Project 07	

Contract/Purchase Order/Quote No.: C03VA03107 MMRP FUDS SI

Analysis (Attach list if more space is needed)

Sample I.D. No. and Description (Containers for each sample may be combined on one line)	Date	Time	Matrix: Air	Aqueous	Sed.	Soil	Containers & Preservatives: Unpres.	H2SO4	HNO3	HCl	NaOH	ZnAc/NaOH	8330-TNT*	Na, RDX, Tetryl	6010C-Fe, Al	6020A-Ba, Cu	Sb, Pb, Ni, Zn	Special Instructions/ Conditions of Receipt
WFF-MRST-SS-01-05	12/12/11	1425				2							X	X	X	X	X	After samples were shipped, TPMC directed TestAmerica to revise some of the requested analyses. Refer to the note and table following these chains of custody.
WFF-MRST-SB-02-05	12/12/11	1430				2							X		X	X	X	
WFF-MRST-SS-01-06		1445				2							X	X	X	X	X	
WFF-MRST-SB-02-06		1450				2							X		X	X	X	
WFF-MRST-SS-01-07		1435				2							X	X	X	X	X	
WFF-MRST-SB-02-07		1438				2							X		X	X	X	
WFF-MRST-SS-01-08		1215				2							X	X	X	X	X	
WFF-MRST-SB-02-08		1250				2							X		X	X	X	
WFF-MRST-SS-01-09		1300				2							X	X	X	X	X	
WFF-MRST-SB-02-09		1305				2							X		X	X	X	
WFF-MRST-SS-01-10		1310				6							X	X	X	X	X	ms/msd
WFF-MRST-SB-02-10		1318				2							X		X	X	X	

Possible Hazard Identification: ☐ Non-Hazard ☐ Flammable ☐ Skin Irritant ☐ Poison B ☐ Unknown

Sample Disposal: ☐ Return To Client ☐ Disposal By Lab ☐ Archive For _____ Months (A fee may be assessed if samples are retained longer than 1 month)

Turn Around Time Required: ☐ 24 Hours ☐ 48 Hours ☐ 7 Days ☐ 14 Days ☐ 21 Days ☐ Other Standard

QC Requirements (Specify)

	Date	Time		Date	Time
1. Relinquished By: [signature]	12/15/11	1300	1. Received By: FedEx	12/15/11	1300
2. Relinquished By			2. Received By		
3. Relinquished By			3. Received By		

Comments: *TNT breakdown products – 2-Amino,4,6-DNT; 4-Amino-2,6-DNT; Nitrobenzene; 2,6-DNT; 1,3,5-TNB
DNT breakdown products – 2,4-DNT; 2-Amino-4,6-DNT; 2-Nitrotoluene; 3-NT; 4-NT; 2,6-DNT; 4-Amino-2,6-DNT

DISTRIBUTION: WHITE - Returned to Client with Report; CANARY - Stays with the Sample; PINK - Field Copy

Chain of Custody Record

Sampler ID _____

Temperature on Receipt _____

Drinking Water? Yes ☐ No ☑

TestAmerica

THE LEADER IN ENVIRONMENTAL TESTING

TAL-4124-280 (0508)

Client: TPMC/HFA	Project Manager: Sarah Moore	Date: 12/15/11	Chain of Custody Number: 149471
Address: 500 Herndon Parkway	Telephone Number (Area Code)/Fax Number: 703-437-9685	Lab Number	Page 2 of 3
City: Herndon; State: VA; Zip Code:	Site Contact: Sarah Moore	Lab Contact: Elaine Walker	
Project Name and Location (State): Wallops Flight Facility-Project 07	Carrier/Waybill Number		
Contract/Purchase Order/Quote No.: CO3VA030107 MMRP FUDSI			

Analysis (Attach list if more space is needed): 8330 TNT & DNT, Ni, Pb, Cd, Cr, Se, Ba, Cu, Zn, Al, Fe, Mn, Zn

Special Instructions/ Conditions of Receipt

Sample I.D. No. and Description (Containers for each sample may be combined on one line)	Date	Time	Air	Aqueous	Sed.	Soil	Unpres.	H2SO4	HNO3	HCl	NaOH	ZnAc/ NaOH	8330 TNT & DNT	Ni, Pb, Cd	Cr, Cu, Ba	Se, Ba, Cu, Zn, Al, Fe, Mn, Zn	Special Instructions/ Conditions of Receipt
WFF-MRS7-SS-01-12	12/12/11	1455				2							X	X	X	X	After samples were shipped, TPMC directed TestAmerica to revise some of the requested analyses. Refer to the note and table following these chains of custody.
WFF-MRS7-SS-01-13		1500				2							X	X	X	X	
WFF-MRS7-SS-01-14		1505				2							X	X	X	X	
WFF-MRS7-SS-01-15		1200				2							X	X	X	X	
WFF-MRS7-SS-01-16		1208				2							X	X	X	X	
WFF-MRS7-SS-01-17		1150				2							X	X	X	X	
WFF-MRS7-SS-01-18		1558				2							X	X	X	X	
WFF-MRS7-SS-01-19		1535				2							X	X	X	X	
WFF-MRS7-SS-01-20		1525				2							X	X	X	X	
WFF-MRS7-SS-01-21		1540				6							X	X	X	X	MS/MSD
WFF-MRS7-SS-DUP1		1435				2							X	X	X	X	
WFF-MRS7-SS-DUP2		1530				2							X	X	X	X	

SR 12/19/11 see page 3

SR 12/19/11

Possible Hazard Identification: ☐ Non-Hazard ☐ Flammable ☐ Skin Irritant ☐ Poison B ☐ Unknown

Sample Disposal: ☐ Return To Client ☐ Disposal By Lab ☐ Archive For _____ Months (A fee may be assessed if samples are retained longer than 1 month)

Turn Around Time Required: ☐ 24 Hours ☐ 48 Hours ☐ 7 Days ☐ 14 Days ☐ 21 Days ☐ Other Std

QC Requirements (Specify)

	Date	Time		Date	Time
1. Relinquished By: [signature]	12/15/11	1300	1. Received By: FedEx	1300	12/15/11
2. Relinquished By			2. Received By		
3. Relinquished By			3. Received By		

Comments: See page 1 for TNT & DNT Breakdown products

DISTRIBUTION: WHITE - Returned to Client with Report; CANARY - Stays with the Sample; PINK - Field Copy

Chain of Custody Record

Sampler ID _____

Temperature on Receipt _____

Drinking Water? Yes ☐ No ☐

TestAmerica

THE LEADER IN ENVIRONMENTAL TESTING

TAL-4124-280 (0508)

Client: See Pg 1	Project Manager: See Pg 1	Date: 12/15/11	Chain of Custody Number: 149474
Address:	Telephone Number (Area Code)/Fax Number	Lab Number	Page 3 of 3
City / State / Zip Code	Site Contact	Lab Contact	
Project Name and Location (State)	Carrier/Waybill Number		
Contract/Purchase Order/Quote No.			

Analysis (Attach list if more space is needed)

Sample I.D. No. and Description (Containers for each sample may be combined on one line)	Date	Time	Air	Aqueous	Sed.	Soil		Unpres.	H2SO4	HNO3	HCl	NaOH	ZnAc/NaOH		8330-TNT, DNT, NG, RDX, Tetryl	Perchlorate	6010B-Fe	6020 or 7470 Hg	Pb, Ni, Zn								Special Instructions/ Conditions of Receipt
WFF-MRS7-GW-00-03	12/13/11	1135		12											X	X	X	X	X								ms/msd
WFF-MRS7-GW-00-04	↓	1510		4											X	X	X	X	X								After samples were shipped, TPMC directed TestAmerica to revise some of the requested analyses. Refer to the note and table following these chains of custody.
WFF-MRS7-GW-DUP1	↓	1140		4											X	X	X	X	X								
SW 12/19/11 WFF-MRS7-SB-DUP1	↓	1435				2									X			X	X								

Possible Hazard Identification: ☐ Non-Hazard ☐ Flammable ☐ Skin Irritant ☐ Poison B ☐ Unknown

Sample Disposal: ☐ Return To Client ☐ Disposal By Lab ☐ Archive For _____ Months (A fee may be assessed if samples are retained longer than 1 month)

Turn Around Time Required: ☐ 24 Hours ☐ 48 Hours ☐ 7 Days ☐ 14 Days ☐ 21 Days ☐ Other Standard

QC Requirements (Specify)

	Date	Time		Date	Time
1. Relinquished By: [signature]	12/15/11	1300	1. Received By: FedEx	12/15/11	1300
2. Relinquished By			2. Received By		
3. Relinquished By			3. Received By		

Comments: See page 1 for TNT & DNT Breakdown products; Perchlorate not filtered

DISTRIBUTION: WHITE - Returned to Client with Report; CANARY - Stays with the Sample; PINK - Field Copy

BOAT BASIN

Chain of Custody Record

Sampler ID _____

Temperature on Receipt _____

Drinking Water? Yes ☐ No ☑

TestAmerica

THE LEADER IN ENVIRONMENTAL TESTING

TAL-4124-280 (0508)

Client: TPMC / HFA	Project Manager: Sarah Moore	Date: 12/15/11	Chain of Custody Number: 149473
Address: 560 Herndon Parkway Suite 120	Telephone Number (Area Code)/Fax Number: 703 437-9685	Lab Number	Page 1 of 1
City: Herndon; State: VA; Zip Code: 20170	Site Contact: Sarah Moore	Lab Contact: Elaine Walker	
Project Name and Location (State): WFF - Project 07	Carrier/Waybill Number		
Contract/Purchase Order/Quote No.: C03VA030107			

Sample I.D. No. and Description (Containers for each sample may be combined on one line)	Date	Time	Matrix: Air	Aqueous	Sed.	Soil	Containers & Preservatives: Unpres.	H2SO4	HNO3	HCl	NaOH	ZnAc/NaOH	Analysis: VOA/NT DNT	RDX - tetryl	Perchlorate	6010C - Al, Fe, Mn	6020A - Ba, Cu, Se, Pb, Ni, Zn	Special Instructions/ Conditions of Receipt
WFF-MRS7-SD-01-01	12/13/11	939			2								X	X		X	X	After samples were shipped, TPMC directed TestAmerica to revise some of the requested analyses. Refer to the note and table following these chains of custody.
WFF-MRS7-SD-01-02	↓	1035			2								X	X		X	X	
WFF-MRS7-SD-01-03	↓	1420			2								X	X		X	X	
WFF-MRS7-SD-01-04	↓	955			2								X	X		X	X	The sample bottles for the sediment duplicate on this page was inadvertently mislabeled and included with the samples for the Gun Butts. TPMC directed TestAmerica to re-label the sample and report the requested analytes.
WFF-MRS7-SD-01-05	↓	1425			2								X	X		X	X	
WFF-MRS7-SB-01-~~06~~ 11	↓	1005			~~2~~ 2								X	X		X	X	
WFF-MRS7-SB-02-11	↓	1010			2								X	X		X	X	
WFF-MRS7-SW-00-01	↓	1020 11			12/13/11								X	X	X			11 ms/msd
~~WFF-MRS7-SD-DUP1~~													X	X		X		12/15/11
WFF-MRS7 SW-DUP1	↓	1020			12/19/11								X	X		X		nometals 12/19/11
~~WFF-MRS7-SD-DUP3~~	↓				2								X			X		12/19/11

Possible Hazard Identification: ☐ Non-Hazard ☐ Flammable ☐ Skin Irritant ☐ Poison B ☐ Unknown

Sample Disposal: ☐ Return To Client ☐ Disposal By Lab ☐ Archive For _____ Months (A fee may be assessed if samples are retained longer than 1 month)

Turn Around Time Required: ☐ 24 Hours ☐ 48 Hours ☐ 7 Days ☐ 14 Days ☐ 21 Days ☐ Other Standard

QC Requirements (Specify)

1. Relinquished By	Date 12/15/11	Time 1300	1. Received By: FedEx	Date 12/15/11	Time 1300
2. Relinquished By	Date	Time	2. Received By	Date	Time
3. Relinquished By	Date	Time	3. Received By	Date	Time

Comments: Perchlorate not filtered

DISTRIBUTION: WHITE - Returned to Client with Report; CANARY - Stays with the Sample; PINK - Field Copy

Chain of Custody Record

Sampler ID _____

Temperature on Receipt _____

Drinking Water? Yes ☐ No ☑

TestAmerica

THE LEADER IN ENVIRONMENTAL TESTING

~~BURN BASIN~~ PYROTECHNICS BURN AREA

TAL-4124-280 (0508)

Client: TPMC/HFA	Project Manager: Sarah Moore	Date: 12/15/11	Chain of Custody Number: 149472
Address: 560 Herndon Parkway Suite 120	Telephone Number (Area Code)/Fax Number: 703-437-9685	Lab Number:	Page 1 of 2
City: Herndon; State: VA; Zip Code: 20170	Site Contact: Sarah Moore	Lab Contact: Elaine Walker	
Project Name and Location (State): VA-Wallops Flight Facility-Project07	Carrier/Waybill Number:		
Contract/Purchase Order/Quote No.: C03VA03007 MMRP FUSSI			

Sample I.D. No. and Description (Containers for each sample may be combined on one line)	Date	Time	Matrix: Air	Aqueous	Sed.	Soil	Containers & Preservatives: Unpres.	H2SO4	HNO3	HCl	NaOH	ZnAc/NaOH	Analysis: TNT & Breakdown*	Perchlorate	6020c-Al, Fe, Mg	6020A-Ba, Cu, Sb, Pb, Ni, Zn	PAHs	SW 12/19/11	Special Instructions/ Conditions of Receipt
WFF-MRS7-SS-01-01	12/14/11	1220				2							X		X	X	X		After samples were shipped, TPMC directed TestAmerica to revise some of the requested analyses. Refer to the note and table following these chains of custody.
WFF-MRS7-SB-02-01		1235				2							X		X	X			
WFF-MRS7-SS-01-02		1320				2							X		X	X			
WFF-MRS7-SB-02-02		1325				2							X		X	X			
WFF-MRS7-SS-01-03		1245				6							X		X	X	X		ms/msd
WFF-MRS7-SB-02-03		1255				2							X		X	X			
WFF-MRS7-SS-01-04		1305				2							X		X	X			
WFF-MRS7-SB-02-04		1310				2							X		X	X			
WFF-MRS7-GW-00-01		1210		4									X	X	X	X			
WFF-MRS7-GW-00-02		1115		4									X	X	X	X			
WFF-MRS7-GW-DUP2		1120		4									X	X	X	X			
WFF-MRS7-SS-DUP3		1225				2							X		X	X	X		

Possible Hazard Identification: ☑ Non-Hazard ☐ Flammable ☐ Skin Irritant ☐ Poison B ☐ Unknown

Sample Disposal: ☐ Return To Client ☐ Disposal By Lab ☐ Archive For _____ Months (A fee may be assessed if samples are retained longer than 1 month)

Turn Around Time Required: ☐ 24 Hours ☐ 48 Hours ☐ 7 Days ☐ 14 Days ☐ 21 Days ☐ Other Standard

QC Requirements (Specify)

	Date	Time		Date	Time
1. Relinquished By: [signature]	12/15/11	1300	1. Received By: FedEx	12/15/11	1300
2. Relinquished By			2. Received By		
3. Relinquished By: GWC 12/15/11			3. Received By		

Comments: ~~*DNT Breakdown products = 2,4-DNT; 2,6-DNT; 2-Amino-4,6-DNT; 4-Amino-2,6-DNT; 2-Nitrotoluene; 3-NT; 4-NT~~

*TNT Breakdown products = 2,Amino-4,6-DNT; 4-Amino-2,6-DNT; Nitrobenzene; 2,6-DNT; 1,3,5-TNB

DISTRIBUTION: WHITE - Returned to Client with Report; CANARY - Stays with the Sample; PINK - Field Copy

Chain of Custody Record

Sampler ID _____

Temperature on Receipt _____

Drinking Water? Yes ☐ No ☑

TestAmerica

THE LEADER IN ENVIRONMENTAL TESTING

TAL-4124-280 (0508)

Client: TPMC/HFA	Project Manager: Sarah Moore	Date: 12/15/11	Chain of Custody Number: 149470
Address: 560 Herndon Parkway Suite 120	Telephone Number (Area Code)/Fax Number: 703-437-9685	Lab Number	Page 2 of 2
City: Herndon; State: VA; Zip Code: 20170	Site Contact: Sarah Moore	Lab Contact: Elaine Walker	
Project Name and Location (State): WFF - Project 07	Carrier/Waybill Number		
Contract/Purchase Order/Quote No.: CB3VA03017			

Sample I.D. No. and Description (Containers for each sample may be combined on one line)	Date	Time	Matrix: Air	Aqueous	Sed.	Soil		Containers & Preservatives: Unpres.	H2SO4	HNO3	HCl	NaOH	ZnAc/NaOH		Analysis (Attach list if more space is needed): TNT & Breakdowns	Perchlorate	6010C - Al, Fe, Mn	6020A - Ba, Cu, Se, Pb, Ni, Zn									Special Instructions/ Conditions of Receipt
WFF-MR57-EB1	12/14/11	930		4											X	X	X	X									
~~WFF-MR57-EB2~~																											
~~WFF-MR57-EB3~~ 10/15/11																											
~~WFF-MR57-EB4~~																											
WFF-MB36-SD-01	12/14/11	1510			2												X	X									
WFF-MB36-SD-02	↓	1528			2												X	X									
WFF-MB36-SD-03	↓	1500			2												X	X									

After samples were shipped, TPMC directed TestAmerica to revise some of the requested analyses. Refer to the note and table following these chains of custody.

Possible Hazard Identification: ☐ Non-Hazard ☐ Flammable ☐ Skin Irritant ☐ Poison B ☐ Unknown

Sample Disposal: ☐ Return To Client ☐ Disposal By Lab ☐ Archive For _____ Months (A fee may be assessed if samples are retained longer than 1 month)

Turn Around Time Required: ☐ 24 Hours ☐ 48 Hours ☐ 7 Days ☐ 14 Days ☐ 21 Days ☐ Other _____

QC Requirements (Specify)

	Date	Time		Date	Time
1. Relinquished By: [signature]	12/15/11	1300	1. Received By: FedEx	12/15/11	1300
2. Relinquished By			2. Received By		
3. Relinquished By	12/15/11		3. Received By		

Comments: See page 1 for ~~[illegible]~~ TNT breakdown

DISTRIBUTION: WHITE - Returned to Client with Report; CANARY - Stays with the Sample; PINK - Field Copy

After the WFF Project 07 Chain of Custody forms were submitted, TPMC requested that TestAmerica revise some analytes to match Table 3-2 from the Final SSWP dated 30 December 2011 (see below). Appendix F of the SI Report contains the WFF Project 07 analytical results, which reflect the analyses shown below.

Table 3-2. Sample Identification Table

Location	Sampling ID	Media					Analysis (Method)							Quality Control Samples[1]	
		Surface Soil	Subsurface Soil	Sediment	Surface Water	Groundwater	PAHs [6] (8270)	Select Explosive Constituents[2] (8330A)			Per-chlorate (6860)	Select Metals[3]		Field Duplicate [4]	MS/ MSD[5]
								TNT	NG, DNT	RDX, Tetryl		Al & Mg (6010C), Ba (6020A)	Fe (6010C) Sb, Cu, Pb, Ni, Zi (6020A)		
Pyro-technics Burn Area	WFF-MRS7-SS-01-01	X					X	X				X	X	X	
	WFF-MRS7-SB-02-01		X					X				X	X		
	WFF-MRS7-SS-01-02	X						X				X	X		
	WFF-MRS7-SB-02-02		X					X				X	X		
	WFF-MRS7-SS-01-03	X					X	X				X	X		X
	WFF-MRS7-SB-02-03		X					X				X	X		
	WFF-MRS7-SS-01-04	X						X				X	X		
	WFF–MRS7-SB-02-04		X					X				X	X		
	WFF-MRS7-GW-00-01					X		X			X	X	X		
	WFF-MRS7-GW-00-02					X		X			X	X	X	X	
Gun Butt No. 1	WFF-MRS7-SS-01-05	X						X		X			X		
	WFF-MRS7-SB-02-05		X					X		X			X	X	
	WFF-MRS7-SS-01-06	X						X		X			X		
	WFF-MRS7-SB-02-06		X					X		X			X		
	WFF-MRS7-SS-01-07	X						X		X			X		
	WFF-MRS7-SB-02-07		X					X		X			X		
	WFF-MRS7-SS-01-12	X						X	X	X			X		
	WFF-MRS7-SS-01-13	X						X	X	X			X		
	WFF-MRS7-SS-01-14	X						X	X	X					
	WFF-MRS7-GW-00-03					X		X	X	X	X		X	X	

Table 3-2. Sample Identification Table

Location	Sampling ID	Media					Analysis (Method)							Quality Control Samples[1]	
		Surface Soil	Subsurface Soil	Sediment	Surface Water	Groundwater	PAHs [6] (8270)	Select Explosive Constituents[2] (8330A)			Per-chlorate (6860)	Select Metals[3]		Field Duplicate [4]	MS/ MSD[5]
								TNT	NG, DNT	RDX, Tetryl		Al & Mg (6010C), Ba (6020A)	Fe (6010C) Sb, Cu, Pb, Ni, Zi (6020A)		
Gun Butt No. 2	WFF-MRS7-SS-01-08	X						X		X			X		
	WFF-MRS7-SB-02-08		X					X		X			X		
	WFF-MRS7-SS-01-09	X						X		X			X		
	WFF-MRS7-SB-02-09		X					X		X			X		
	WFF-MRS7-SS-01-10	X						X		X			X		X
	WFF-MRS7-SB-02-10		X					X		X			X		
	WFF-MRS7-SS-01-15	X						X	X	X			X		
	WFF-MRS7-SS-01-16	X						X	X	X			X		
	WFF-MRS7-SS-01-17	X						X	X	X					
	WFF-MRS7-GW-00-04					X		X	X	X	X		X		X
Outside MRS/ Drainage Area between Gun Butt No. 1 & 2	WFF-MRS7-SS-01-18/ WFF-MRS7-SD-01-06	*X*		*X*				X		X			X		
	WFF-MRS7-SS-01-19/ WFF-MRS7-SD-01-07	*X*		*X*				X		X			X		
	WFF-MRS7-SS-01-20/ WFF-MRS7-SD-01-08	*X*		*X*				X		X			X	X	
	WFF-MRS7-SS-01-21/ WFF-MRS7-SD-01-09	*X*		*X*				X		X			X		X
South Bank of Boat Basin	WFF-MRS7-SD-01-01			X				X	X	X			X	X	
	WFF-MRS7-SD-01-02			X				X	X	X			X		
	WFF-MRS7-SD-01-03			X				X	X	X			X		
	WFF-MRS7-SD-01-04			X				X	X	X			X		
	WFF-MRS7-SD-01-05			X				X	X	X			X		
	WFF-MRS7-SS-01-11	X						X	X	X			X		
	WFF-MRS7-SB-02-11		X					X	X	X			X		
	WFF-MRS7-SW-00-01				X			X	X	X	X			X	X

Table 3-2. Sample Identification Table

Location	Sampling ID	Media					Analysis (Method)							Quality Control Samples[1]	
		Surface Soil	Subsurface Soil	Sediment	Surface Water	Groundwater	PAHs [6] (8270)	Select Explosive Constituents[2] (8330A)			Per-chlorate (6860)	Select Metals[3]		Field Duplicate [4]	MS/ MSD[5]
								TNT	NG, DNT	RDX, Tetryl		Al & Mg (6010C), Ba (6020A)	Fe (6010C) Sb, Cu, Pb, Ni, Zi (6020A)		
TOTAL		**17 to 20**	**11**	**5 to 9**	**1**	**4**	**2**	**36**	**20**	**36**	**5**	**10**	**39**	**7**	**5**

1. For each QC sample, the marked sample type will be gathered for every MC category that is being sampled. Dedicated equipment will be used. Proposed QA sample locations may change depending on sampling conditions and sampling media available (i.e. may change if adequate media is not available to collect additional volume).
2. Where DNT is listed, DNT break-down products currently on the approved PWP (Alion 2005) will also be analyzed (2,4-Dinitrotoluene; 2,6-Dinitrotoluene; 2-Amino-4,6-dinitrotoluene; 2-Nitrotoluene; 3-Nitrotoluene; 4-Nitrotoluene; 4-Amino-2,6-dinitrotoluene). Where TNT is listed, TNT breakdown products currently on the approved PWP (Alion 2005) will also be analyzed (2-Amino-4,6-dinitrotoluene; 4-Amino-2,6-dinitrotoluene; Nitrobenzene; 2,6-dinitrotoluene; 1,3,5-trinitrobenzene).
3. Zinc will be analyzed at the Pyrotechnics Burn Area only.
4. FD# will replace sample ID (the sample ID and its corresponding FD# will be indicated in the field notebook); duplicate samples will be analyzed at a frequency of 10%.
5. MS/MSD samples will be analyzed at a frequency of 5%. Additional volume will be collected for MS/MSD analysis.
6. PAHs include Acenanaphthylene, Acenaphthene, Anthracene, Benz[a]anthracene, Benzo[a]pyrene, Benzo[b]fluoranthene, Benzo[g,h,i]perylene, Benzo[k]fluoranthene, Chrysene, Dibenz[a,h]anthracene, Fluoranthene, Fluorene, Indeno[1,2,3-cd]pyrene, Naphthalene, Phenanthrene, Pyrene.
7. Samples collected at each MRS will be soil or sediment, depending on which medium is present at each sample location.

FD#: Field Duplicate Number
GW: Groundwater
ID: Identification
MC: Munition Constituent
MRS: Munitions Response Site
MS: Matrix Spike
MSD: Matrix Spike Duplicate
PWP: Programmatic Work Plan for Formerly Used Defense Sites Military Munitions Response Program Site Inspections in the Northeast Region
SB: Subsurface Soil
SD: Sediment
SS: Surface Soil
SW: Surface Water
QA: Quality Assurance
QC: Quality Control

NON-HAZARDOUS WASTE MANIFEST

1. Generator ID Number: CESQG
2. Page 1 of 1
3. Emergency Response Phone: 757-201-7726
4. Waste Tracking Number: 19170

5. Generator's Name and Mailing Address

USACE-NORFOLK DISTRICT
803 FRONT STREET
NORFOLK, VA 23510

Generator's Phone: 757 201-7726

Generator's Site Address (if different than mailing address)

NASA WALLOPS VISITOR CENTER
WALLOPS VISITOR CENTER
WALLOPS ISLAND, VA 23337

6. Transporter 1 Company Name: Environmental Options, Inc. — U.S. EPA ID Number: VAD000122994

7. Transporter 2 Company Name — U.S. EPA ID Number:

8. Designated Facility Name and Site Address — U.S. EPA ID Number:

CMEG, INC.
917 INDUSTRIAL ROAD
WALTERBORO, SC 29488

Facility's Phone: (843) 538-8131

SCR000003442

	9. Waste Shipping Name and Description	10. Containers No.	10. Containers Type	11. Total Quantity	12. Unit Wt./Vol.
1.	SOIL CUTTINGS & PURTE WATER, #13536, NON HAZARDOUS/NON REGULATED	001	DM	055	G
2.					
3.					
4.					

13. Special Handling Instructions and Additional Information

A: 13536
B:
C:
D:

14. **GENERATOR'S/OFFEROR'S CERTIFICATION:** I hereby declare that the contents of this consignment are fully and accurately described above by the proper shipping name, and are classified, packaged, marked and labeled/placarded, and are in all respects in proper condition for transport according to applicable international and national governmental regulations.

Generator's/Offeror's Printed/Typed Name: JEFF ZOECKLER — Signature: [signature] — Month 02 Day 23 Year 12

15. International Shipments ☐ Import to U.S. ☐ Export from U.S. Port of entry/exit:
Transporter Signature (for exports only): Date leaving U.S.:

16. Transporter Acknowledgment of Receipt of Materials

Transporter 1 Printed/Typed Name: Don Hix — Signature: [signature] — Month 02 Day 23 Year 12

Transporter 2 Printed/Typed Name — Signature — Month Day Year

17. Discrepancy

17a. Discrepancy Indication Space ☐ Quantity ☐ Type ☐ Residue ☐ Partial Rejection ☐ Full Rejection

Manifest Reference Number:

17b. Alternate Facility (or Generator) — U.S. EPA ID Number

Facility's Phone:

17c. Signature of Alternate Facility (or Generator) — Month Day Year

18. Designated Facility Owner or Operator: Certification of receipt of materials covered by the manifest except as noted in Item 17a

Printed/Typed Name: Timothy Carpenter — Signature: Timothy Carpenter — Month 2 Day 29 Year 12

GENERATOR — INT'L — TRANSPORTER — DESIGNATED FACILITY

169-BLS-C 6 10497 (Rev. 9/09)

DESIGNATED FACILITY TO GENERATOR

APPENDIX E – PHOTO DOCUMENTATION LOG

APPENDIX E – PHOTOGRAPHIC LOG

Project/Site: Wallops Flight Facility (WFF) Project 07/Boat Basin/Visitor Center (MRS 7)
Project No.: C03VA030107

Date	Photo ID	Description
12/12/11	E.1	Facing the Visitor Information Center and the former Gun Butt firing points at MRS 7.
12/12/11	E.2	Metal debris observed on the surface while completing QR at Gun Butt No. 1 and 2.
12/12/11	E.3	An intact 20-mm projectile located between Gun Butt No. 1 and Gun Butt No. 2 that possibly contained energetic material (MPPEH) but was too rusty for UXO technician to confirm.
12/12/11	E.4	Completing QR at Gun Butt No. 1.
12/13/11	E.5	Metal debris observed while completing QR around the perimeter of the Boat Basin.
12/13/11	E.6	Three MPPEH (larger than 20-mm) near a tree on the bank of the Boat Basin that may contain energetic material (too rusty to confirm).
12/13/11	E.7	Completing QR around the perimeter of the Boat Basin.
12/13/11	E.8	The dock at the Boat Basin facing the location of the MPPEH and metal items observed during QR.
12/13/11	E.9	Marston matting and rusty metal debris at higher tide.
12/13/11	E.10	Marston matting and rusty metal debris at lower tide.
12/14/11	E.11	Fence at the Pyrotechnics Burn Area.
12/14/11	E.12	Burn pile within the fenced Pyrotechnics Burn Area.
12/14/11	E.13	Metal debris north and just outside of the Pyrotechnics Burn Area fence.
12/14/11	E.14	Purging groundwater sample WFF-MRS7-GW-00-01.

WFF Project 07 – Field Photographs

Photographer: Sarah Moore
Location of Photograph: MRS 7
GPS Coordinates (m): N 4198995.78 E 459837.54
(UTM Zone 18N)
Direction of Photo: Northwest

Comments: Facing the Visitor Information Center and the former Gun Butt firing points at MRS 7

Photograph No.: E.1 Date: 12/12/11 Time: 10:27 AM

Photographer: Sarah Moore
Location of Photograph: MRS 7
GPS Coordinates (m): N 4198982.47 E 459884.71
(UTM Zone 18N)
Direction of Photo: Toward the ground

Comments: Metal debris observed on the surface while completing QR at Gun Butt No. 1 and 2.

Photograph No.: E.2 Date: 12/12/11 Time: 10:28 AM

WFF Project 07 – Field Photographs

Photographer: Sarah Moore
Location of Photograph: MRS 7
GPS Coordinates(m): N 4198981.91 E 459876.69
(UTM Zone 18N)
Direction of Photo: Toward the ground

Comments: An intact 20-mm projectile located between Gun Butt No. 1 and Gun Butt No. 2 that possibly contained energetic material (MPPEH) but was too rusty for UXO technician to confirm.

Photograph No.: E.3 Date: 12/12/11 Time: 10:30 AM

Photographer: Sarah Moore
Location of Photograph: MRS 7
GPS Coordinates(m): N 4199000.72 E 459942.64
(UTM Zone 18N)
Direction of Photo: Southeast

Comments: Completing QR at Gun Butt No. 1.

Photograph No.: E.4 Date: 12/12/11 Time: 10:47 AM

WFF Project 07 – Field Photographs

Photographer: Sarah Moore
Location of Photograph: MRS 7
GPS Coordinates (m): N 4199198.93 E 460008.24
(UTM Zone 18N)
Direction of Photo: Toward the ground

Comments: Metal debris observed while completing QR around the perimeter of the Boat Basin.

Photograph No.: E.5 Date: 12/13/11 Time: 9:34 AM

Photographer: Sarah Moore
Location of Photograph: MRS 7
GPS Coordinates (m): N 4199205.00 E 460019.83
(UTM Zone 18N)
Direction of Photo: Toward the ground

Comments: Three MPPEH (larger than 20-mm) near a tree on the bank of the Boat Basin that may contain energetic material (too rusty to confirm).

Photograph No.: E.6 Date: 12/13/11 Time: 9:47 AM

WFF Project 07 – Field Photographs

Photographer: Sarah Moore
Location of Photograph: MRS 7
GPS Coordinates (m): N 4199262.42 E 460075.26
(UTM Zone 18N)
Direction of Photo: Northwest

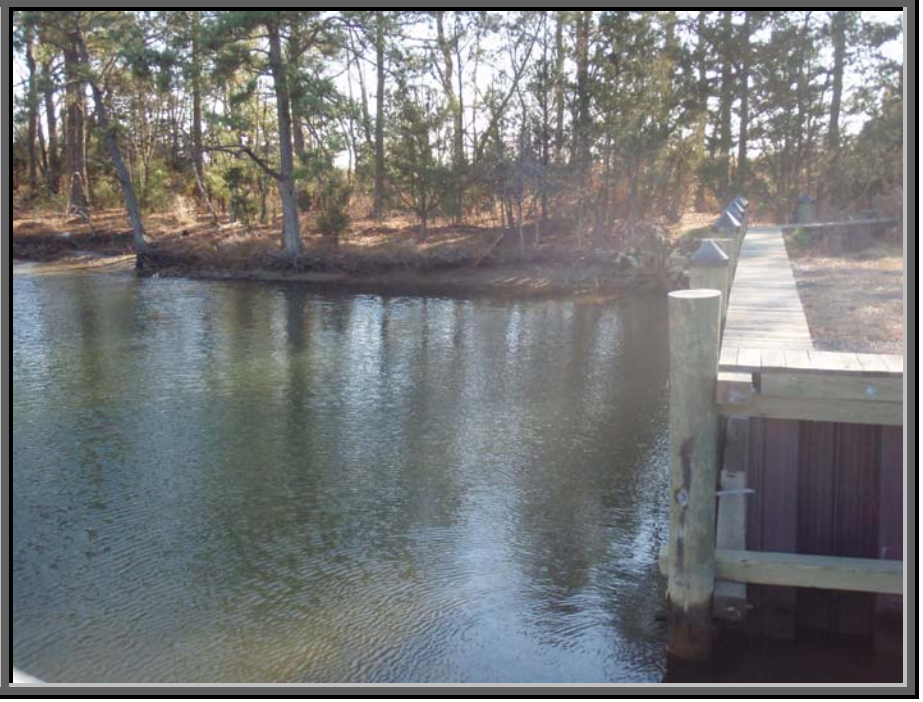
Comments: Completing QR around the perimeter of the Boat Basin.

Photograph No.: E.7 Date: 12/13/11 Time: 11:00 AM

Photographer: Sarah Moore
Location of Photograph: MRS 7
GPS Coordinates (m): N 4199214.32 E 460015.79
(UTM Zone 18N)
Direction of Photo: South

Comments: The dock at the Boat Basin facing the location of the MPPEH and metal items observed during QR.

Photograph No.: E.8 Date: 12/13/11 Time: 13:07 PM



WFF Project 07 – Field Photographs

Photographer: Sarah Moore
Location of Photograph: MRS 7
GPS Coordinates (m): N 4199202.04 E 460013.01
(UTM Zone 18N)
Direction of Photo: Toward the ground

Comments: Marston matting and rusty metal debris at higher tide.

Photograph No.: E.9 Date: 12/13/11 Time: 9:35 AM

Photographer: Sarah Moore
Location of Photograph: MRS 7
GPS Coordinates (m): N 4199202.04 E 460013.01
(UTM Zone 18N)
Direction of Photo: Toward the ground

Comments: Marston matting and rusty metal debris at lower tide.

Photograph No.: E.10 Date: 12/14/11 Time: 2:18 PM

WFF Project 07 – Field Photographs

Photographer: Sarah Moore
Location of Photograph: MRS 7
GPS Coordinates (m): N 4199128.89 E 460103.59
(UTM Zone 18N)
Direction of Photo: Northeast
Comments: Fence at the Pyrotechnics Burn Area.
Photograph No.: E.11 Date: 12/14/11 Time: 9:26 AM

Photographer: Sarah Moore
Location of Photograph: MRS 7
GPS Coordinates (m): N 4199132.66 E 460106.08
(UTM Zone 18N)
Direction of Photo: Toward the ground
Comments: Burn pile within the fenced Pyrotechnics Burn Area.
Photograph No.: E.12 Date: 12/14/11 Time: 9:54 AM

WFF Project 07 – Field Photographs

Photographer: Sarah Moore
Location of Photograph: MRS 7
GPS Coordinates (m): N 4199147.12 E 460103.56
(UTM Zone 18N)
Direction of Photo: Toward the ground

Comments: Metal debris north and just outside of the Pyrotechnics Burn Area fence.

Photograph No.: E.13 Date: 12/14/11 Time: 9:59 AM

Photographer: Temple Coffindaffer
Location of Photograph: MRS 7
GPS Coordinates (m): N 4199131.82 E 460107.11
(UTM Zone 18N)
Direction of Photo: Southeast

Comments: Purging groundwater sample WFF-MRS7-GW-00-01.

Photograph No.: E.14 Date: 12/14/11 Time: 11:36 AM

APPENDIX F – ANALYTICAL DATA

- Automated Data Review Library
- Automated Data Review Electronic Data Deliverable (EDD)
- Environmental Data Management System (EDMS)
- Analytical Summary Reports
- Analytical Data Reports
- Staged Electronic Data Deliverable (SEDD)

Located on CD.

APPENDIX G – ANALYTICAL DATA QUALITY ASSURANCE/ QUALITY CONTROL REPORT

- Validated Data
- Chemical Quality Assurance Report (CQAR) of Split Samples (Split Samples not collected in accordance with CENAB direction.)
- Chemical Data Quality Assessment Report (CDQAR)

Located on CD.

APPENDIX H – GEOGRAPHIC INFORMATION SYSTEMS DATA

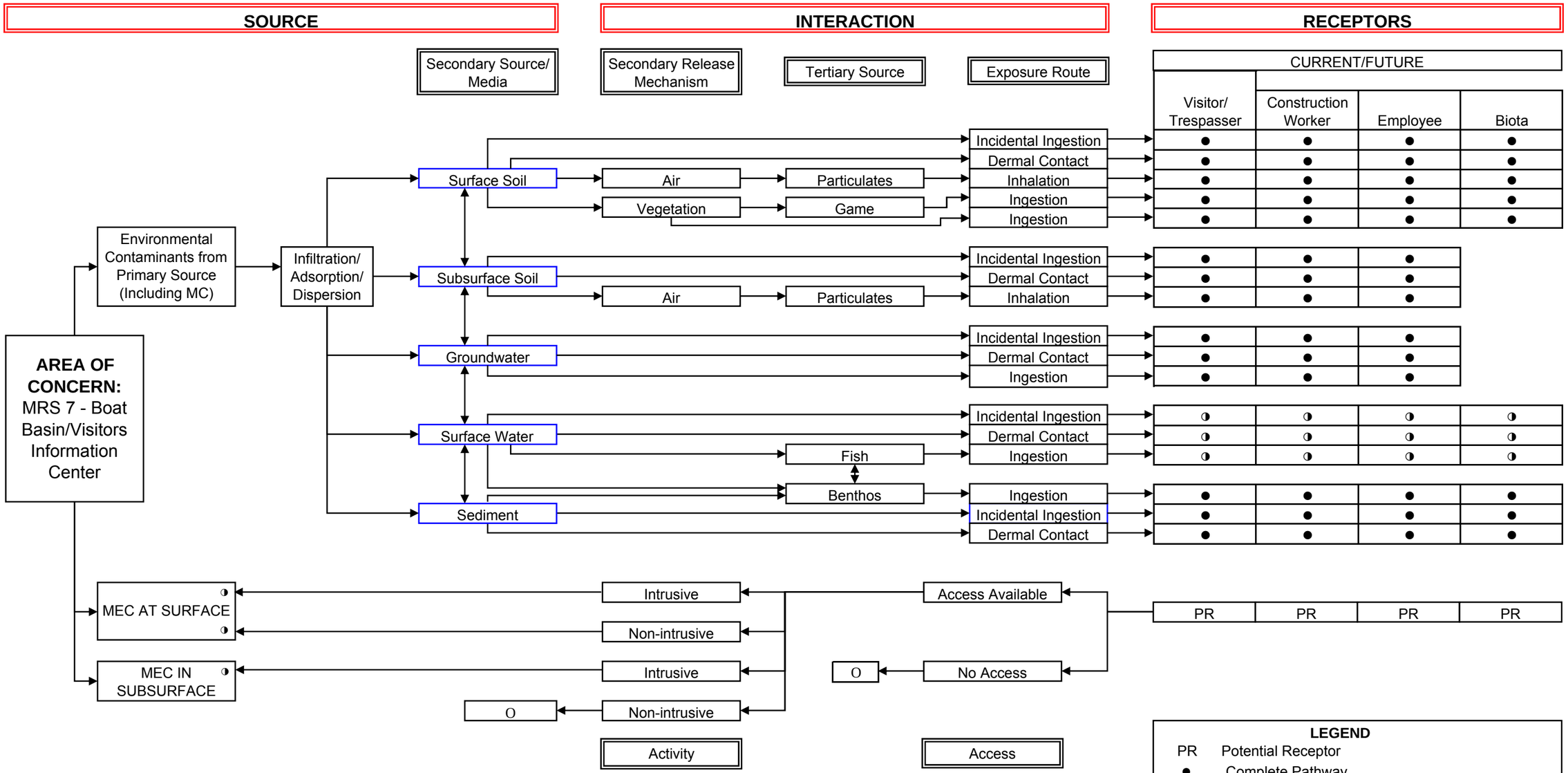
Located on CD.

APPENDIX I – GEOPHYSICAL DATA

Appendix not used.

APPENDIX J – CONCEPTUAL SITE MODEL

- MRS 7 – Boat Basin/Visitors Information Center



LEGEND

PR Potential Receptor
● Complete Pathway
◑ Potentially Complete Pathway
○ Incomplete Pathway (no expected exposure)

NOTES:

1. For the MMRP SI at Wallops Flight Facility, this CSM summarizes the potential risk exposure scenarios for MRS 7. For a pathway to be complete, it must include a source, an exposure medium, an exposure route, and a receptor. A complete pathway may also include a release mechanism and a transport medium. Interaction between a potential receptor and MEC has two components: access and activity.

2. The primary munitions source for MRS 7 is where historical munitions activities occurred (disposal burn areas, firing points, impact areas). Numerous MD have been found historically and MD was observed during the 2011 SI field activities. No confirmed MEC was observed during the SI field event; however, seven MPPEH items were observed. Subsurface anomalies were detected throughout MRS 7 including five areas of concentrated anomalies; therefore, MEC at surface and subsurface remains potentially complete.

3. Metals were detected above background concentrations in surface and subsurface soil, sediment, and groundwater; therefore, the pathway is complete for these media. No MC were detected in surface water above background concentrations. However, since the reporting limit for Nitroglycerin is higher than the human health screening level, the pathway is noted as being potentially complete.

DIAGRAM OF THE INTEGRATED CONCEPTUAL SITE MODEL FOR

Wallops Flight Facility Boat Basin and Visitors Center [1,2,3]

MRS 7 - Boat Basin/Visitors Information Center

Revised June 2012

Source: U.S. Army Corps of Engineers (USACE). 2003. *Conceptual Site Models for Ordnance and Explosives (OE) and Hazardous, Toxic, and Radioactive Wastes (HTRW) Projects.* EM 1110-1-1200.

APPENDIX K – MUNITIONS REPONSE SITE PRIORITIZATION PROTOCOL RESULTS

- MRS 7 – Boat Basin/Visitors Information Center

Table A

MRS Background Information

DIRECTIONS: Record the background information below for the MRS to be evaluated. Much of this information is available from Service and DoD databases. If the MRS is located on a FUDS property, the suitable FUDS property information should be substituted. In the MRS summary, briefly describe the UXO, DMM, or MC that are known or suspected to be present, the exposure setting (the MRS's physical environment), any other incidental nonmunitions-related contaminants (e.g., benzene, trichloroethylene) found at the MRS, and any potentially exposed human and ecological receptors. If possible, include a map of the MRS.

Munitions Response Site Name: Boat Basin/Visitors Information Center

Component: U.S. Army

Installation/Property Name: Wallops Flight Facility (FFID: VA39799F169700)

Location (City, County, State): Wattsville, Accomack County, VA

Site Name/Project Name (Project No.): Boat Basin/Visitors Information Center/Wallops Flight Facility Project 07 ((C03VA030107)

Date Information Entered/Updated: 3/16/2012 4:26:42 AM

Point of Contact (Name/Phone): Sher Zaman/410-962-3134

Project Phase (check only one):

☐ PA	■ SI	☐ RI	☐ FS	☐ RD
☐ RA-C	☐ RIP	☐ RA-O	☐ RC	☐ LTM

Media Evaluated (check all that apply):

■ Groundwater	■ Sediment (human receptor)
■ Surface soil	■ Surface Water (ecological receptor)
■ Sediment (ecological receptor)	■ Surface Water (human receptor)

MRS Summary:

MRS Description: Describe the munitions-related activities that occurred at the installation, the dates of operation, and the UXO, DMM or MC known or suspected to be present. When possible, identify munitions, CWM, and MC by type:

The WFF Project 07 is approximately 1.53 acres of land located in the Main Base Sector. It is comprised of four areas: Pyrotechnics Burn Area, Gun Butt No. 1, Gun Butt No. 2, and Boat Basin. The WFF was used by the Naval Aviation Ordnance Test Station (NAOTS) between 1946 and 1959 to conduct secret aviation ordnance tests and munitions experiments. Munitions historically used or burned at WFF Project 07 include AN Mk4 signals, AN Mk5/Mk23/Mk43 practice bombs, Mk6 parachute flares, 20-mm, 27-mm, and .50-caliber. Since military use ended, no confirmed MEC is known to have been found, but numerous MD items have been found and subsurface anomalies have been recorded. Refer to Paragraphs 2.1.2, 2.1.3, 2.1.4, 2.2.2, and 4.2.1.1 and Table 2-2 of the SI Report.

The MRSPP was addressed with stakeholders during an initial Technical Project Planning (TPP) meeting. Appendix B of the Final SI Report contains the TPP #1 and #2 memorandums and a copy of the public notice indicating availability of the MRSPP.

Description of Pathways for Human and Ecological Receptors:

Surface soil, subsurface soil (12- to 24-inch depth, not included in MRSPP per the MRSPP Primer), sediment, surface water, and groundwater were sampled at MRS 7. Refer to the CSM for MRS 7 (Appendix J) and Paragraphs 3.3.2.1, 5.2.0.2, and 5.2.0.3 of the SI Report.
Description of Receptors (Human and Ecological):
Visitor/trespasser, construction worker, employee, and biota. Refer to the CSM for the land portion of MRS 7 (Appendix J) and Paragraphs 5.2.0.2 and 5.2.0.3 of the SI Report.

Table 1

EHE Module: Munitions Type Data Element Table

DIRECTIONS: Below are 11 classifications of munitions and their descriptions. Circle the scores that correspond with **all** the munitions types known or suspected to be present at the MRS.

Note: The terms practice munitions, small arms ammunition, physical evidence, and historical evidence are defined in Appendix C of the Primer.

Classification	Description	Score
Sensitive	◆ UXO that are considered likely to function upon any interaction with exposed persons (e.g., submunitions, 40mm high-explosive [HE] grenades, white phosphorus [WP] munitions, high-explosive antitank [HEAT] munitions, and practice munitions with sensitive fuzes, but excluding all other practice munitions). ◆ Hand grenades containing energetic filler. ◆ Bulk primary explosives, or mixtures of these with environmental media, such that the mixture poses an explosive hazardard.	30
High explosive (used or damaged)	◆ UXO containing a high-explosive filler (e.g., RDX, Composition B), that are not considered "sensitive." ◆ DMM containing a high-explosive filler that have: ▪ Been damaged by burning or detonation ▪ Deteriorated to the point of instability.	25
Pyrotechnic (used or damaged)	◆ UXO containing a pyrotechnic fillers other than white phosphorous (e.g., flares, signals, simulators, smoke grenades). ◆ DMM containing pyrotechnic fillers other than white phosphorous (e.g., flares, signals, simulators, smoke grenades) that have: ▪ Been damaged by burning or detonation ▪ Deteriorated to the point of instability.	20
High explosive (unused)	◆ DMM containing a high explosive filler that: ▪ Have not been damaged by burning or detonation ▪ Are not deteriorated to the point of instability.	15
Propellant	◆ UXO containing mostly single-, double-, or triple-based propellant, or composite propellants (e.g., a rocket motor). ◆ DMM containing mostly single-, double-, or triple-based propellant, or composite propellants (e.g., a rocket motor) that are: ▪ Damaged by burning or detonation ▪ Deteriorated to the point of instability.	15
Bulk secondary high explosives, pyrothechnics, or propellant	◆ DMM containing mostly single-, double-, or triple-based propellant, or composite propellants (e.g., a rocket motor). ◆ DMM that are bulk secondary high explosives, pyrotechnic compositions, or propellant (not contained in a munition), or mixtures of these with environmental media such that the mixture poses an explosive hazard.	10
Pyrotechnic (not used or damaged)	◆ DMM containing a pyrotechnic fillers (i.e., red phosphorous), other than white phosphorous filler, that: ▪ Have not been damaged by burning or detonation ▪ Are not deteriorated to the point of instability.	10
Practice	◆ UXO that are practice munitions that are not associated with a sensitive fuze. ◆ DMM that are practice munitions that are not associated with a sensitive fuze and that have not: ▪ Been damaged by burning or detonation ▪ Deteriorated to the point of instability.	5
Riot control	◆ UXO or DMM containing a riot control agent filler (e.g., tear gas).	3
Small arms	◆ Used munitions or DMM that are categorized as small arms ammunition [Physical evidence or historical evidence that no other types of munitions (e.g., grenades, subcaliber training rockets, demolition charges) were used or are present on the MRS is required for selection of this category.].	2
Evidence of no munitions	◆ Following investigation of the MRS, there is physical evidence that there are no UXO or DMM present, or there is historical evidence indicating that no UXO or DMM are present.	0
MUNITIONS TYPE	**DIRECTIONS:** Record **the single highest score** from above in the box to the right (maximum score = 30).	25

DIRECTIONS: Document any MRS-specific data used in selecting the ***Munitions Type*** classifications in the space provided.

Munitions used or disposed of included practice (rated in this table as "Practice") and HE (rated in this table as "High explosive [used or damaged]") medium (20-mm) and large (37-mm) caliber, practice bombs; small arms (rated in this table as "Small arms"); flares and signals (rated in this table as "Pyrotechnic [used or damaged]"). Since military use ended, no confirmed MEC is known to have been found, but numerous MD items have been found and subsurface anomalies have been recorded. Refer to Paragraphs 2.4.1.2, 2.4.3.2, 3.3.1.2, and 4.2.1.1 and Tables 2-2 and 4-2 of this SI Report for more information.

Table 2

EHE Module: Source of Hazard Data Element Table

DIRECTIONS: Below are 11 classifications describing sources of explosive hazards. Circle the scores that correspond with **all** the sources of explosive hazards known or suspected to be present at the MRS.

Note: The terms former range, practice munitions, small arms range, physical evidence, and historical evidence are defined in Appendix C of the Primer.

Classification	Description	Score
Former range	◆ The MRS is a former military range where munitions (including practice munitions with sensitive fuzes) have been used. Such areas include impact or target areas and associated buffer and safety zones.	10
Former munitions treatment (i.e., OB/OD) unit	◆ The MRS is a location where UXO or DMM (e.g., munitions, bulk explosives, bulk pyrotechnic, or bulk propellants) were burned or detonated for the purpose of treatment prior to disposal.	8
Former practice munitions range	◆ The MRS is a former military range on which only practice munitions without sensitive fuzes were used.	6
Former maneuver area	◆ The MRS is a former maneuver area where no munitions other than flares, simulators, smokes, and blanks were used. There must be evidence that no other munitions were used at the location to place an MRS into this category.	5
Former burial pit or other disposal area	◆ The MRS is a location where DMM were buried or disposed of (e.g., disposed of into a water body) without prior thermal treatment.	5
Former industrial operating facilities	◆ The MRS is a location that is a former munitions maintenance, manufacturing, or demilitarization facility.	4
Former firing points	◆ The MRS is a firing point, where the firing point is delineated as an MRS separate from the rest of a former military range.	4
Former missile or air defense artillery emplacements	◆ The MRS is a former missile defense or air defense artillery (ADA) emplacement not associated with a military range.	2
Former storage or transfer points	◆ The MRS is a location where munitions were stored or handled for transfer between different modes of transportation (e.g., rail to truck, truck to weapon system).	2
Former small arms range	◆ The MRS is a former military range where only small arms ammunition was used. (There must be evidence that no other types of munitions [e.g., grenades] were used or are present to place an MRS into this category.)	1
Evidence of no munitions	◆ Following investigation of the MRS, there is physical evidence that no UXO or DMM are present, or there is historical evidence indicating that no UXO or DMM are present.	0
SOURCE OF HAZARD	**DIRECTIONS:** Record **the single highest score** from above in the box to the right (maximum score = 10).	10

DIRECTIONS: Document any MRS-specific data used in selecting the ***Source of Hazard*** classifications in the space provided.

WFF Project 07 comprises Gun Butts No. 1 and 2 (former ranges), Pyrotechnics Burn Area (former munitions treatment), and South Bank of Boat Basin (former transfer point). Refer to Paragraphs 2.1.3 and 2.4.3.2 of the SI Report.

Table 3

EHE Module: Location of Munitions Data Element Table

DIRECTIONS: Below are eight classifications of munitions locations and their descriptions. Circle the scores that correspond with **all** the locations where munitions are known or suspected to be present at the MRS.

Note: The terms confirmed, surface, subsurface, small arms ammunition, physical evidence, and historical evidence are defined in Appendix C of the Primer.

Classification	Description	Score
Confirmed surface	◆ Physical evidence indicates that there are UXO or DMM on the surface of the MRS. ◆ Historical evidence (i.e., a confirmed report such as an explosive ordnance disposal [EOD], police, or fire department report that an incident or accident that involved UXO	25
Confirmed subsurface, active	◆ Physical evidence indicates the presence of UXO or DMM in the subsurface of the MRS,and the geological conditions at the MRS are likely to cause UXO or DMM to be exposed, in the future, by naturally occurring phenomena (e.g., drought, flooding, erosion, frost heave, tidal action), or intrusive activities (e.g., plowing, construction, dredging) at the MRS are likely to expose UXO or DMM. ◆ Historical evidence indicates that UXO or DMM are located in the subsurface of the MRS and the geological conditions at the MRS are likely to cause UXO or DMM to be exposed, in the future, by naturally occurring phenomena (e.g., drought, flooding, erosion, frost heave, tidal action), or intrusive activities (e.g., plowing, construction, dredging) at the MRS are likely to expose UXO or DMM.	20
Confirmed subsurface, stable	◆ Physical evidence indicates the presence of UXO or DMM in the subsurface of the MRS and the geological conditions at the MRS are not likely to cause UXO or DMM to be exposed, in the future, by naturally occurring phenomena, or intrusive activities at the MRS are not likely to cause UXO or DMM to be exposed. ◆ Historical evidence indicates that UXO or DMM are located in the subsurface of the MRS and the geological conditions at the MRS are not likely to cause UXO or DMM to be exposed, in the future, by naturally occurring phenomena, or intrusive activities at the MRS are not likely to cause UXO or DMM to be exposed.	15
Suspected (physical evidence)	◆ There is physical evidence (e.g., munitions debris, such fragments, penetrators, projectiles, shell casings, links, fins), other than the documented presence of UXO or DMM, indicating that UXO or DMM may be present at the MRS.	10
Suspected (historical evidence)	◆ There is historical evidence indicating that UXO or DMM may be present at the MRS.	5
Subsurface, physical constraint	◆ There is physical or historical evidence indicating that UXO or DMM may be present in the subsurface, but there is a physical constraint (e.g., pavement, water depth over 120 feet) preventing direct access to the UXO or DMM.	2
Small arms (regardless of location)	◆ The presence of small arms ammunition is confirmed or suspected, regardless of other factors such as geological stability (There must be evidence that no other types of munitions [e.g., grenades] were used or are present at the MRS to place an MRS into this category.)	1
Evidence of no munitions	◆ Following investigation of the MRS, there is physical evidence that there are no UXO or DMM present, or there is historical evidence indicating that no UXO or DMM are present.	0
LOCATION OF MUNITIONS	**DIRECTIONS:** Record **the single highest score** from above in the box to the right (maximum score = 25).	10

DIRECTIONS: Document any MRS-specific data used in selecting the ***Location of Munitions*** classifications in the space provided.

Since military use ended, no confirmed MEC is known to have been found, but numerous MD items have been found on the surface and subsurface anomalies have been recorded. Refer to Paragraphs 2.4.1.2, 2.4.3.2, 3.3.1.2, and 4.2.1.1 and Table 4-2 of this SI Report for more information.

Table 4

EHE Module: Ease of Access Data Element Table

DIRECTIONS: Below are four classifications of barrier types that can surround an MRS and their descriptions. The barrier type is directly related to the ease of public access to the MRS. Circle the score that corresponds with the ease of access to the MRS.

Note: The term barrier is defined in Appendix C of the Primer.

Classification	Description	Score
No barrier	◆ There is no barrier preventing access to any part of the MRS (i.e., all parts of the MRS are accessible).	10
Barrier to MRS access is incomplete	◆ There is a barrier preventing access to parts of the MRS, but not the entire MRS.	8
Barrier to MRS access is complete but not monitored	◆ There is a barrier preventing access to all parts of the MRS, but there is no surveillance (e.g., by a guard) to ensure that the barrier is effectively preventing access to all parts of the MRS.	5
Barrier to MRS access is complete and monitored	◆ There is a barrier preventing access to all parts of the MRS, and there is active, continual surveillance (e.g., by a guard, video monitoring) to ensure that the barrier is effectively preventing access to all parts of the MRS.	0
EASE OF ACCESS	**DIRECTIONS:** Record **the single highest score** from above in the box to the right (maximum score = 10).	8

DIRECTIONS: Document any MRS-specific data used in selecting the ***Ease of Access*** classifications in the space provided.

WFF Project 07 is located near the NASA Visitor Center, which is located behind a fence and gate that are open to the public during limited hours. Once at the Visitor Center, the public has access to Gun Butts No. 1 and 2, but not the Pyrotechnics Burn Area and South Bank of Boat Basin, which are located behind additional fences. The Marine Science Consortium and NASA employees have access to the Boat Basin. Refer to Paragraph 3.3.1.2 of the SI Report.

Gun Butts No. 1 and 2 are in an area outside of the Visitor Information Center that is open to the public. There is a gate at the entrance to the visitor center parking lot to regulate/control entering this area if necessary; however, the gate is open during daylight hours (10 am to 4 pm) on a schedule that is seasonal but a minimum of five days a week. 3.3.1.2

Table 5

EHE Module: Status of Property Data Element Table

DIRECTIONS: Below are three classifications of the status of a property within the Department of Defense (DoD) and their descriptions. Circle the score that corresponds with the status of property at the MRS.

Classification	Description	Score
Non-DoD control	◆ The MRS is at a location that is no longer owned by, leased to, or otherwise possessed or used by DoD. Examples are privately owned land or water bodies; land or water bodies owned or controlled by state, tribal, or local governments; and land or water bodies managed by other federal agencies.	5
Scheduled for transfer from DoD control	◆ The MRS is on land or is a water body that is owned, leased, or otherwise possessed by DoD, and DoD plans to transfer that land or water body to the control of another entity (e.g., a state, tribal, or local government; a private party; another federal agency) within 3 years from the date the Protocol is applied.	3
DoD control	◆ The MRS is on land or is a water body that is owned, leased, or otherwise possessed by DoD. With respect to property that is leased or otherwise possessed, DoD must control access to the MRS 24 hours per day, every day of the calendar year.	0
STATUS OF PROPERTY	**DIRECTIONS:** Record **the single highest score** from above in the box to the right (maximum score = 5).	5

DIRECTIONS: Document any MRS-specific data used in selecting the ***Status of Property*** classifications in the space provided.

WFF Project 07 currently is owned by NASA and operated as part of the NASA WFF. Refer to Paragraph 2.3.4.1 of the SI Report.

Table 6

EHE Module: Population Density Data Element Table

DIRECTIONS: Below are three classifications for population density and their descriptions. Determine the population density per square mile that most closely corresponds with the population of the MRS, including the area within a two-mile radius of the MRS's perimeter. Circle the most appropriate score.

Note: Note: Use the U.S. Census Bureau tract data available to capture the highest population density within a two-mile radius of the perimeter of the MRS.

Classification	Description	Score
> 500 persons per square mile	◆ There are more than 500 persons per square mile in the U.S. Census Bureau tract in which the MRS is located.	5
100–500 persons per square mile	◆ There are 100 to 500 persons per square mile in the U.S. Census Bureau tract in which the MRS is located.	3
< 100 persons per square mile	◆ There are fewer than 100 persons per square mile in the U.S. Census Bureau tract in which the MRS is located.	1
POPULATION DENSITY	**DIRECTIONS:** Record **the single highest score** from above in the box to the right (maximum score = 5).	1

DIRECTIONS: Document any MRS-specific data used in selecting the ***Population Density*** classifications in the space provided.

The WFF Project 03 is located near Wattsville in Accomack County, VA. The 2010 Census estimate indicates that the population density of Accomack County is 73.8 people per square mile. Refer to Paragraph 2.3.3.1 of the SI Report.

Table 7

EHE Module: Population Near Hazard Data Element Table

DIRECTIONS: Below are six classifications describing the number of inhabited structures near the MRS. The number of inhabited buildings relates to the potential population near the MRS. Determine the number of inhabited structures within two miles of the MRS boundary and select the score that corresponds with the number of inhabited structures.

Note: The term inhabited structures is defined in Appendix C of the Primer.

Classification	Description	Score
26 or more inhabited structures	◆ There are 26 or more inhabited structures located up to 2 miles from the boundary of the MRS, within the boundary of the MRS, or both.	5
16 to 25 inhabited structures	◆ There are 16 to 25 inhabited structures located up to 2 miles from the boundary of the MRS, within the boundary of the MRS, or both.	4
11 to 15 inhabited structures	◆ There are 11 to 15 inhabited structures located up to 2 miles from the boundary of the MRS, within the boundary of the MRS, or both.	3
6 to 10 inhabited structures	◆ There are 6 to 10 inhabited structures located up to 2 miles from the boundary of the MRS, within the boundary of the MRS, or both.	2
1 to 5 inhabited structures	◆ There are 1 to 5 inhabited structures located up to 2 miles from the boundary of the MRS, within the boundary of the MRS, or both.	1
0 inhabited structures	◆ There are no inhabited structures located up to 2 miles from the boundary of the MRS, within the boundary of the MRS, or both.	0
POPULATION NEAR HAZARD	**DIRECTIONS:** Record **the single highest score** from above in the box to the right (maximum score = 5).	5

DIRECTIONS: Document any MRS-specific data used in selecting the ***Population Near Hazard*** classifications in the space provided.

There are more than 26 inhabited structures within a two-mile radius of the MRS boundary. Refer to Paragraph 2.3.3.1 of the SI Report.

Table 8

EHE Module: Types of Activities/Structures Data Element Table

DIRECTIONS: Below are five classifications of activities and/or inhabited structures and their descriptions. Review the types of activities that occur and/or structures that are present withinn two miles of the MRS and circle the scores that correspond with **all** the activities/structures classifications at the MRS.

Note: The term inhabited structure is defined in Appendix C of the Primer.

Classification	Description	Score
Residential, educational, commercial, or subsistence	◆ Activities are conducted, or inhabited structures are located up to two miles from the MRS's boundary or within the MRS's boundary, that are associated with any of the following purposes: residential, educational, child care, critical assets (e.g., hospitals, fire and rescue, police stations, dams), hotels, commercial, shopping centers, playgrounds, community gathering areas, religious sites, or sites used for subsistence hunting, fishing, and gathering.	5
Parks and recreational areas	◆ Activities are conducted, or inhabited structures are located up to two miles from the MRS's boundary or within the MRS's boundary, that are associated with parks, nature preserves, or other recreational uses.	4
Agricultural, forestry	◆ Activities are conducted, or inhabited structures are located up to two miles from the MRS's boundary or within the MRS's boundary, that are associated with agriculture or forestry.	3
Industrial or warehousing	◆ Activities are conducted, or inhabited structures are located up to two miles from the MRS's boundary or within the MRS's boundary, that are associated with industrial activities or warehousing.	2
No known or recurring activities	◆ There are no known or recurring activities occurring up to two miles from the MRS's boundary or within the MRS's boundary.	1
TYPES OF ACTIVITIES/STRUCTURES	**DIRECTIONS:** Record **the single highest score** from above in the box to the right (maximum score = 5).	***5***

DIRECTIONS: Document any MRS-specific data used in selecting the ***Types of Activities/Structures*** classifications in the space provided.

The NASA WFF visitor center (educational) is located adjacent to WFF Project 07 and visitors access Gun Butts No. 1 and 2 where rockets are on display. The Marine Science Consortium (educational) accesses their boats in the boat basin. The active NASA WFF Main Base (industrial or warehousing) and various bays and wetland areas (parks and recreational areas) are located within two miles of WFF Project 07. Refer to Paragraph 2.3.4.1 and Figure 2-3 of the SI Report.

Table 9

EHE Module: Ecological and/or Cultural Resources Data Element Table

DIRECTIONS: Below are four classifications of ecological and/or cultural resources and their descriptions. Review the types of resources present and circle the score that corresponds with the ecological and/or cultural resources present on the MRS.

Note: The terms ecological resources and cultural resources are defined in Appendix C of the Primer.

Classification	Description	Score
Ecological and cultural resources present	◆ There are both ecological and cultural resources present on the MRS.	5
Ecological resources present	◆ There are ecological resources present on the MRS.	3
Cultural resources present	◆ There are cultural resources present on the MRS.	3
No ecological or cultural resources present	◆ There are no ecological resources or cultural resources present on the MRS.	0
ECOLOGICAL AND/OR CULTURAL RESOURCES	**DIRECTIONS:** Record **the single highest score** from above in the box to the right (maximum score = 5).	3

DIRECTIONS: Document any MRS-specific data used in selecting the ***Ecological and/or Cultural Resources*** classifications in the space provided.

USFWS identified several federally threatened (Loggerhead sea turtle, Northeastern Beach tiger beetle, Piping Plover, Seabeach amaranth) and endangered (Delmarva Peninsula Fox squirrel, Roseate tern) species within WFF Project 07. No cultural resources were identified within WFF Project 07. Refer to Paragraphs 3.2.1.1, 3.2.1.2, and 3.2.2.1.

Table 10
Determining the EHE Module Rating

DIRECTIONS:

1. From Tables 1–9, record the data element scores in the **Score** boxes to the right.
2. Add the **Score** boxes for each of the three factors and record this number in the **Value** boxes to the right.
3. Add the three **Value** boxes and record this number in the **EHE Module Total** box below.
4. Circle the appropriate range for the **EHE Module Total** below.
5. Circle the **EHE Module Rating** that corresponds to the range selected and record this value in the **EHE Module Rating** box found at the bottom of the table.

Note:
An alternative module rating may be assigned when a module letter rating is inappropriate. An alternative module rating is used when more information is needed to score one or more data elements, contamination at an MRS was previously addressed, or there is no reason to suspect contamination was ever present at an MRS.

	Source	Score	Value
Explosive Hazard Factor Data Elements			
Munitions Type	Table 1	25	35
Source of Hazard	Table 2	10	
Accessibility Factor Data Elements			
Location of Munitions	Table 3	10	23
Ease of Access	Table 4	8	
Status of Property	Table 5	5	
Receptor Factor Data Elements			
Population Density	Table 6	1	14
Population Near Hazard	Table 7	5	
Types of Activities/ Structures	Table 8	5	
Ecological and /or Cultural Resources	Table 9	3	
EHE MODULE TOTAL			72

EHE Module Total	EHE Module Rating
92 to 100	A
82 to 91	B
71 to 81	*C*
60 to 70	D
48 to 59	E
38 to 47	F
less than 38	G
Alternative Module Ratings	Evaluation Pending
	No Longer Required
	No Known or Suspected Explosive Hazard
EHE MODULE RATING	*C*

Table 11

CHE Module: CWM Configuration Data Element Table

DIRECTIONS: Below are seven classifications of CWM configuration and their descriptions. Circle the scores that correspond to **all** the CWM configurations known or suspected to be present at the MRS.

Note: The terms CWM/UXO, CWM/DMM, physical evidence, and historical evidence are defined in Appendix C of the Primer.

Classification	Description	Score
CWM, that are either UXO, or explosively configured damaged DMM	The CWM known or suspected of being present at the MRS is: ◆ CWM that are UXO (i.e., CWM/UXO). ◆ Explosively configured CWM that are DMM (i.e., CWM/DMM) that have been damaged.	30
CWM mixed with UXO	◆ The CWM known or suspected of being present at the MRS are undamaged CWM/DMM or CWM not configured as a munition that are commingled with conventional munitions that are UXO.	25
CWM, explosive configuration that are undamaged DMM	◆ The CWM known or suspected of being present at the MRS are explosively configured CWM/DMM that have not been damaged.	20
CWM/DMM, not explosively configured or CWM, bulk container	The CWM known or suspected of being present at the MRS is: ◆ Nonexplosively configured CWM/DMM either damaged or undamaged ◆ Bulk CWM (e.g., ton container).	15
CAIS K941 and CAIS K942	◆ The CWM/DMM known or suspected of being present at the MRS is CAIS K941-toxic gas set M-1 or CAIS K942-toxic gas set M-2/E11.	12
CAIS (chemical agent identification sets)	◆ CAIS, other than CAIS K941 and K942, are known or suspected of being present at the MRS.	10
Evidence of no CWM	◆ Following investigation, the physical evidence indicates that CWM are not present at the MRS, or the historical evidence indicates that CWM are not present at the MRS.	0
CWM CONFIGURATION	**DIRECTIONS:** Record **the single highest score** from above in the box to the right (maximum score = 30).	0

DIRECTIONS: Document any MRS-specific data used in selecting the ***CWM Configuration*** classifications in the space provided.

CWM was not known to have been used, stored, or disposed of at WFF Project 06. Refer to Paragraph 2.4.3.1 of the SI Report.

TABLES 12 THROUGH 19 ARE INTENTIONALLY OMITTED ACCORDING TO ARMY GUIDANCE

Table 20

Determining the CHE Module Rating

DIRECTIONS:

1. From Tables 11–19, record the data element scores in the **Score** boxes to the right.
2. Add the **Score** boxes for each of the three factors and record this number in the **Value** boxes to the right.
3. Add the three **Value** boxes and record this number in the **CHE Module Total** box below.
4. Circle the appropriate range for the **CHE Module Total** below.
5. Circle the **CHE Module Rating** that corresponds to the range selected and record this value in the **CHE Module Rating** box found at the bottom of the table.

Note:
An alternative module rating may be assigned when a module letter rating is inappropriate. An alternative module rating is used when more information is needed to score one or more data elements, contamination at an MRS was previously addressed, or there is no reason to suspect contamination was ever present at an MRS.

	Source	Score	Value
CWM Hazard Factor Data Elements			
CWM Configuration	Table 11	0	0
Sources of CWM	Table 12		
Accessibility Factor Data Elements			
Location of CWM	Table 13		0
Ease of Access	Table 14		
Status of Property	Table 15		
Receptor Factor Data Elements			
Population Density	Table 16		0
Population Near Hazard	Table 17		
Types of Activities/ Structures	Table 18		
Ecological and /or Cultural Resources	Table 19		
CHE MODULE TOTAL			0

CHE Module Total	CHE Module Rating
92 to 100	A
82 to 91	B
71 to 81	C
60 to 70	D
48 to 59	E
38 to 47	F
less than 38	G
Alternative Module Ratings	Evaluation Pending
	No Longer Required
	No Known or Suspected CWM Hazard
CHE MODULE RATING	***No Known or Suspected CWM Hazard***

Table 21

HHE Module: Groundwater Data Element Table

Contaminant Hazard Factor (CHF)

DIRECTIONS: Record the maximum concentrations of all contaminants in the MRS's groundwater and their comparison values (from Appendix B of the Primer) in the table below. Additional contaminants can be recorded on Table 27. Calculate and record the ratios for each contaminant by dividing the maximum concentration by the comparison value. Determine the CHF by adding the contaminant ratios together, including any additional groundwater contaminants recorded on Table 27. Based on the CHF, use the CHF Scale to determine and display the CHF Value. If there is no known or suspected MC hazard present in the groundwater, select the box at the bottom of the table.

Note: Use dissolved, rather than total, metals analyses when both are available.

Contaminant	Maximum Concentration	Comparison Value	Unit	Ratios
Iron	65000	11000	ug/L	5.9
Antimony	5.7	15	ug/L	0.38

CHF Scale	CHF Value	Sum The Ratios	6.3
CHF > 100	H (High)	*CHF* = [Maximum Concentration of Contaminant] / [Comparison Value for Contaminant]	
100 > CHF > 2	M (Medium)		
2 > CHF	L (Low)		

CONTAMINANT HAZARD FACTOR	**DIRECTIONS:** Record **the CHF Value** from above in the box to the right (maximum value = H).	*M*

Migratory Pathway Factor

DIRECTIONS: Circle the value that corresponds most closely to the groundwater migratory pathway at the MRS.

Classification	Description	Value
Evident	Analytical data or observable evidence indicates that contamination in the groundwater is present at, moving toward, or has moved to a point of exposure.	H
Potential	Contamination in groundwater has moved only slightly beyond the source (i.e., tens of feet), could move but is not moving appreciably, or information is not sufficient to make a determination of Evident or Confined.	M
Confined	Information indicates a low potential for contaminant migration from the source via the groundwater to a potential point of exposure (possibly due to geological structures or physical controls).	L
MIGRATORY PATHWAY FACTOR	**DIRECTIONS:** Record **the single highest value** from above in the box to the right (maximum value = H).	*M*

Receptor Factor

DIRECTIONS: Circle the value that corresponds most closely to the groundwater receptors at the MRS.

Classification	Description	Value
Identified	There is a threatened water supply well downgradient of the source and the groundwater is a current source of drinking water or source of water for other beneficial uses such as irrigation/agriculture (equivalent to Class I or IIA aquifer).	H
Potential	There is no threatened water supply well downgradient of the source and the groundwater is currently or potentially usable for drinking water, irrigation, or agriculture (equivalent to Class I, IIA, or IIB aquifer).	M
Limited	There is no potentially threatened water supply well downgradient of the source and the groundwater is not considered a potential source of drinking water and is of limited beneficial use (equivalent to Class IIIA or IIIB aquifer, or where perched aquifer exists only).	L
RECEPTOR FACTOR	**DIRECTIONS:** Record **the single highest value** from above in the box to the right (maximum value = H).	*M*

No Known or Suspected Groundwater MC Hazard ☐

Table 21 Comments: Iron and antimony were detected at WFF Project 07 above maximum background concentrations derived from the "Background Soil and Groundwater Investigation Report for the Main Base, NASA Wallops Flight Facility" dated May 2004. Maximum concentrations at WFF Project 07 were detected in the following samples: WFF-MRS7-GW-00-03 (iron) and WFF-MRS7-GW-00-02 (antimony). Refer to Table 5-4 of the SI Report.

Table 22

HHE Module: Surface Water – Human Endpoint Data Element Table

Contaminant Hazard Factor (CHF)

DIRECTIONS: Record the maximum concentrations of all contaminants in the MRS's surface water and their comparison values (from Appendix B of the Primer) in the table below. Additional contaminants can be recorded on Table 27. Calculate and record the ratios for each contaminant by dividing the maximum concentration by the comparison value. Determine the CHF by adding the contaminant ratios together, including any additional surface water contaminants recorded on Table 27. Based on the CHF, use the CHF Scale to determine and record the CHF Value. If there is no known or suspected MC hazard for human endpoints present in the surface water, select the box at the bottom of the table.

Note: Use dissolved, rather than total, metals analyses when both are available.

Contaminant	Maximum Concentration	Comparison Value	Unit	Ratios

CHF Scale	CHF Value	Sum The Ratios
CHF > 100	H (High)	$CHF = \frac{\text{[Maximum Concentration of Contaminant]}}{\text{[Comparison Value for Contaminant]}}$
100 > CHF > 2	M (Medium)	
2 > CHF	L (Low)	

CONTAMINANT HAZARD FACTOR	**DIRECTIONS:** Record **the CHF Value** from above in the box to the right (maximum value = H).	

Migratory Pathway Factor

DIRECTIONS: Circle the value that corresponds most closely to the surface water migratory pathway at the MRS.

Classification	Description	Value
Evident	Analytical data or observable evidence indicates that contamination in the surface water is present at, moving toward, or has moved to a point of exposure.	H
Potential	Contamination in surface water has moved only slightly beyond the source (i.e., tens of feet), could move but is not moving appreciably, or information is not sufficient to make a determination of Evident or Confined.	M
Confined	Information indicates a low potential for contaminant migration from the source via the surface water to a potential point of exposure (possibly due to geological structures or physical controls).	L
MIGRATORY PATHWAY FACTOR	**DIRECTIONS:** Record **the single highest value** from above in the box to the right (maximum value = H).	

Receptor Factor

DIRECTIONS: Circle the value that corresponds most closely to the surface water receptors at the MRS.

Classification	Description	Value
Identified	Identified receptors have access to surface water to which contamination has moved or can move.	H
Potential	Potential for receptors to have access to surface water to which contamination has moved or can move.	M
Limited	Little or no potential for receptors to have access to surface water to which contamination has moved or can move.	L
RECEPTOR FACTOR	**DIRECTIONS:** Record **the single highest value** from above in the box to the right (maximum value = H).	

No Known or Suspected Surface Water (Human Endpoint) MC Hazard ■

Table 22 Comments: None of the explosive analytes were detected in surface water samples collected. Refer to Table 5 -3 of the SI Report.

Table 23

HHE Module: Sediment – Human Endpoint Data Element Table

Contaminant Hazard Factor (CHF)

DIRECTIONS: Record the maximum concentrations of all contaminants in the MRS's sediment and their comparison values (from Appendix B of the Primer) in the table below. Additional contaminants can be recorded on Table 27. Calculate and record the ratios for each contaminant by dividing the maximum concentration by the comparison value. Determine the CHF by adding the contaminant ratios together, including any additional sediment contaminants recorded on Table 27. Based on the CHF, use the CHF Scale to determine and record the CHF Value. If there is no known or suspected MC hazard with human endpoints present in the sediment, select the box at the bottom of the table.

Contaminant	Maximum Concentration	Comparison Value	Unit	Ratios
Copper	42	3100	mg/Kg	0.014

CHF Scale	CHF Value		
		Sum The Ratios	0.014
CHF > 100	H (High)	*CHF* = [Maximum Concentration of Contaminant] / [Comparison Value for Contaminant]	
100 > CHF > 2	M (Medium)		
2 > CHF	L (Low)		

CONTAMINANT HAZARD FACTOR	**DIRECTIONS:** Record **the CHF Value** from above in the box to the right (maximum value = H).	*L*

Migratory Pathway Factor

DIRECTIONS: Circle the value that corresponds most closely to the sediment migratory pathway at the MRS.

Classification	Description	Value
Evident	Analytical data or observable evidence indicates that contamination in the sediment is present at, moving toward, or has moved to a point of exposure.	H
Potential	Contamination in sediment has moved only slightly beyond the source (i.e., tens of feet), could move but is not moving appreciably, or information is not sufficient to make a determination of Evident or Confined.	M
Confined	Information indicates a low potential for contaminant migration from the source via the sediment to a potential point of exposure (possibly due to presence of geological structures or physical controls).	L
MIGRATORY PATHWAY FACTOR	**DIRECTIONS:** Record **the single highest value** from above in the box to the right (maximum value = H).	*M*

Receptor Factor

DIRECTIONS: Circle the value that corresponds most closely to the sediment receptors at the MRS.

Classification	Description	Value
Identified	Identified receptors have access to sediment to which contamination has moved or can move.	H
Potential	Potential for receptors to have access to sediment to which contamination has moved or can move.	M
Limited	Little or no potential for receptors to have access to sediment to which contamination has moved or can move.	L
RECEPTOR FACTOR	**DIRECTIONS:** Record **the single highest value** from above in the box to the right (maximum value = H).	*M*
	No Known or Suspected Sediment (Human Endpoint) MC Hazard	☐

Table 23 Comments: Copper was detected at WFF Project 07 above the maximum concentration of background sediment samples collected during the 2011 SI field activities. The maximum concentration of copper at WFF Project 07 was detected in sample WFF-MRS7-SD-01-04. Refer to Table 5-2 of the SI Report.

Table 24

HHE Module: Surface Water – Ecological Endpoint Data Element Table

Contaminant Hazard Factor (CHF)

DIRECTIONS: Record the maximum concentrations of all contaminants in the MRS's surface water and their comparison values (from Appendix B of the Primer) in the table below. Additional contaminants can be recorded on Table 27. Calculate and record the ratios for each contaminant by dividing the maximum concentration by the comparison value. Determine the CHF by adding the contaminant ratios together, including any additional surface water contaminants recorded on Table 27. Based on the CHF, use the CHF Scale to determine and record the CHF Value. If there is no known or suspected MC hazard with ecological endpoints present in the surface water, select the box at the bottom of the table.

Contaminant	Maximum Concentration	Comparison Value	Unit	Ratios

CHF Scale	CHF Value	Sum The Ratios	
CHF > 100	H (High)	*CHF* = [Maximum Concentration of Contaminant] / [Comparison Value for Contaminant]	
100 > CHF > 2	M (Medium)		
2 > CHF	L (Low)		
CONTAMINANT HAZARD FACTOR	**DIRECTIONS:** Record **the CHF Value** from above in the box to the right (maximum value = H).		

Migratory Pathway Factor

DIRECTIONS: Circle the value that corresponds most closely to the surface water migratory pathway at the MRS.

Classification	Description	Value
Evident	Analytical data or observable evidence indicates that contamination in the surface water is present at, moving toward, or has moved to a point of exposure.	H
Potential	Contamination in surface water has moved only slightly beyond the source (i.e., tens of feet), could move but is not moving appreciably, or information is not sufficient to make a determination of Evident or Confined.	M
Confined	Information indicates a low potential for contaminant migration from the source via the surface water to a potential point of exposure (possibly due to presence of geological structures or physical controls).	L
MIGRATORY PATHWAY FACTOR	**DIRECTIONS:** Record **the single highest value** from above in the box to the right (maximum value = H).	

Receptor Factor

DIRECTIONS: Circle the value that corresponds most closely to the surface water receptors at the MRS.

Classification	Description	Value
Identified	Identified receptors have access to surface water to which contamination has moved or can move.	H
Potential	Potential for receptors to have access to surface water to which contamination has moved or can move.	M
Limited	Little or no potential for receptors to have access to surface water to which contamination has moved or can move.	L
RECEPTOR FACTOR	**DIRECTIONS:** Record **the single highest value** from above in the box to the right (maximum value = H).	

No Known or Suspected Surface Water (Ecological Endpoint) MC Hazard ■

Table 24 Comments: None of the explosive analytes were detected in surface water samples collected. Refer to Table 5 -3 of the SI Report.

Table 25

HHE Module: Sediment – Ecological Endpoint Data Element Table

Contaminant Hazard Factor (CHF)

DIRECTIONS: Record the maximum concentrations of all contaminants in the MRS's sediment and their comparison values (from Appendix B of the Primer) in the table below. Additional contaminants can be recorded on Table 27. Calculate and record the ratios for each contaminant by dividing the maximum concentration by the comparison value. Determine the CHF by adding the ratios together, including any additional sediment contaminants recorded on Table 27. Based on the CHF, use the CHF Scale to determine and record the CHF Value. If there is no known or suspected MC hazard with ecological endpoints present in the sediment, select the box at the bottom of the table.

Contaminant	Maximum Concentration	Comparison Value	Unit	Ratios
Copper	42	31.6	mg/Kg	1.3

CHF Scale	CHF Value		
		Sum The Ratios	1.3
CHF > 100	H (High)	*CHF* = [Maximum Concentration of Contaminant] / [Comparison Value for Contaminant]	
100 > CHF > 2	M (Medium)		
2 > CHF	L (Low)		

CONTAMINANT HAZARD FACTOR	**DIRECTIONS:** Record **the CHF Value** from above in the box to the right (maximum value = H).	*L*

Migratory Pathway Factor

DIRECTIONS: Circle the value that corresponds most closely to the sediment migratory pathway at the MRS.

Classification	Description	Value
Evident	Analytical data or observable evidence indicates that contamination in the sediment is present at, moving toward, or has moved to a point of exposure.	H
Potential	Contamination in sediment has moved only slightly beyond the source (i.e., tens of feet), could move but is not moving appreciably, or information is not sufficient to make a determination of Evident or Confined.	M
Confined	Information indicates a low potential for contaminant migration from the source via the sediment to a potential point of exposure (possibly due to presence of geological structures or physical controls).	L
MIGRATORY PATHWAY FACTOR	**DIRECTIONS:** Record **the single highest value** from above in the box to the right (maximum value = H).	*M*

Receptor Factor

DIRECTIONS: Circle the value that corresponds most closely to the sediment receptors at the MRS.

Classification	Description	Value
Identified	Identified receptors have access to sediment to which contamination has moved or can move.	H
Potential	Potential for receptors to have access to sediment to which contamination has moved or can move.	M
Limited	Little or no potential for receptors to have access to sediment to which contamination has moved or can move.	L
RECEPTOR FACTOR	**DIRECTIONS:** Record **the single highest value** from above in the box to the right (maximum value = H).	*M*
	No Known or Suspected Sediment (Ecological Endpoint) MC Hazard	☐

Table 25 Comments: Copper was detected at WFF Project 07 above the maximum concentration of background sediment samples collected during the 2011 SI field activities. The maximum concentration of copper at WFF Project 07 was detected in sample WFF-MRS7-SD-01-04. Refer to Table 5-2 of the SI Report.

Table 26

HHE Module: Surface Soil Data Element Table

Contaminant Hazard Factor (CHF)

DIRECTIONS: Record the maximum concentrations of all contaminants in the MRS's surface soil and their comparison values (from Appendix B of the Primer) in the table below. Additional contaminants can be recorded on Table 27. Calculate and record the ratios for each contaminant by dividing the maximum concentration by the comparison value. Determine the CHF by adding the contaminant ratios together, including any additional surface soil contaminants recorded on Table 27. Based on the CHF, use the CHF Scale to determine and record the CHF Value. If there is no known or suspected MC hazard present in the surface soil, select the box at the bottom of the table.

Contaminant	Maximum Concentration	Comparison Value	Unit	Ratios
Zinc	1900	23000	mg/Kg	0.083
Lead	290	400	mg/Kg	0.72
Copper	92	3100	mg/Kg	0.03
Antimony	1.9	31	mg/Kg	0.061
Tetryl	0.35	240	mg/Kg	0.0015

CHF Scale	CHF Value	Sum The Ratios	0.91
CHF > 100	H (High)	*CHF* = [Maximum Concentration of Contaminant] / [Comparison Value for Contaminant]	
100 > CHF > 2	M (Medium)		
2 > CHF	L (Low)		

CONTAMINANT HAZARD FACTOR	**DIRECTIONS:** Record **the CHF Value** from above in the box to the right (maximum value = H).	*L*

Migratory Pathway Factor

DIRECTIONS: Circle the value that corresponds most closely to the surface soil migratory pathway at the MRS.

Classification	Description	Value
Evident	Analytical data or observable evidence indicates that contamination in the surface soil is present at, moving toward, or has moved to a point of exposure.	H
Potential	Contamination in surface soil has moved only slightly beyond the source (i.e., tens of feet), could move but is not moving appreciably, or information is not sufficient to make a determination of Evident or Confined.	M
Confined	Information indicates a low potential for contaminant migration from the source via the surface soil to a potential point of exposure (possibly due to presence of geological structures or physical controls).	L
MIGRATORY PATHWAY FACTOR	**DIRECTIONS:** Record **the single highest value** from above in the box to the right (maximum value = H).	*M*

Receptor Factor

DIRECTIONS: Circle the value that corresponds most closely to the surface soil receptors at the MRS.

Classification	Description	Value
Identified	Identified receptors have access to surface soil to which contamination has moved or can move.	H
Potential	Potential for receptors to have access to surface soil to which contamination has moved or can move.	M
Limited	Little or no potential for receptors to have access to surface soil to which contamination has moved or can move.	L
RECEPTOR FACTOR	**DIRECTIONS:** Record **the single highest value** from above in the box to the right (maximum value = H).	*M*

No Known or Suspected Surface Soil MC Hazard ☐

Table 26 Comments: Maximum metal and PAHs detections were compared to maximum background concentrations derived from the "Background Soil and Groundwater Investigation Report for the Main Base, NASA Wallops Flight Facility" dated May 2004. Maximum concentrations detected at WFF Project 07 were detected in the following samples: WFF-MRS7-SS-01-01 (antimony, acenaphthene, anthracene, naphthalene), WFF-MRS7-SS-01-03 (zinc), WFF-MRS7-SS-01-04 (lead), WFF-MRS7-SS-01-11 (nitrobenzene, tetryl), WFF-MRS7-SS-01-15 (nitroglycerine), and WFF-MRS7-SS-01-18 (copper). Refer to Table 5-1 in the SI Report.

Table 27

HHE Module: Supplemental Contaminant Hazard Factor Table

Contaminant Hazard Factor (CHF)

DIRECTIONS: Only use this table if there are more than five contaminants in any given medium present at the MRS. This is a supplemental table designed to hold information about contaminants that do not fit in the previous tables. Indicate the media in which these contaminants are present. Then record all contaminants, their maximum concentrations and their comparison values (from Appendix B of the Primer) in the table below. Calculate and record the ratio for each contaminant by dividing the maximum concentration by the comparison value. Determine the CHF for each medium on the

Note: Dissolved, rather than total, metals analyses are used when both are available.

Media	Contaminant	Maximum Concentration	Comparison Value	Ratio
Surface Soil	Acenaphthene	0.00077	3700	2.1E-07
Surface Soil	Anthracene	0.0033	22000	1.5E-07
Surface Soil	Naphthalene	0.0016	56	2.9E-05
Surface Soil	Nitrobenzene	0.16	20	0.008
Surface Soil	Nitroglycerine	0.29	1000	0.00029

Table 28

Determining the HHE Module Rating

DIRECTIONS:

1. Record the letter values (H, M, L) for the Contaminant Hazard, Migration Pathway, and Receptor Factors for the media (from Tables 21–26) in the corresponding boxes below.
2. Record the media's three-letter combinations in the Three-Letter Combination boxes below (three-letter combinations are arranged from Hs to Ms to Ls).
3. Using the HHE Ratings provided below, determine each media's rating (A-G) and record the letter in the corresponding Media Rating box below.

Media (Source)	Contaminant Hazard Factor Value	Migratory Pathway Factor Value	Receptor Factor Value	Three-Letter Combination (Hs-Ms-Ls)	Media Rating (A-G)
Groundwater (Table 21)	M	M	M	MMM	D
Surface Water/Human Endpoint (Table 22)					
Sediment/Human Endpoint (Table 23)	L	M	M	MML	E
Surface Water/Ecological Endpoint (Table 24)					
Sediment/Ecological Endpoint (Table 25)	L	M	M	MML	E
Surface Soil (Table 26)	L	M	M	MML	E

DIRECTIONS (cont.):

4. Select the single highest Media Rating (A is highest; G is lowest) and enter the letter in the HHE Module Rating box.

Note:
An alternative module rating may be assigned when a module letter rating is inappropriate. An alternative module rating is used when more information is needed to score one or more media, contamination at an MRS was previously addressed, or there is no reason to suspect contamination was ever present at an MRS.

HHE MODULE RATING	*D*

HHE Ratings (for reference only)	
Combination	**Rating**
HHH	A
HHM	B
HHL	C
HMM	C
HML	*D*
MMM	*D*
HLL	E
MML	E
MLL	F
LLL	G
Alternative Module Ratings	Evaluation Pending
	No Longer Required
	No Known or Suspected MC Hazard

Table 29
MRS Priority

DIRECTIONS: In the chart below, circle the letter rating for each module recorded in Table 10 (EHE), Table 20 (CHE), and Table 28 (HHE). Circle the corresponding numerical priority for each module. If information to determine the module rating is not available, choose the appropriate alternative module rating. The MRS Priority is the single highest priority; record this relative priority in the MRS Prioriy or Alternative MRS Rating at the bottom of the table.

Note: An MRS assigned Priority 1 has the highest relative priority; an MRS assigned Priority 8 has the lowest relative priority. Only an MRS with CWM known or suspected to be present can be assigned Priority 1; an MRS that has CWM known or suspected to be present cannot be assigned Priority 8.

EHE Rating	Priority	CHE Rating	Priority	HHE Rating	Priority
		A	1		
A	2	B	2	A	2
B	3	C	3	B	3
C	*4*	D	4	C	4
D	5	E	5	*D*	*5*
E	6	F	6	E	6
F	7	G	7	F	7
G	8			G	8
Evaluation Pending		Evaluation Pending		Evaluation Pending	
No Longer Required		No Longer Required		No Longer Required	
No Known or Suspected Explosive Hazard		*No Known or Suspected CWM Hazard*		No Known or Suspected MC Hazard	
MRS PRIORITY or ALTERNATIVE MRS RATING				*4*	

APPENDIX L – REFERENCE COPIES

Located on CD.

FINAL

Response to Stakeholder Comments - Site Inspection Report for Wallops Flight Facility Project 07, Accomack County, Virginia

MMRP Project No. **C03VA030107**

Prepared for:

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June 2012

PROJECT: WALLOPS FLIGHT FACILITY FUDS			
STAKEHOLDER REVIEW COMMENTS			
		REVIEW:	Draft Final Site Inspection Report for Wallops Flight Facility Project 07, February 2012
		DATE:	16 May 2012
		NAME:	Paul E. Herman, P.E., VDEQ
ITEM	SECTION OR REFERENCE	COMMENT	ACTION
1.	General Comment	VDEQ agrees with the recommendation to conduct a remedial investigation/feasibility study at Project 07. Given this recommendation and in consideration of the workload of the VDEQ risk assessors, this Site Investigation Report was not provided to the VDEQ risk assessment staff for review. Risks to human and ecological receptors from MEC and MC are expected to be fully evaluated during the RI which will be reviewed by the VDEQ risk assessor.	A-ACCEPTED/CONCUR. No action necessary.
2.	Section ES.7	Regarding the 5th sentence which begins "Only expended and inert MD have been observed historically", does it refer to the entire MRS or only the water portion discussed in the 4th sentence? Please clarify.	A-ACCEPTED/CONCUR. The 5th sentence refers to the entire MRS. For clarification; the fourth sentence was moved to become the 10th sentence before the discussion of underwater anomalies detected.
3.	Section ES.8	Please revise the 6th sentence to acknowledge NASA owns the land associated with Project 07.	A-ACCEPTED/CONCUR. The 6th sentence of paragraph ES.8 was revised as suggested.
4.	Section 1.3	Please delete the last sentence as it does not seem necessary.	A-ACCEPTED/CONCUR. The last sentence of Section 1.3 was deleted.
5.	Section 2.2.2	Please delete the phrase "stakeholder and/or" from the last sentence.	A-ACCEPTED/CONCUR. The text was revised as suggested.
6.	Section 2.3.4	Please add future residents as a potential receptor and ensure future residents are considered throughout the document when developing the conceptual site model, evaluating exposures, and screening data.	A-ACCEPTED/CONCUR. The CSM was updated to include residents as potential future receptors and the following text was added to Paragraph 2.3.4, *"Although future land use plans do not include residential reuse, stakeholders have requested that residents be included as potential future receptors. The future residential use of MRS 7 is not expected due to the unlikely closure of NASA WFF."* The following text was added to Section 5.1.3.2: "*Although future land use plans do not include residential reuse, stakeholders have requested that residents be included as potential future receptors and that COPCs are compared against USEPA regional SLs for residential soil to evaluate the upper bound for*

ACTION CODES: A-ACCEPTED/CONCUR; D-ACTION DEFERRED; W-WITHDRAWN; N-NON-CONCUR; V-VE POTENTIAL/VEP ATTACHED

ITEM	SECTION OR REFERENCE	COMMENT	ACTION
			potential site risks. However, future residential use of MRS 7 is not expected due to the unlikely closure of WFF."
7.	Section 2.3.7.1	Please note in this section some of the Town of Chincoteague drinking water comes from their wells in the Columbia aquifer and note the locations of these water supply wells relative to Project 07.	A-ACCEPTED/CONCUR. Information related to the Town of Chincoteague drinking water wells was added to Paragraph 2.3.7.1 per your suggestion.
8.	Section. 2.3.7.2	Please include the owners of the nearby wells such as Town of Chincoteague Wallops Flight Facility, NOAA, private residence, etc.	A-ACCEPTED/CONCUR. The last two sentences of Paragraph 2.3.7.2 were revised as follows, "*The ToC and NASA water supply well locations within a four mile radius of MRS 7 are shown on Figure 2-5. Information regarding the location of groundwater supply wells for private residences is not available to the general public, thus these wells are not included on Figure 2-5.*" No information was found regarding a well owned by NOAA in proximity to the WFF.
9.	Section 2.3.8.1	Please revise the last sentence as follows, "... within the Virginia Coastal Zone and *subject to the substantive requirements of* the Federal Coastal Zone Management Act (VDEQ 2010)."	A-ACCEPTED/CONCUR The last sentence of Paragraph 2.3.8.3.1 was revised as follows " *According to the VDEQ, the lead agency for the Virginia Coastal Zone Management Program, the WFF Project 07 is located within the Virginia Coastal Zone established as directed by the Federal Coastal Zone Management Act (VDEQ 2010).*"
10.	Section 2.5	Regarding the "citizen reports" referenced in the opening sentence, with whom would citizens file such reports and where would records of such reports be filed/archived?	A-ACCEPTED/CONCUR. Section 2.5 was updated as follows, "*Citizen reports are the result of a citizen calling the local authorities to remove a munitions item. Records of these reports can be filed with local EOD units, police, and/or fire and rescue who would maintain these records. Since military use of the MRS ceased, there are no known citizen reports of MEC or MD found at MRS 7 (USACE 2011). It would be expected that NASA would have knowledge of such records since their ownership of the property began; however, NASA is unaware of a citizen report occurring within WFF*

PROJECT: WALLOPS FLIGHT FACILITY FUDS			
STAKEHOLDER REVIEW COMMENTS			
		REVIEW:	Draft Final Site Inspection Report for Wallops Flight Facility Project 07, February 2012
		DATE:	16 May 2012
		NAME:	Paul E. Herman, P.E., VDEQ
ITEM	SECTION OR REFERENCE	COMMENT	ACTION
			Project 07 (TPMC 2012). Refer to Paragraph 3.1.1 for munitions finds mentioned by NASA during the TPP #1 meeting."
11.	Table 2-1	Why doesn't the table reflect the acreage of water investigated within the boat basin?	A-ACCEPTED/CONCUR. Table 2-1 represents the MRS 7 acreage for each of the four areas. The water acreage inspected during the SI activities was outside of the MRS 7 boundary. Therefore, no changes to the table have been made.
12.	Table 2-3, Number 14	Where is the Wallops Island National Wildlife Refuge border relative to Project 07?	A-ACCEPTED/CONCUR. The following comment was added to number 14 of Table 2-3, "*The Wallops Island National Wildlife Refuge is approximately 500 ft from the boundary of the MRS (USFWS 2011b).*"
13.	Section 3.1.4	Did the USEPA acknowledge the data collected for Project 07 would "support potential Hazard Ranking System scoring"? If so, please include a reference to this acknowledgement. If not, how is this DQO considered "attained" as only EPA is able to determine the suitability of the data for their HRS scoring purposes?	N- NON-CONCUR. Analytical data, environmental setting information, location of water supply wells, and other site-specific information collected during the SI may be relevant to an HRS score. Since an SI is a limited scope study, the data collected during this study can be used to support HRS scoring; however, this SI was not intended to be the only source of data used for HRS scoring. Therefore, since information collected during the SI may be relevant to an HRS score, the DQO was attained. As a result of USEPA's comment 2, the following text was added to Section 3.1.4: "*However, this SI was not intended to be the only source of data used to score WFF Project 07 in the HRS. While there is insufficient data in the SI for USEPA to perform an evaluation under the HRS Model, any data gaps will be discussed during the scoping process of the future RI.*"
14.	Section 3.1.6	Does the USEPA agree DQO 3 was attained? Who determines whether or not the DQO's were attained? Are the stakeholders queried? This section should state it is the opinion of the USACE the DQO's were attained but the ultimate determination of attainment requires input from the stakeholders.	N- NON-CONCUR. Refer to the response to VDEQ comment 13.

ACTION CODES: A-ACCEPTED/CONCUR; D-ACTION DEFERRED; W-WITHDRAWN; N-NON-CONCUR; V-VE POTENTIAL/VEP ATTACHED

PROJECT: WALLOPS FLIGHT FACILITY FUDS			
STAKEHOLDER REVIEW COMMENTS			
		REVIEW:	Draft Final Site Inspection Report for Wallops Flight Facility Project 07, February 2012
		DATE:	16 May 2012
		NAME:	Paul E. Herman, P.E., VDEQ
ITEM	SECTION OR REFERENCE	COMMENT	ACTION
15.	Section 3.2.1	Please note the proximity of Project 07 to the Wallops Island National Wildlife Refuge in this section.	A-ACCEPTED/CONCUR. The following sentence was added to Paragraph 3.2.1.1, "*In addition, the Wallops Island National Wildlife Refuge is approximately 500 feet from the boundary of the MRS (USFWS 2011b).*"
16.	Section 3.2.2	a) Please review the USACE February 28, 2011 letter to the Virginia State Historic Preservation Office (SHPO) and rewrite the entire section to reflect the tone of the letter. In the letter the USACE tells the Virginia SHPO "the proposed SI undertaking involves limited intrusive sampling, so significant impacts to cultural resources are not expected. The Baltimore District therefore has determined that the proposed project will have no effect on historic properties, and no further work is recommended at this time. However, if further remediation is recommended as a result of this inspection, or we become aware that historic properties are located at or near the property, we will continue coordination with your office." Clearly, this letter to the Virginia SHPO does not warrant or require a response as the USACE made a determination relative to the proposed project. The letter further states any future coordination between the offices would be initiated by the USACE. For any other efforts by USACE to contact a Virginia agency where no response was received, please include documentation of those efforts (letters, phone calls, persons contacted, etc.). Otherwise, please delete from this section all inferences to Virginia's unresponsiveness in this matter. As the purpose of the USACE letter was to consult with the Virginia SHPO as required by Section 106 of the National Historic Preservation Act more information is needed in this section to document how the USACE met the intent of the Programmatic Agreement Among U.S. Army Corps of Engineers Norfolk District Regulatory Office, Advisor)' Council on Historic Preservation, Virginia Department of Environmental Quality and Virginia State Historic Preservation Office Regarding Implementation of the Norfolk District Corps of Engineers State Program General Permit and Section 106 of the National Historic Preservation Act.	a) A-ACCEPTED/CONCUR. Inferences to Virginia's unresponsiveness have been deleted and Paragraph 3.2.2.1 was revised as follows, "*Prior to the SI field activities at WFF Project 07, USACE sent a letter with supporting figures (proposed sampling and areas of archaeological sensitivity) to the Virginia Department of Historic Resources for consultation. The letter indicated that, based on the cultural resource assessment completed in 2003 and the limited intrusive sampling proposed during the SI field activities, significant impacts to cultural resources were not expected. Given the limited field activities, USACE concluded that no adjustments were necessary to the sampling design to avoid impact on cultural resources. The letter and supporting figures sent by USACE, dated 28 February 2011, to VA SHPO is included in Appendix L.*" b) D-ACTION DEFERRED. Comment noted. This comment will be addressed during the scoping process of the future RI.

ACTION CODES: A-ACCEPTED/CONCUR; D-ACTION DEFERRED; W-WITHDRAWN; N-NON-CONCUR; V-VE POTENTIAL/VEP ATTACHED

PROJECT: WALLOPS FLIGHT FACILITY FUDS			
STAKEHOLDER REVIEW COMMENTS			
		REVIEW:	Draft Final Site Inspection Report for Wallops Flight Facility Project 07, February 2012
		DATE:	16 May 2012
		NAME:	Paul E. Herman, P.E., VDEQ
ITEM	SECTION OR REFERENCE	COMMENT	ACTION
		b) Prior to initiating any intrusive investigative activities (I.e., excavation to acquire anomalies) will the USACE develop a plan to ensure possible encounters with cultural or archeological artifacts are properly managed and preserved?	
17.	Section 3.3.1.2	The opening sentence implies all QR occurred outside the boundaries of the 4 primary focus areas. Is this correct?	A-ACCEPTED/CONCUR. The sentence was revised as follows for clarification, "*…however, additional QR and sampling were completed outside of the boundary of these four areas*."
18.	Section 3.3.2.4	Please revise the opening sentence to note NASA provided the background data set to the USACE.	A-ACCEPTED/CONCUR. The first sentence of Paragraph 3.3.2.2 was revised from "USACE" to "NASA".
19.	Section 4.2.1.1	Please consider rewriting the opening sentence as follows, "MRS 7 includes four areas (Gun Butt No.1, Gun Butt No.2, the South Bank of the Boat Basin, and the Pyrotechnics Bum Area). The Sl field activities focused on these four areas and included some areas outside the boundary of the MRS 7."	A-ACCEPTED/CONCUR. The first two sentences of Paragraph 4.2.1.1 were revised as follows, "*MRS 7 comprises four areas (Gun Butt No. 1, Gun Butt No. 2, the South Bank of the Boat Basin, and the Pyrotechnics Burn Area) which were the focus of this SI. However, the SI field activities included some areas outside the boundary of MRS 7*."
20.	Section 5.1.3.15	Were the Virginia Water Quality Standards (9 VAC25-260-1AO) considered when selecting screening criteria for surface water quality comparisons?	A-ACCEPTED/CONCUR. As documented in the approved Final Site Specific Work Plan (SS-WP) for WFF Project 07 and the SI Report, the National Ambient Water Quality Criteria were used for screening COPECs in surface water.
21.	Section 5.1.3.21	Please describe how cumulative impacts were considered during the screening process.	A-ACCEPTED/CONCUR. The following sentence was added to the relevant Paragraph 5.1.3.10, "*These adjustments to the residential screening values used in the HHRA account for the potential cumulative effect of simultaneous exposures to multiple non-carcinogens*."
22.	Section 5.1.4.14 and Section 5.1.4.16	In the opening sentence please replace "risk assessment" with "SLERA".	A-ACCEPTED/CONCUR. The text was revised as suggested.
23.	Section 5.2.0.5	Why is a chemical detection at levels that exceed maximum and/or	N-NON-CONCUR. As shown on the CSM included in

ITEM	SECTION OR REFERENCE	COMMENT	ACTION
		mean site background sample concentrations necessary in order for a pathway to be considered complete? The mere act of drinking groundwater or working in surface soil presents a complete pathway to those media. Whether or not the receptor is at risk from a specific exposure pathway depends on the concentration of chemicals in the specific media.	the approved SS-WP, for a pathway to be complete, it must include a source, an exposure medium, an exposure route, and a receptor. Constituent concentrations at or below background are not considered indicative of a source but reflective of background (non-influenced) conditions. The first sentence in Section 5.2.0.5 was revised as follows: "*Under the MMRP program, a pathway is complete for this SI,…*"
24.	Table 5-1 through 5-4	Is it possible to incorporate the screening values into these tables? Please define the use of shaded, bold, and italicized data in Table 5-2.	A-ACCEPTED/CONCUR. The tables were revised as suggested.
25.	Section 5.4.2	Why weren't ecological receptors considered during the screening of subsurface soil? Burrowing animals are expected to inhabit uplands adjacent to marshes and could be exposed to subsurface soil in these areas.	A-ACCEPTED/CONCUR. Ecological receptors (biota) were not identified in the Final SS-WP as potential receptors for subsurface soil at MRS 7. Therefore, the SLERA used the EcoSSLs for the most sensitive ecological receptors for surface soils. These receptors were identified in the Final SS-WP. Potential subsurface ecological receptors will be addressed during the scoping process of the future RI.
26	Section 6, General Comment	Please ensure specific results and conclusions for each media (soil, subsurface soil, groundwater, surface water, and sediment) and receptor (human or ecological) are presented for each portion of the MRS. As there are 4 areas associated with the MRS, the text for each area should discuss results and conclusions for each receptor and each media. Perhaps each area could be assigned a subsection and each media assigned a sub-subsection, i.e., Section 6 - Summary and Conclusions - Boat Basin/Visitors Information Center (MRS 7), Section 6.1-Pyrotechnic Burn Area, Section 6.1.1-Surface Soil (human and eco receptors), Section 6.1.2- Subsurface Soil (human and eco receptors), etc.	A-ACCEPTED/CONCUR. The text was revised to discuss the MC results and conclusions for each medium at each area of MRS 7.
27	Section 6.1.1	Add future residents and burrowing animals to the lists of potential human and ecological receptors.	A-ACCEPTED/CONCUR. Future residents were added as potential human receptors to the text and CSM (refer

ITEM	SECTION OR REFERENCE	COMMENT	ACTION
			to response to comment #6). Burrowing animals were not included as potential ecological receptors in subsurface soil (refer to response to comment #25).
28	Section 6.1.2	Please include some discussion of the surface and subsurface anomalies detected during the QR and any SI sampling limitations the anomalies may have presented.	A-ACCEPTED/CONCUR. The sampling limitations due to surface and subsurface anomalies occurred in the Pyrotechnics Burn Area and this discussion is included in Paragraph ES.12, Section 3.4, and Section 7.0.1.
29	Section 6.1.4	Please consider revising the 3rd sentence as follows, "In the Pyrotechnics Burn Area and the Gun Butt No. 1 and 2 Area iron concentrations were below background; therefore, based on the limited data available the evaluation identified no risks to human receptors due to iron released from MD."	A-ACCEPTED/CONCUR. Paragraph 6.1.4 through 6.1.9 was revised as result of VDEQ comment 26. Paragraph 6.2.1 was revised as follows, "*Iron was detected below background concentrations; therefore, based on the limited data available for evaluation (samples could not be collected from within the fenced Pyrotechnics Burn Area), no risks to human receptors from FUDS-related activities were determined.*" "*Based on the data available,..*" was added to Paragraph 6.3.1 which discusses the surface and subsurface soil risk conclusions for Gun Butts No 1 and 2.
30	Section 6.1.5	Are all portions of the MRS (Pyro, Gun Butt, Basin) subject to the result/conclusion presented? Please consider revising the 4th sentence as follows, "Based on the limited data available, iron concentrations in the South Bank of the Boat Basin, Pyrotechnics Burn Area and the Gun Butt No.1 and 2 Area were below background levels indicating no risk to human receptors due to iron released from MD."	A-ACCEPTED/CONCUR. Refer to response to VDEQ comment 29 for the revision to Paragraph 6.2.2.
31	Section 6.1.9	Please consider revising the 3rd sentence as follows, "However, based on the limited data available, iron concentrations detected in the Pyrotechnics Burn Area were below background levels indicating no risk to human receptors due to iron released to groundwater from MD."	A-ACCEPTED/CONCUR. Refer to response to VDEQ comment 29 for the revision to Paragraph 6.2.3.

PROJECT: WALLOPS FLIGHT FACILITY FUDS			
STAKEHOLDER REVIEW COMMENTS			
		REVIEW:	Draft Final Site Inspection Report for Wallops Flight Facility Project 07, February 2012
		DATE:	22 May 2012
		NAME:	TJ Meyer, NASA WFF
ITEM	SECTION OR REFERENCE	COMMENT	ACTION
Intro	No reference	I have completed the review of the Project 7 Site Investigation Report and appreciate the opportunity to review this report. I concur with the report recommendation to conduct a remedial investigation/feasibility study at Project 7. In addition, I have the following comments:	A-ACCEPTED/CONCUR. No action necessary.
1.	p. 2-5, Section 2.3.7	Please indicate that the drinking water wells near Project 7 supply the Town of Chincoteague. It would be beneficial to the reader to have a figure showing the location, well name, user and depth of nearby wells.	A-ACCEPTED/CONCUR. Refer to the responses to VDEQ comments 7 and 8.
2.	p. 5-16, Section 5.2.0.5, 1st bullet	This is not required to have a complete pathway. Please delete.	N-NON-CONCUR. Refer to the response to VDEQ comment 23.

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PROJECT: WALLOPS FLIGHT FACILITY FUDS			
STAKEHOLDER REVIEW COMMENTS			
		REVIEW:	Draft Final Site Inspection Report for Wallops Flight Facility Project 07
		DATE:	24 May 2012
		NAME:	Dawn Fulsher, USEPA
ITEM	SECTION OR REFERENCE	COMMENT	ACTION
1	General	EPA agrees with the United State Army Corps of Engineers (USACE's) recommendation that a Remedial Investigation/ Feasibility Study (RI/FS) is warranted for Site 7, Boat Basin and Visitor's Information Center (Land portion).	A-ACCEPTED/CONCUR. No action necessary.
2	Section 2.3.7.1	EPA suggests modifying the sentence that indicates that the Columbia aquifer is not a major source of drinking water and changing the sentence to read that the Columbia aquifer is used minimally or in a limited capacity for drinking water. The NASA Site Management Plan (SMP) for 2012 and 2013 indicates that: "Three of the Town of Chincoteague wells, TOC 3A, 3B and 3C, are completed within the Columbia aquifer at depths of 40 to 60 feet below ground surface. Two of these wells are operated on a seasonal as-needed basis and the other is inoperable." The text should be modified to include the information on the Town of Chincoteague wells.	A-ACCEPTED/CONCUR. Refer to the responses to VDEQ comments 7 and 8. Please note that the most recent water withdrawal permit indicates the Columbia aquifer wells are used on a daily basis and the water is blended with water withdrawn from the Yorktown-Eastover aquifer.
3	Section 2.3.7.2	While specific locations of domestic and community wells are not typically available to the public, utilities may provide maps depicting which structures and homes are connected to the municipal water system. To obtain an estimate of the population served by private wells in a 4 mile radius you would count the structures not connected to public water then multiply that number by the average number of individuals per household as reported in the most recent census. EPA uses this information when evaluating a site under the Hazardous Ranking System (HRS) model. EPA suggests adding this information to the report in this section.	D-ACTION DEFERRED. Comment noted. This comment will be addressed during the scoping process of the future RI. Refer to the responses to VDEQ comments 7 and 8.
4	Section 2.3.8	Please indicate if there are any identified commercial or recreational fisheries within the boundary of NASA Wallops.	D-ACTION DEFERRED. Comment noted. This comment will be addressed during the scoping process of the future RI.
5		While there is insufficient data in the Project 7 SI for EPA to perform an evaluation under the Hazardous Ranking System (HRS) Model, EPA expects that any data gaps need be	D-ACTION DEFERRED. Comment noted. This comment will be addressed during the scoping process of the future RI.

ACTION CODES: A-ACCEPTED/CONCUR; D-ACTION DEFERRED; W-WITHDRAWN; N-NON-CONCUR; V-VE POTENTIAL/VEP ATTACHED

PROJECT: WALLOPS FLIGHT FACILITY FUDS			
STAKEHOLDER REVIEW COMMENTS			
		REVIEW:	Draft Final Site Inspection Report for Wallops Flight Facility Project 07
		DATE:	24 May 2012
		NAME:	Dawn Fulsher, USEPA
ITEM	SECTION OR REFERENCE	COMMENT	ACTION
		addressed during the Remedial Investigation. EPA will provide more specific comments regarding these data gaps once the USACE issues the sampling plan for the RI to the regulators.	

ACTION CODES: A-ACCEPTED/CONCUR; D-ACTION DEFERRED; W-WITHDRAWN; N-NON-CONCUR; V-VE POTENTIAL/VEP ATTACHED