Environmental Assessment for Construction & Operation of

Electromagnetic Railgun

Research, Development, Test, and Evaluation Facility

MILCON P-306

Naval Support Facility Dahlgren
Dahlgren, Virginia

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Environmental Assessment for Construction and Operation of an Electromagnetic Railgun Research, Development, Test & Evaluation Facility (MILCON P-306) Naval Support Facility Dahlgren Dahlgren, Virginia

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EXECUTIVE SUMMARY

This environmental assessment (EA) addresses the potential environmental effects of constructing and operating a facility for the research, development, test and evaluation (RDT&E) of an electromagnetic (EM) railgun system at Naval Surface Warfare Center Dahlgren Laboratory (NSWCDL or Dahlgren), a tenant on the Naval Support Facility (NSF) Dahlgren installation.

S.1 Proposed Action

The proposed action is to construct and operate a facility for RDT&E of a high-power EM railgun system of up to 64 megajoules (MJ) muzzle energy at NSF Dahlgren. The facility would include a full-scale EM railgun projectile launcher, a high-energy electrical pulse-forming network (PFN), and a terminal range to capture the projectiles. Implementation of this project would address the Navy's requirement for a full-scale, 64-MJ, multiple-shot, EM railgun system capable – after further testing at another installation – of being used on Navy ships for indirect naval gunfire support. The construction phase would be Military Construction Project 306 (MILCON P-306).

S.2 Purpose and Need

The proposed action would advance the development of a new naval weapon. Railgun technology uses high-power EM energy instead of explosive chemical propellants to propel projectiles farther and faster than any preceding gun. At full capability – when the railgun is ready to be tested on a larger range than Dahlgren's or on a ship at sea – a 64-MJ muzzle velocity railgun is expected to be able to fire a projectile more than 200 nautical miles (NM) at a muzzle velocity seven times the speed of sound (8,200 feet [ft] per second [ft/s]) and five times the speed of sound when it impacts the target, six minutes later. In contrast, the standard gun used on Navy ships – the MK 45 five-inch (in) gun – has a range of slightly more than 13 NM and a muzzle velocity of 2,620 ft/s. In addition to the railgun's innovative propulsion system, the high-velocity projectiles the railgun fires are expected to be able to destroy targets using kinetic energy – the sheer force of the impact – rather than conventional explosives.

The purpose of the proposed action is to meet the Navy's requirement to develop a full-scale, multiple-shot railgun system capable of generating 64-MJ muzzle energy. The Navy's need for this new weapon results from:

- The Navy's decision to make future surface combatant ships, such as the DDG-1000, all-electric. This fundamental shift to electric propulsion opens the door for a new generation of electric weapons, including the railgun. Integrated power systems can dedicate most of the power onboard ship to electric propulsion motors for high-speed operations, but when the tactical situation requires, the power can be shared with electric weapons and sensors.

- A requirement for long-range, hypersonic (can travel at more than five times the speed of sound in air) weapons for attacking time-critical targets. The 5-in guns available today do not fully satisfy the requirements of either the Marine Corps for artillery support from the sea or the Navy to operate farther from hostile shores because of exposure to longer-range enemy anti-ship weapons.

- A requirement for efficient weapons that can match many of the attributes of the powerful, precise Tomahawk missile but do so at much less cost.

- A requirement to improve shipboard logistics and safety, facilitating the design of future ships, such as the DDG-1000. The railgun projectiles offer distinct logistical advantages over propellant-based gun projectiles. Thousands of railgun projectiles can be loaded into the same magazine volume that accommodates only hundreds of propellant-based projectiles. Because railgun projectiles contain no propellant-based charges, explosive hazards are minimized. The absence of explosive-based propellants would lessen the need for the stringent explosives safety procedures currently required for the manufacture, transportation, handling, and storage of conventional ammunition. The result would be vastly improved shipboard safety for sailors and reduced logistics.

S.3 Alternatives Considered but Eliminated from Further Analysis

The Navy considered three locations other than Dahlgren for construction and operation of the proposed full-scale 64-MJ EM railgun system. These locations were considered because each has existing, small-scale EM railgun facilities: the British Ministry of Defence’s facility at Kirkcudbright, Scotland; the University of Texas Institute for Advanced Technology; and the US Army’s Aberdeen Proving Ground, Maryland. However, each of these locations and their associated facilities presented challenges such as insufficient real estate to safely operate the facility and/or lack of infrastructure to support the upgrade to a 64-MJ EM railgun system.

The Navy determined that locating the 64-MJ railgun system on one of NSWCDL’s ranges was the best alternative because of NSWCDL’s extensive experience in conducting high-energy EM pulsed-power research. EM testing is one of Dahlgren’s core capabilities. The proposed full-scale EM railgun system could be integrated into Dahlgren’s existing naval surface weapons RDT&E program run by Dahlgren’s resident scientists and engineers, who are among the nation’s foremost experts in combat and weapons systems. The personnel who would operate the railgun would be existing personnel at Dahlgren who are trained to handle high-energy EM systems. Therefore, the Navy eliminated locations other than Dahlgren from further consideration.

The Navy considered various locations on NSWCDL's ranges to construct the railgun facilities, but only one site met all the siting criteria, which included location on an existing range; sufficient land area for a projectile terminal range with associated safety hazard zone; sufficient land area outside of existing explosive safety hazard areas; and minimization of impacts to natural resources.

The only location that met all the siting criteria on NSWCDL's ranges was the existing Electromagnetic Launch Facility (EMLF) on NSWCDL's Missile Test Range, which houses a 32-MJ railgun installed in 2007. Because railgun and electrical pulse power technology are maturing much more rapidly than envisioned even two years ago, it is now feasible to build and test a full-scale 64-MJ system. The Navy investigated upgrading the 32-MJ railgun, but this was not feasible. The existing EMLF with a 32-MJ railgun cannot support the Navy's requirement to scale-up to a 64-MJ EM railgun system because it does not have the space to accommodate a larger projectile launcher and electrical system or the capability to capture and recover simulated projectiles. Therefore, various ways to incorporate the 64-MJ facilities into the EMLF were considered. The Navy found that modifying the existing EMLF building to add the 64-MJ railgun would cause substantial impacts to wetlands close to the site and would stop all testing currently taking place on the 32-MJ railgun during construction. This would cause an unacceptable delay in the Navy's EM railgun program because the 32-MJ railgun is being actively tested to advance the technology. The only feasible alternative was to build a new addition to house the 64-MJ railgun on the southwest side of the EMLF, which would avoid any impacts on wetlands and would allow the 32-MJ to continue operating during the construction period.

S.4 No Action Alternative

S.4.1 Description

Under the No Action Alternative, the Navy would not build or operate the proposed 64-MJ EM railgun at Dahlgren. The existing 32-MJ railgun at Dahlgren cannot be upgraded to function as a 64-MJ launcher. Therefore, facilities would not be available to allow the Navy to meet its requirement to develop a full-scale EM railgun system to 64-MJ muzzle energy. Thus, under the No Action Alternative, the ability of the Navy and the Office of Naval Research (ONR) to achieve their specific, identified mission of developing and demonstrating a full-scale 64-MJ EM railgun system would be impeded. Although the No Action Alternative is not considered to be a reasonable alternative, it provides a baseline condition against which the impacts of the proposed action can be assessed.

S.4.2 No Action Alternative Environmental Consequences

Under the No Action Alternative, the proposed 64-MJ railgun facilities would not be built. Therefore, there would be no change in the existing environmental conditions on and near the project site, which are described in Chapter 3. NSWCDL would continue to conduct RDT&E

activities, including operation of the 32-MJ railgun, with future environmental consequences similar to those occurring today.

S.5 Preferred Alternative

S.5.1 Description

A railgun system consists of an EM launcher powered by a high-energy electrical PFN composed of a bank of electrical capacitors that fires inert, hypersonic projectiles. The railgun launcher includes two parallel metal rails that conduct electricity and an electrically-conductive, sliding armature. The projectile is launched when the PFN releases a high-energy-current pulse (i.e., millions of amperes of electricity) at the end of one rail. The pulse then flows down the rail, across the armature, and back up the other rail. This current loop induces a magnetic field that interacts with the current in the armature to produce a force proportional to the magnitude of the current. This force rapidly accelerates the armature, on which rides a projectile, or launch package.

The RDT&E program for the 64-MJ railgun would focus on: scaling up from 16-MJ operation to full 64-MJ launcher operation over several years; testing the capability of hypersonic projectiles, the barrel, and the PFN; thermal management; design of the sabot; increasing the firing rate; and validating lethality.

The proposed project would involve the construction of the following structures:

- **Launch Building.** A 10,080-square-foot (sq-ft) high-bay addition on the southwest side of existing Building 1410 to house the 64-MJ railgun along with a bank of electrical capacitors that comprise the pulse-forming network (PFN).

- **Control and Instrumentation Building.** A 5,040-sq-ft stand-alone building located 80 ft from the launch building to provide an operations control room for remote control, observation, and documentation of railgun tests.

- **Projectile Range/Trajectory Control Structures/Slug Catch Chamber.** A 656-ft above-grade outdoor projectile range extending from the muzzle chamber of the railgun to the entrance of the tactical catch chamber. Both the muzzle chamber and the tactical catch chamber would be constructed of cast-in-place concrete. The muzzle chamber, attached to the railgun in the launch building, directs the projectile. The range includes a series of trajectory control structures to guide projectiles safely into the tactical catch chamber and deflect ricochets. Any deviation of flight would cause immediate deflection of the projectile into the ground by these heavily reinforced structures slanted at an angle towards the railgun muzzle.

- **Tactical Catch Chamber.** A 200-ft-by-60-ft reinforced concrete structure topped by fill at the terminus of the projectile range that is designed to safely catch railgun projectiles.

The addition to Building 1410 (the EMLF) would be a single-story pre-engineered metal building with a structural steel frame, metal panel exterior wall system, reinforced concrete foundation, and a sloped metal roof system. Anti-terrorism/force protection measures would be included. Sustainable design principles would be integrated into the design, development, and construction of the facilities. All utilities would tap into the existing EMLF infrastructure system. The railgun would operate by drawing power from the existing electrical power grid. Since the railgun system would use electrical capacitors to store power in order to generate a large electrical pulse for firing, a managed capacitor charging rate would allow the existing utilities to meet the overall power demand.

The area disturbed by construction would cover about 5 ac. This area includes the existing EMLF facilities, the footprint of the proposed new facilities and a temporary construction zone. After construction of the 64-MJ railgun facilities, the 4.4-ac EMLF site would be enclosed by an 8-ft project area fence. The proposed construction, including the buildings, new paved surfaces, and the paved areas of the projectile range/trajectory control structures, would add 1.44 ac of impervious surface to the existing 1.12 ac of impervious surface on the site.

Shock Tube Road, Frontage Road, and Gambo Road, which intersect at the EMLF site, would continue on their existing alignments, but would now pass through the fenced area. Except during railgun operations, traffic would pass through this intersection as it does presently. Before a railgun operation commences, gates on Shock Tube Road, Gambo Road, and Frontage Road would be closed except for emergency vehicles to keep everyone but EMLF operating personnel out of the area. Barricades would be in place prior to and during testing to ensure that no one enters the operation area during railgun firing. Only EMLF personnel would be allowed within the operation area. EMLF personnel would control operations from the proposed Instrumentation and Control building, outside the EM safety buffer zone.

The personnel who would operate the proposed facility already work at NSWCDL. Therefore, no additional personnel would be hired or would move to NSF Dahlgren as a result of the proposed action.

S.5.2 Preferred Alternative Environmental Consequences

The magnetic field and electrical field exposures for personnel on-site and on-installation, as well as the public off-installation, during firing of the 64-MJ railgun would not exceed established and scientifically-based exposure limits. Test barriers and the Control and Instrument Building, from which personnel would operate the railgun, would be located 80 ft from the railgun, which has been calculated to be a safe distance from the railgun during firing. Field measurements would be conducted during testing to validate these predictions and shielding measures would be incorporated, if needed. Standard operating procedures (SOP), such as are in place for operation of the 32-MJ railgun, would be developed and would be carried out for every 64-MJ railgun firing operation.

The electric and magnetic field levels generated by the EM railgun outside of the 80-ft buffer zone would be well below the most stringent guidelines for humans (based on effects on pacemakers and other medical devices). The magnetic field strength that wildlife would be exposed to would rapidly return to that of the earth's natural magnetic field away from the facility and would be below levels that could impact wildlife. In addition, the short duration of each test (8 milliseconds) makes exposure of wildlife unlikely.

No threatened and endangered species or their habitats or special interest areas occur at the proposed railgun site. Coordination with the US Fish and Wildlife Service, the Virginia Department of Game and Inland Fisheries (VDGIF), and the Virginia Department of Conservation and Recreation-Natural Heritage Service confirmed this. An active bald eagle nest is located more than 3,000 ft and the Caledon eagle winter concentration area is located more than 4,000 ft from the project site, but VDGIF found that there would be no impact on nesting eagles.

Because the EM railgun system is a new type of large weapon that is still in RDT&E, no noise model exists to predict future noise levels as railgun power levels increase. Tests of the existing 32-MJ railgun at power levels of up to 16-MJ indicate that the maximum peak noise for off-installation receptors and on-installation housing would be below 130 peak decibels (dBP). So far, no clear relationship has been found between increasing muzzle energy levels and peak noise levels during railgun testing. Sound levels below 115 dBP are associated with a low risk of generating complaints and levels between 115 dBP to 130 dBP have a moderate risk of generating complaints. The peak noise levels generated from railgun shots are lower than the existing large-caliber gun firing event noise measured along the Potomac River Test Range (PRTR). Given the greater peak noise generated from large-gun firing at PRTR, as well as the existing explosive detonations at the Explosives Experimental Area (EEA) Range, future peak noise levels are expected to be dominated by the existing large-gun firing and EEA Range detonation activities.

As railgun muzzle energy levels increase, more tests and subsequent noise measurements would be needed to determine the potential noise impacts. Dahlgren will continue to measure noise levels as power levels of the existing 32-MJ railgun increase above 16 MJ. If this proposed action were implemented, Dahlgren would ultimately increase muzzle energy up to 64 MJ while continuing to take noise measurements under varying weather conditions. The future measurements would be taken at additional noise receivers to: (1) develop a mathematical noise prediction model able to forecast peak noise from higher muzzle energies; (2) ensure that potential high risk of generating noise complaints (i.e., greater than 130 dBP at noise sensitive receptors) are minimized and/or mitigated in the future; and (3) ensure that noise impacts to the public and Dahlgren's personnel are minimized and/or mitigated. The methodical and deliberate scaling-up process over several years, leading to and including a full scale 64-MJ demonstration, would allow the Navy to develop noise and other mitigation measures, if necessary, to ensure that noise impacts remain minor.

Because the existing electrical power grid can provide the power needed to charge the banks of electrical capacitors that form the PFN for the foreseeable future, there would be no need for additional electrical generators. NSF Dahlgren is currently operating under an air quality State Operating Permit rather than a Major Source Title V permit. No change to the existing Dahlgren air permit would be required. Existing utility system capacities are sufficient to provide services to the expanded EMLF and the new building.

The proposed activities would not involve the use of explosives, and thus would not generate any explosives safety quantity distance (ESQD) arcs. However, three of the proposed structures – the Building 1410 addition, the projectile range/trajectory control structure, and the tactical catch chamber – are within the ESQD arc of Radiography Building 1180. Explosives in the process of being x-rayed are stored overnight or over the weekend at Building 1180. Because the three proposed structures are within an ESQD arc, approval was requested to build within an ESQD arc and granted by the Naval Ordnance Safety and Security Activity, provided that no railgun operations take place when ordnance is present in Building 1180. The SOPs for both buildings include this provision.

The foundation of a Cold War nuclear blast simulator, the conical shock tube facility, and some above-ground features remain on the proposed 64-MJ railgun project site. The proposed action would require demolishing some of the foundation and above-ground features to slightly below grade and topping them with 8 in of concrete to form the new 656-ft projectile terminal range for the 64-MJ railgun. The Navy sent a letter to the Virginia Department of Historic Resources (VDHR) on December 8, 2008 asking for comments on the proposed impacts to the conical shock tube site and structures. In a letter dated December 18, 2009, VDHR responded that no further identification efforts are warranted, as no historic properties will be affected by the action.

Construction of the proposed facilities would disturb approximately 5 ac of land (part of which is already occupied by the EMLF) and create 1.4 ac of new impervious surface. In accordance with Virginia Erosion and Sediment Control and Stormwater Management Regulations, Dahlgren would develop, implement, and monitor an erosion and sediment control plan and a stormwater pollution prevention plan to control soil erosion and minimize sedimentation in nearby off-site wetlands.

No surface waters, wetlands, or floodplains exist on the proposed site, but wetlands have been delineated close to the site. Implementing soil erosion and sediment control and pollution prevention plans, such as by constructing a silt fence around the construction site, would minimize indirect impacts to the nearby wetlands.

The Virginia Department of Environmental Quality concurred with the Federal Coastal Consistency Determination submitted by Dahlgren that indicated that the project would be consistent to the maximum extent practicable with the enforceable policies of the Virginia Coastal Management Program, provided that applicable local, state, and federal laws, such as soil erosion and stormwater management requirements, are adhered to.

One acre of pine and mixed hardwood forest would be removed from the edge of forests adjacent to the existing roads and EMLF. While this would result in a loss of wildlife habitat, this strip of forest is already affected by the land uses at the site and the proposed action would result in a negligible loss of habitat compared to Dahlgren's more than 1,550 acres of forest. Erection of silt fences to manage stormwater would also serve to keep construction equipment away from the remaining vegetation, minimizing damage.

The preferred alternative is not anticipated to have a significant environmental impact nor will it be scientifically controversial. Therefore, preparation of an environmental impact statement is not required.

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ACRONYMS AND ABBREVIATIONS

A	Ampere
AA	Anti-aircraft
ac	Acre
ADNL	A-weighted day-night level
ACGIH	American Conference of Governmental Industrial Hygeniests
AIMD	Active implantable medical device
A/m	Amperes per meter
BMP	Best management practice
CAA	Clean Air Act
CAT	Computed axial tomography
CBLAD	Chesapeake Bay Local Assistance Department
CBPA	Chesapeake Bay Preservation Act
CCD	Coastal consistency determination
CDNL	C-weighted day-night level
CEQ	Council on Environmental Quality
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
cgs	Centimeter-gram-second
CHRIMP	Consolidated Hazardous Material Reutilization and Inventory Management Program
CO	Carbon monoxide
CRMP	Coastal Resources Management Program
CWA	Clean Water Act
CZM	Coastal zone management
CZMA	Coastal Zone Management Act
DA	Department of the Army
dB	Decibel
dBA	A-weighted decibel
dBC	C-weighted decibel
dBP	Peak sound level
DC	Direct current
DNL	Day-night noise level
DoD	Department of Defense
DoN	Department of the Navy
DOT	Department of Transportation
DRMO	Defense Reutilization and Marketing Office
DVP	Dominion Virginia Power
EA	Environmental assessment

EEA	Explosive Experimental Area
EIS	Environmental impact statement
ELF	Extremely low frequency
EMLF	Electromagnetic launch facility
EM	Electromagnetic
EME	Electromagnetic energy
EMI	Electromagnetic interference
EO	Executive Order
EOD	Explosives ordnance disposal
ESA	Endangered Species Act
ESQD	Explosives safety quantity distance
f	Frequency
FCD	Federal consistency determination
FICUN	Federal Interagency Committee on Urban Noise
FONSI	Finding of no significant impact
ft	Foot/feet
G	Gauss
g	Gram
gpd	Gallons per day
GPS	Global positioning system
HAPs	Hazardous air pollutants
HERF	Hazards of electromagnetic radiation to fuel
HERO	Hazards of electromagnetic radiation to ordnance
HERP	Hazards of electromagnetic radiation to personnel
HM	Hazardous materials
HSWA	Hazardous and Solid Waste Amendments
HUD	Department of Housing and Urban Development
HW	Hazardous waste
Hz	Hertz
I-95	Interstate 95
IARC	International Agency for Research on Cancer
ICNIRP	International Commission on Non-ionizing Radiation Protection
IEEE	Institute of Electrical and Electronics Engineers
IEMF	International Electromagnetic Field
in	Inch(es)
INRMP	Integrated Natural Resources Management Plan
j	Joule
kg	Kilogram

kHz	KiloHertz
km	Kilometer
km/hr	Kilometers per hour
kV	Kilovolt
kV/m	Kilovolts per meter
lb(s)	Pound(s)
LED	Light-emitting diode
LUPZ	Land use planning zone
m	Meter
mA	Milliampere
MA	Mega amps
MAGLEV	Magnetic levitation
MDZ	Middle Danger Zone
MHz	Megahertz
MILCON	Military Construction
MINCON	Military Minor Construction
mG	MilliGauss
mi	Mile(s)
MJ	Megajoule
mm	Millimeter
mph	Miles per hour
MRI	Magnetic resonance imaging
msec	Millisecond
msl	Mean sea level
MSWMP	Mainside Stormwater Management Plan
MW	Megawatt
MWH	Megawatt-hours
$\mu g/m^3$	Microgram per cubic meter
NAAQS	National Ambient Air Quality Standards
NAVFAC	Naval Facilities Engineering Command
NCI	National Cancer Institute
NDW	Naval District Washington
NEPA	National Environmental Policy Act
NESHAPs	National Emission Standards for Hazardous Air Pollutants
NHPA	National Historic Preservation Act
NIEHS	National Institute of Environmental Health Sciences
NIH	National Institutes of Health
NM	Nautical mile(s)
NMFS	National Marine Fisheries Service
NMP	Noise management procedures
NOSSA	Naval Ordnance Safety and Security Activity
NO_x	Nitrogen oxides

NPDES	National Pollutant Discharge Elimination System
NRCS	Natural Resources Conservation Service
NRHP	National Register of Historic Places
NSF	Naval Support Facility
NSPS	New Source Performance Standards
NSWDD	Naval Surface Warfare Center Dahlgren Division
NSWCDL	Naval Surface Warfare Center, Dahlgren Laboratory
O_3	Ozone
OSHA	Occupational Safety and Health Administration
ONR	Office of Naval Research
OPNAVINST	Chief of Naval Operations Instruction
OPS	Operating Procedures Supplement
PAO	Public Affairs Office
Pb	Lead
PEL	Permissible exposure limit
PEPCO	Potomac Electric Power Company
PEM1	Palustrine emergent wetland
PFN	Pulse-forming network
PFO1	Palustrine forested wetlands
PM_{10}	Particulate matter with diameters up to 10 µm
$PM_{2.5}$	Particulate matter with diameters up to 2.5 µm
PMS	Program manager
PPE	Personal protective equipment
ppm	Parts per million
ppt	Parts per thousand
PRTR	Potomac River Test Range
psi	Pounds per square inch
PSS1	Palustrine scrub-shrub wetland
PZs	Protection zones
PZ1	Primary protection zone
PZ2	Secondary protection zone
RCRA	Resource Conservation and Recovery Act
RDT&E	Research, development, testing, and evaluation
RHA	Risk hazard analysis
RPAs	Resource Protection Areas
s	Second(s)
SARA	Superfund Amendments and Reauthorization Act
SDI	Strategic Defense Initiative
SI	International system of units
SIA	Special Interest Area
SIP	State Implementation Plan
SIPS	Sound Intensity Prediction System

SPL	Sound pressure level
SO_2	Sulfur dioxide
SOP	Standard Operating Procedure
sq m	Square meter
ST	State threatened
T	Tesla
TSCA	Toxic Substances Control Act
USACE	US Army Corps of Engineers
USACHPPM	US Army Center for Health Promotion and Preventive Medicine
USBEA	US Bureau of Economic Analysis
USBLS	US Bureau of Labor Statistics
USC	US Code
USEPA	US Environmental Protection Agency
USFWS	US Fish and Wildlife Service
USGS	US Geological Survey
UXO	Unexploded ordnance
V	Volt
V/m	Volt(s) per meter
VDCR-DNH	Virginia Department of Conservation and Recreation Division of Natural Heritage
VDGIF	Virginia Department of Game and Inland Fisheries
VDEQ	Virginia Department of Environmental Quality
VDHR	Virginia Department of Historic Resources
VOCs	Volatile organic compounds
VPDES	Virginia Pollutant Discharge Elimination System
VR	Virginia Regulation
VR	Virginia Route
Wb	Weber
WHO	World Health Organization

1 PURPOSE AND NEED

This environmental assessment (EA) addresses the potential environmental effects of constructing and operating a facility for the research, development, test and evaluation (RDT&E) of an electromagnetic (EM) railgun system at Naval Surface Warfare Center Dahlgren Laboratory (NSWCDL), a tenant on the Naval Support Facility (NSF) Dahlgren installation (Figure 1-1, Location of NSF Dahlgren).

NSF Dahlgren is located in King George County, Virginia, along the southern shore of the Potomac River, approximately 28 miles (mi) east of Fredericksburg, Virginia, and 53 mi south of Washington, DC (Figure 1-1). NSF Dahlgren occupies about 4,319 acres (ac) and is divided by Upper Machodoc Creek into Mainside (2,678 ac), which includes the Potomac River Test Range Complex's land ranges, and the Explosives Experimental Area (EEA) Range Complex (1,641 ac) (Figure 1-2, Dahlgren's Ranges).

This EA has been prepared by the Navy pursuant to the National Environmental Policy Act (NEPA) of 1969; the Council on Environmental Quality (CEQ) regulations implementing NEPA (40 Code of Federal Regulations [CFR] 1501 to 1508); and Chief of Naval Operations Instruction (OPNAVINST) 5090.1C, *Environmental Readiness Program Manual* (Chapter 5).

1.1 Proposed Action

The proposed action is to construct and operate a facility for RDT&E of a high-power EM railgun system of up to 64 megajoules[1] (MJ) muzzle energy at NSF Dahlgren. The facility would include a full-scale EM railgun projectile launcher, a high-energy electrical pulse-forming network (PFN), and a terminal range to capture the projectiles. Implementation of this project would address the Navy's requirement for a full-scale, 64-MJ, multiple-shot, EM railgun system capable – after further testing at another installation – of being used on Navy ships for indirect naval gunfire support. The construction phase would be Military Construction Project 306 (MILCON P-306).

Muzzle Energy and Muzzle Velocity

Muzzle energy is the kinetic (moving) energy of a projectile as it is expelled from the muzzle of a gun. The heavier the projectile and/or the faster it moves, the higher the muzzle energy and the more damage the projectile will inflict on its target.

Muzzle velocity is the speed at which the projectile leaves the muzzle of the gun.

[1] One joule (J) is the work done to produce power of one watt continuously for one second; one kilowatt hour equals 3.6 MJ or 3.6 million joules. Put another way, one joule is the energy required to lift a small apple one meter straight up, or the energy released when that same apple falls one meter to the ground.

1.2 Background

The proposed action would advance the development of a new weapon. Railgun technology uses high-power EM energy instead of explosive chemical propellants to propel projectiles farther and faster than any preceding gun. At full capability – when the railgun is ready to be tested on a larger range than Dahlgren's or a ship at sea – a 64-MJ muzzle velocity railgun is expected to be able to fire a projectile more than 200 nautical miles (NM) at a muzzle velocity seven times the speed of sound (8,200 feet [ft] per second [ft/s]) and five times the speed of sound when it impacts the target six minutes later (Figure 1-3, Fully-Operational Railgun at Sea). In contrast, the standard gun used on Navy ships – the MK 45 five-inch (in) gun – has a range of slightly more than 13 NM and a muzzle velocity of 2,620 ft/s (Office of Naval Research [ONR], 2008; ONR, 2009; Bean, April 2003).

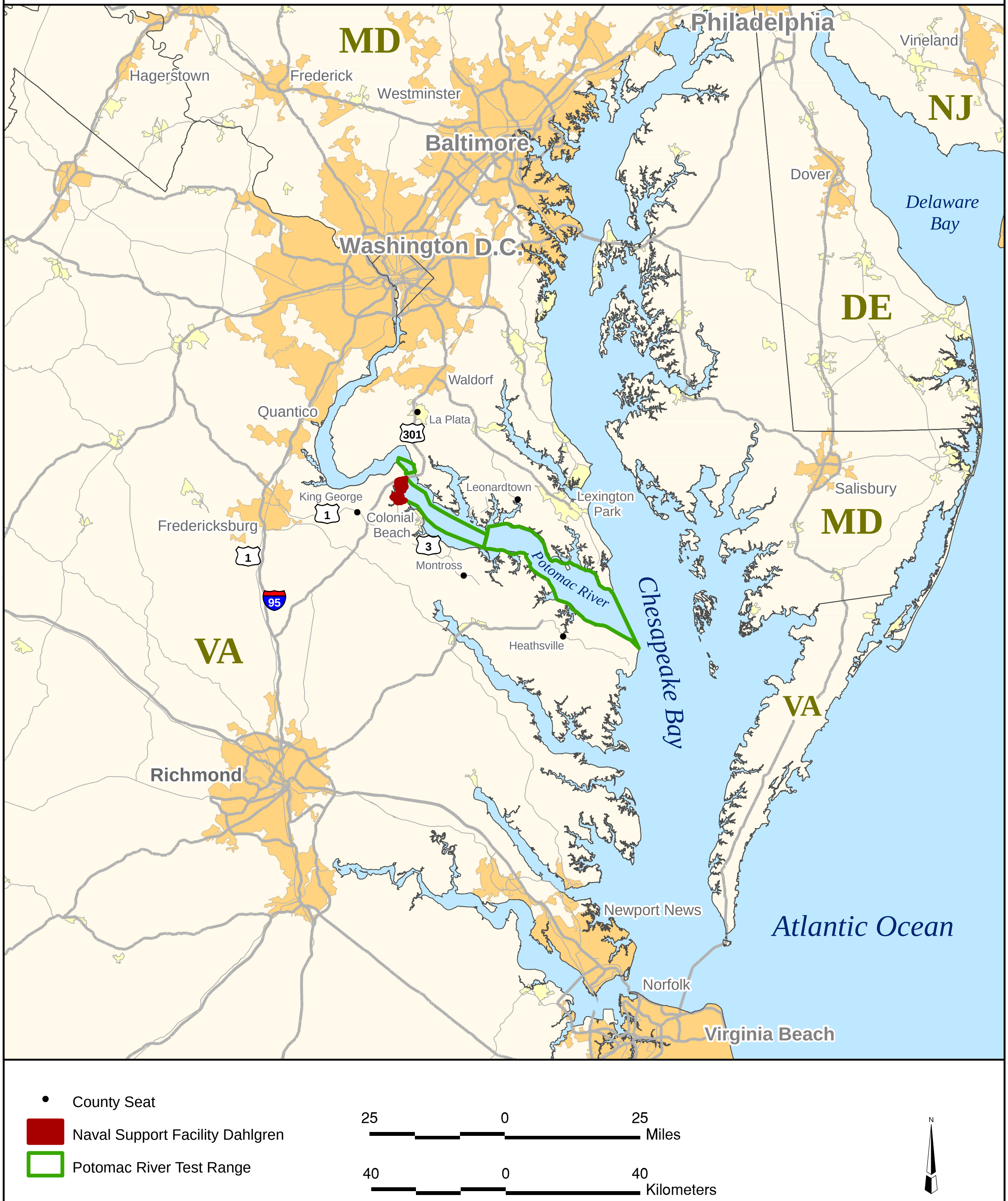
In addition to the railgun's innovative propulsion system, the high-velocity projectiles the railgun fires are expected to be able to destroy targets using kinetic energy – the sheer force of the impact – rather than conventional explosives. In essence, damage is caused by the thousands of fragments – each one of them traveling at lethal velocities – created by the impact of each projectile. This would be one of the railgun's greatest potential advantages: the safety of sailors on board ships would increase substantially because no explosives would be required to fire the projectiles, and no explosive rounds would be loaded into and stored in the ship's magazine. The small projectiles also would require less storage space, allowing for many more rounds to be carried on board ships and for the redesign of naval ships. Another benefit of the high velocity of the projectiles is illustrated in Figure 1-3: the trajectory of the projectiles would arc up to 500,000 ft – above earth's atmosphere – which would minimize their susceptibility to detection and global positioning system (GPS)-jamming, as well as allow them to engage targets on the reverse slopes of hills and mountains along the gun target line.

Railgun research began in the 1980s as part of the Strategic Defense Initiative (SDI), which was seeking long-range weapons to intercept intercontinental ballistic missiles in space. In 1985, the US Army began research to develop a mobile, ground-based EM system capable of defeating the armored combat vehicles of the future. Army-sponsored research at the University of Texas Institute for Advanced Technology has led to significant progress in the area of railgun barrel life, which has enabled development of 32-MJ and 64-MJ railguns.

In 2006, a refurbished 8-MJ SDI launcher was transferred from the Army and installed in a laboratory at Dahlgren. This enabled Dahlgren's initial research into the effects of EM propulsion. NSWCDL scientists and engineers also were participating in railgun RDT&E at the British Ministry of Defence's 8-MJ railgun facility at Kirkcudbright, Scotland.

In 2006, the Navy built the electromagnetic launch facility (EMLF) (Building 1410) on Dahlgren's Missile Test Range to expand railgun RDT&E capabilities. As initially conceived, the EMLF was to house the 8-MJ railgun with a 100-ft outdoor terminal firing range, which allows projectiles to be caught or terminated after being fired a short distance. However, railgun technology has developed so rapidly that industry actually delivered a 32-MJ launcher. While railgun technology has advanced enough to support a 32-MJ launcher, the bank of electrical

Location of NSF Dahlgren



Source: NSWCDL GIS; Danger Zones defined in 33 CFR § 334.230.

Figure 1-1

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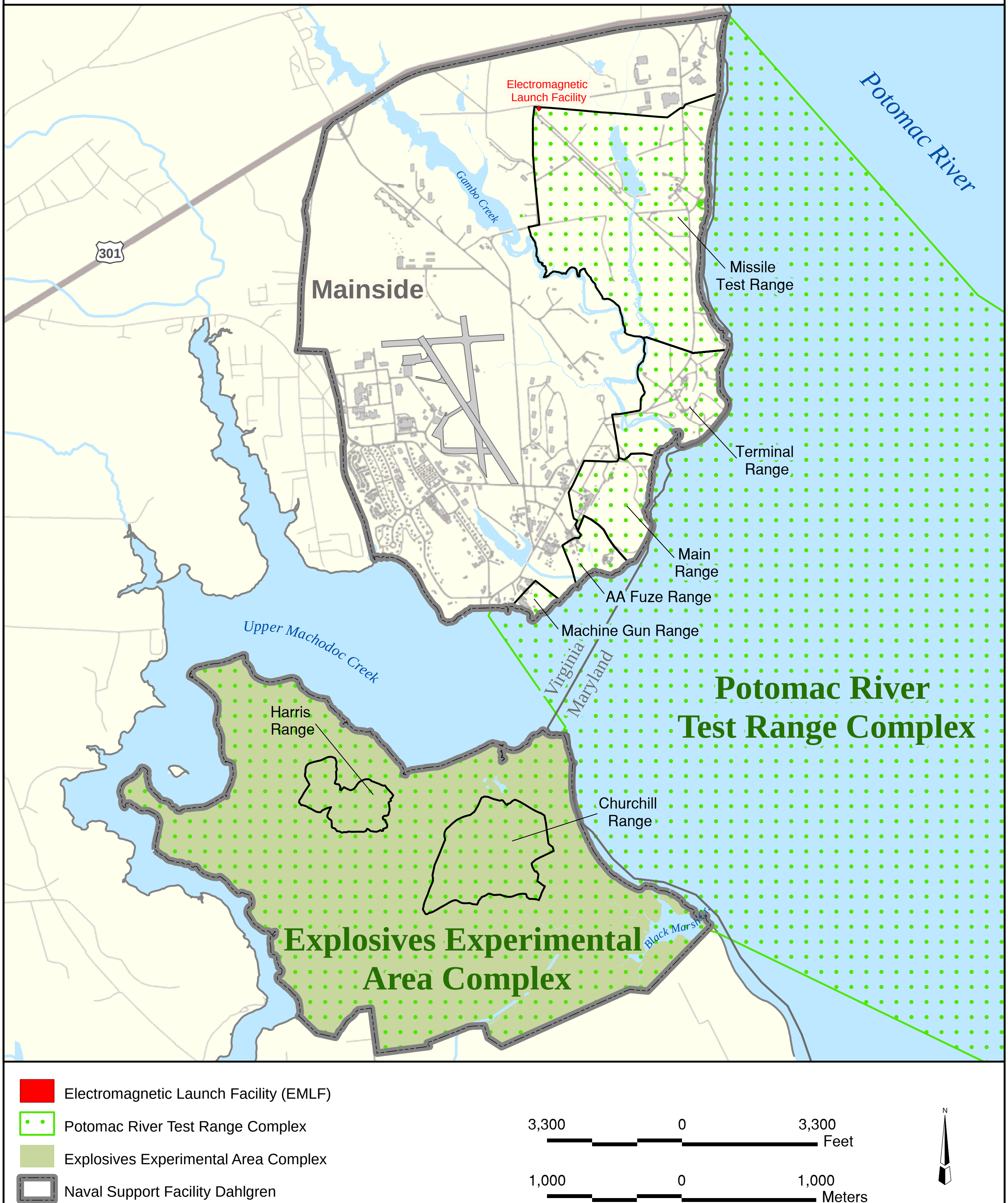
Dahlgren's Ranges



Source: NSWCDL GIS; Danger Zones defined in 33 CFR § 334.230.

Figure 1-2

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Fully-Operational Railgun at Sea

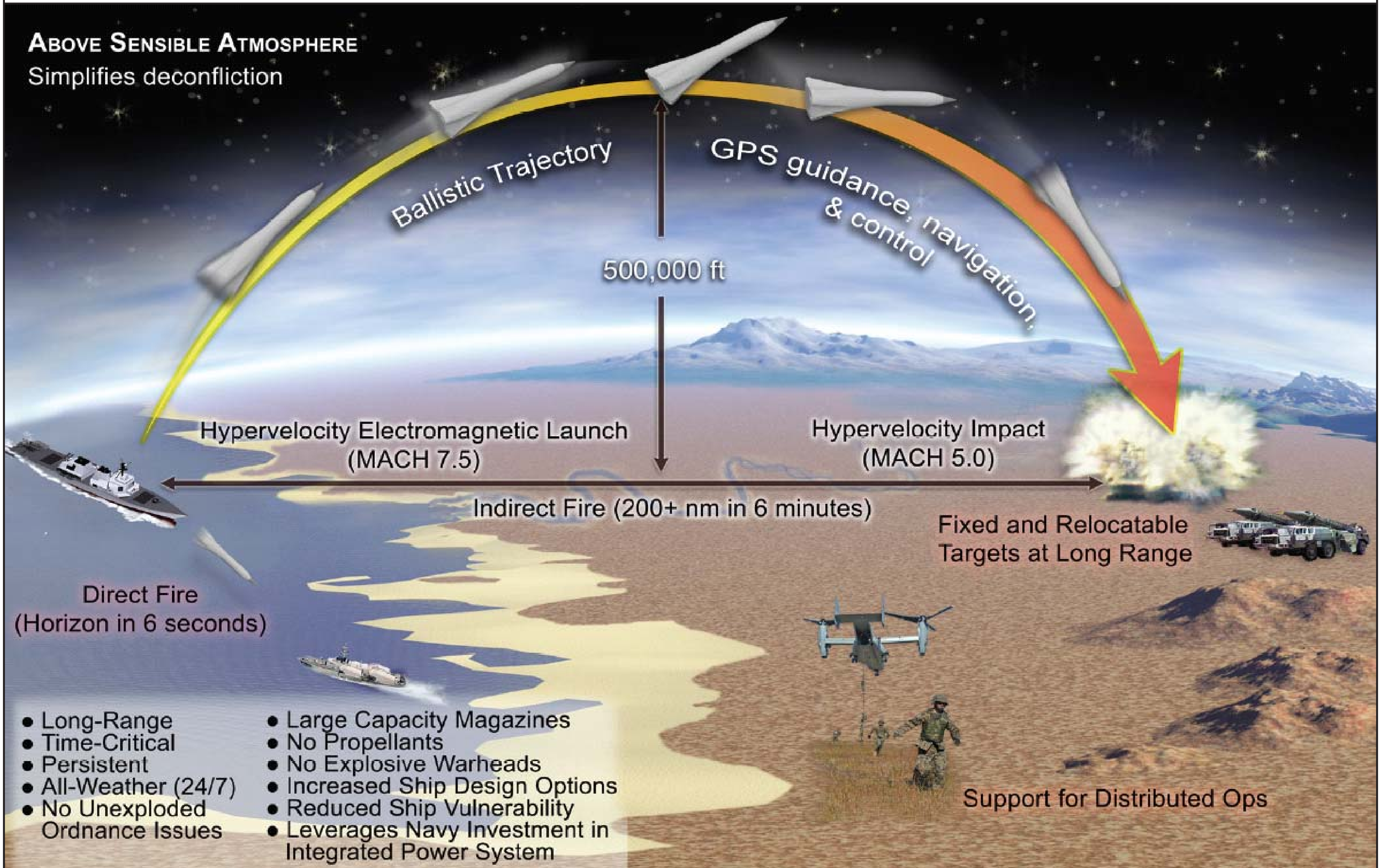

Figure 1-3

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capacitors that powers the system – the PFN – currently only provides up to 16 MJ of muzzle energy. Therefore, current tests have been limited to 16 MJ.

The construction of the EMLF was a Military Minor Construction (or MINCON) project; the environmental impacts of building the facility were evaluated in a NEPA categorical exclusion document in February 2005. Supplements to the categorical exclusion were prepared March 30, 2006 and October 2, 2007, as a result of changes in project elements that caused impacts to less than 0.1 ac of wetland. The categorical exclusions and supplements are included in Appendix A.

Because railgun and PFN technology have matured much more rapidly than envisioned even two years ago, the ONR and the industry and military groups working with them have found that it is now feasible to build and test a 64-MJ system. Three technology advances have set the stage for developing a 64-MJ US Navy railgun: the Secretary of the Navy's decision to develop an all-electric ship, as described below in Section 1.3, Purpose and Need; the advance in precision-guided projectile technology; and extended railgun barrel life resulting from the Army's RDT&E program described above.

The existing EMLF with a 32-MJ railgun cannot support the Navy's requirement to scale up (gradually increase power) to a 64-MJ EM railgun system because it does not have either the space to accommodate a larger projectile launcher and its associated electrical PFN, or the capability to capture and recover simulated projectiles.

Therefore, the proposed action would construct a new facility attached to the existing EMLF to house a 64-MJ railgun launcher, a high-energy electrical PFN, and a terminal range to capture the projectiles. The proposed project would advance RDT&E EM railgun system technology by validating key performance aspects of the launcher, PFN, and hypersonic projectiles.

1.3 Purpose and Need

The purpose of the proposed action is to meet the Navy's requirement to develop a full-scale, multiple-shot railgun system capable of generating 64-MJ muzzle energy. The Navy's need for this new weapon results from:

- **All-Electric Ships.** The Secretary of the Navy's decision to make future surface combatant ships, such as the DDG-1000 (a guided missile destroyer), all-electric (e.g., employing an integrated power system). Figure 1-4, Future US Navy DDG-1000 All-Electric Ship, is a conceptual drawing of what such a ship will look like in operation. This fundamental shift to electric propulsion opens the door for a new generation of electric weapons, including the railgun. Integrated power systems can dedicate most of the power onboard ship to electric propulsion motors for high-speed operations, but when the tactical situation requires, the power can be shared with electric weapons and sensors. The amount of power required for a railgun depends on the rate of fire. With an expected 80 megawatts (MW) of installed electrical power, future electric warships will have ample power to supply a railgun with the 15-30 MW necessary for sustained firing at 6-12 rounds/minute.

- **Long-range Firepower.** There have been numerous studies, including the *Quadrennial Defense Review* (Department of Defense [DoD], 2001) and the *Joint Vision 2020* (Joint Chiefs of Staff, 2000), that specify the need for long-range, time-critical strike capability in our nation's defense inventory. "Hypervelocity weapons" for attacking time-critical targets, the ability to defeat "bunkers and hardened targets," and low-cost "volume fires" are repeatedly cited as being critical to transforming our war-fighting capability (Roberts, 2002).

  - Guns from World War II Naval battleships could fire more than 25 NM in amphibious and shore-bombardment operations. Since these battleships were decommissioned after the Cold War, the Navy has been criticized for failing to provide a substitute capability in the form of long-range artillery aboard surface combatants (Erwin, 2003). The 5-in guns available today, which fire projectiles that can hit targets about 13 NM away, do not fully satisfy the requirements of either the Marine Corps or the Navy. The Marine Corps requires long-range artillery (gun) support from the sea, and the modern Navy needs to operate farther from hostile shores than just two decades ago because of exposure to longer-range enemy anti-ship weapons. The only weapon in the Fleet today that can reach extended distances from a ship is the Tomahawk missile; however, the Navy and the Marine Corps would benefit from also having less-costly, rapid-fire, long-range artillery available.

  - With the potential to deliver lethal, inexpensive, and timely projectile strikes, naval railguns offer a solution for high-volume firing and rapid strikes after a target is identified. Railguns have the potential to provide a means for sustained offensive power projection that is complementary to the use of missiles and aircraft. Railguns are uniquely qualified to satisfy the following key Navy fighting objectives (Bean, April 2003):

    - Long-range artillery.
    - Short time-of-flight.
    - High lethality (energy on target).

- **Efficiency.** Although the Tomahawk missile is a powerful and precise weapon, it is very expensive, costing more than $500,000 each time one is fired (Erwin, 2003). In comparison, ONR estimates that the railgun system will use bursts of electrical energy from the PFN equivalent to only a few gallons of ship's fuel to generate EM forces to accelerate a projectile to hypersonic speeds. The projectiles, as well, are far simpler in design than a missile and are inexpensive to manufacture.

- **Shipboard Logistical Advantages.** The railgun projectiles offer distinct logistical advantages over propellant-based gun projectiles. Thousands of railgun projectiles can be loaded into the same magazine volume that accommodates only hundreds of propellant-based projectiles. Because railgun projectiles contain no propellant-based

> charges, explosive hazards are minimized. The absence of explosive-based propellants would lessen the need for the stringent explosives- safety procedures currently required for conventional ammunition during manufacture, transportation, handling, and storage. The result would be vastly improved shipboard safety for sailors and reduced logistics costs (Bean, April 2003).

For the reasons cited above, the Navy needs to develop a long-range railgun system capable of generating projectile launch speeds greater than five times the speed of sound. The existing 32-MJ railgun at Dahlgren cannot support the Navy's requirement to scale up to a full-power 64-MJ EM railgun system. Once the Navy has developed a 64-MJ, multi-firing-capable railgun system that can consistently generate the required levels of power and speed, the technology would be transferred to a location with a larger range than NSWCDL's ranges to be tested in a configuration comparable to that which would be found on board naval surface combatant ships. Thus, the proposed 64-MJ railgun at Dahlgren would be an intermediate step on the road to a 64-MJ Tactical System capable of deployment on board naval ships.

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2 DESCRIPTION OF THE PROPOSED ACTION AND ALTERNATIVES

The *Regulations for Implementing the Procedural Provisions of the National Environmental Policy Act* establish a number of policies for federal agencies, including "...using the NEPA process to identify and assess the reasonable alternatives to the proposed action that will avoid or minimize adverse effects of these actions on the quality of the human environment" (40 CFR 1500.2 [e]). This chapter describes the proposed action, the Preferred Alternative, alternative site locations considered by the Navy, and the No Action Alternative.

2.1 Proposed Action

2.1.1 Railgun Technology

A railgun system consists of an EM launcher powered by a high-energy electrical PFN that fires inert, hypersonic projectiles (Figure 2-1, Railgun Components and Operation). The railgun launcher includes two parallel metal rails that conduct electricity and an electrically-conductive, sliding armature. The projectile is launched when the large bank of electrical capacitors that form the PFN releases a high-energy-current pulse (i.e., millions of amperes of electricity) at the end of one rail. The pulse then flows down the rail, across the armature, and back up the other rail. This current loop induces a magnetic field that interacts with the current in the armature to produce a force proportional to the magnitude of the current. This force rapidly accelerates the armature, on which rides a projectile, or launch package.

Future plans call for developing two different rounds for the railgun: a unitary round for engaging "hard" targets such as prepared positions, bunkers, and buildings and a pellet-dispensing round for "soft" targets, such as vehicles and personnel (ONR, 2009). In more highly-developed systems, aerodynamically-shaped projectiles will be supported in the squared-off railgun launcher by a sabot and propelling armature, which are necessary for propelling the projectile since no explosive propellants are used. The projectiles can be made of various metals, are equipped with accurate GPS guidance technology to pinpoint targets and avoid collateral damage, and contain no explosives. Figure 2-2, Railgun Projectiles and Launch Package, shows typical projectiles that eventually will be used in the railgun and a projectile launch package, as it is being fired, with the projectile separating from the sabot. The sabot and propelling armature are discarded after the launch package clears the muzzle.

At the current stage of development of the system, however, rather than the aerodynamic projectiles shown in Figure 2-2, blunt-ended metal "slugs" with an armature are being fired from the 32-MJ railgun to provide the mass of a projectile (the shot illustrated on the cover of the EA is using a slug). Slugs will continue to be fired while the RDT&E focus is on developing basic system functions, such as ramping up the muzzle energy, developing sufficient PFN power, ensuring that the rails can withstand the rapid acceleration, and ensuring that the energy transferred from one rail through the armature back to the other rail is sufficient to provide the required magnetic acceleration. This work would continue on the proposed 64-MJ railgun system. Once RDT&E moves to the tactical proof-of-concept phase, power and speed would increase and aerodynamic projectiles such as those shown in Figure 2-2 would be fired from the 64-MJ railgun.

The high-energy electrical pulse required to produce the EM energy for each shot uses large banks of electrical capacitors – the PFN – to store and then release energy. Figure 2-3, 32-MJ Railgun Launcher, shows the 32-MJ railgun launcher within the Dahlgren EM Launch Facility. The 64-MJ railgun would be similar in appearance. Electrical cables emerge from the railgun just in front of where projectiles are loaded (the blue structure) and lead to the PFN electrical capacitor banks to the right of the pictures. The rails used to conduct the EM charge (shown in Figure 2-1) are within the railgun. The muzzle chamber that guides the projectile as it is being fired extends outside the building.

Once Dahlgren has developed a multi-firing capable railgun system that can consistently generate the required levels of power and speed, further development of the technology would take place on a system comparable to that which would be placed on a combatant ship. In theory, the PFN can produce a force capable of accelerating a projectile to hypersonic velocity (defined as a speed five times the speed of sound in air or greater). As indicated in Section 1.2, it is expected that when fully operational, an EM railgun system will be able to deliver hypersonic inert projectiles at ranges in excess of 200 NM. Launching a projectile to hit a target more than 200 NM away would only take place during the operational testing and evaluation phase and at a location (still to be determined) that has a range capable of accommodating such full-scale operational test firings.

2.1.2 Railgun Facility Construction

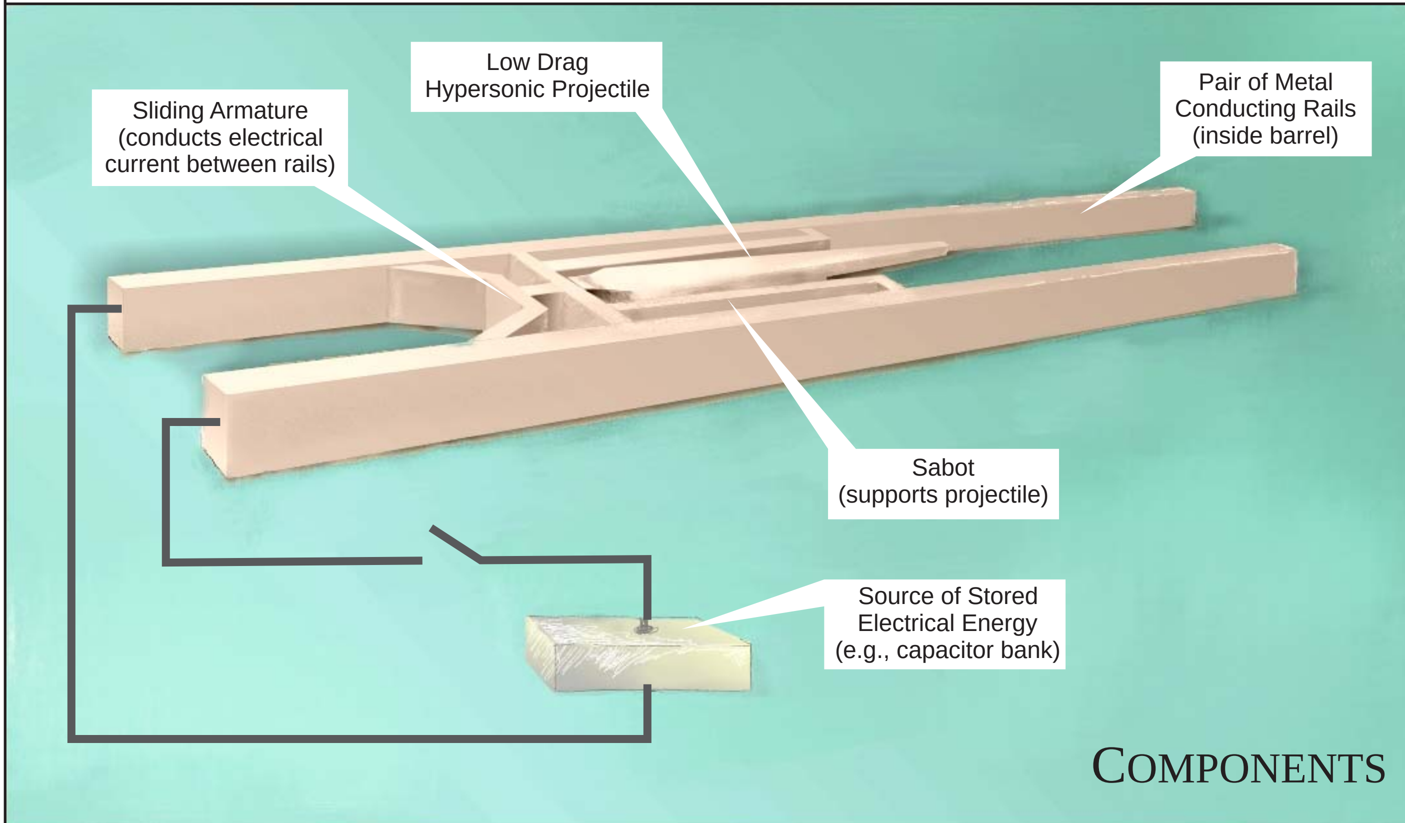
The proposed 64-MJ railgun facilities would be built on NSWCDL's Missile Test Range (missiles are no longer fired there) as an addition to Building 1410, the EMLF. The EMLF houses the 32-MJ railgun system (Figure 2-4, Proposed Railgun Site at Dahlgren).

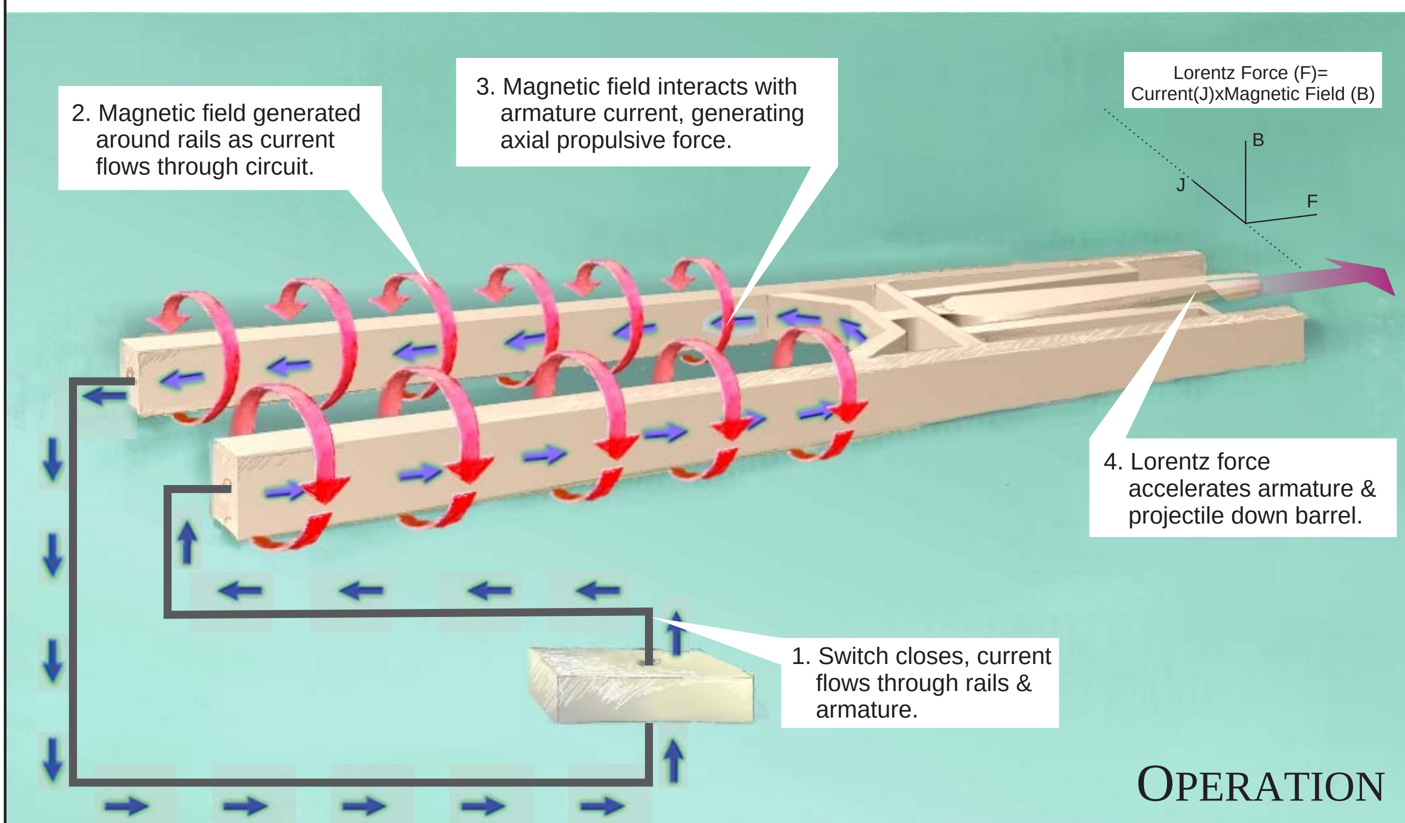
The proposed project would involve the construction of the following structures (see Figures 2-5, Railgun Site Layout, and 2-6, EMLF with Proposed Project Addition):

- **Launch Building.** A 10,080-square-foot (sq-ft) high-bay addition on the southwest side of existing Building 1410 to house the 64-MJ railgun along with the PFN. This addition would make use of the existing Building 1410 overhead crane and other existing infrastructure and add another 126 ft of length to the 80-ft-wide, 110-ft-long Building 1410.

- **Control and Instrumentation Building.** A 5,040-sq-ft stand-alone building to provide an operations control room for remote control, observation, and documentation of railgun tests, as well as offices, a conference room, storage rooms, utility rooms, and restrooms. The control building would be located 80 ft from the

Railgun Components and Operation





Source: Bean, April 2003

Figure 2-1

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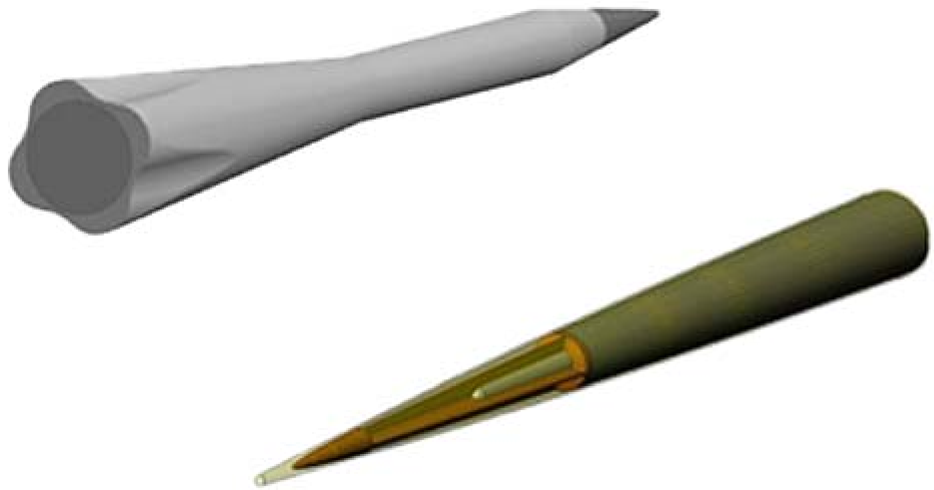
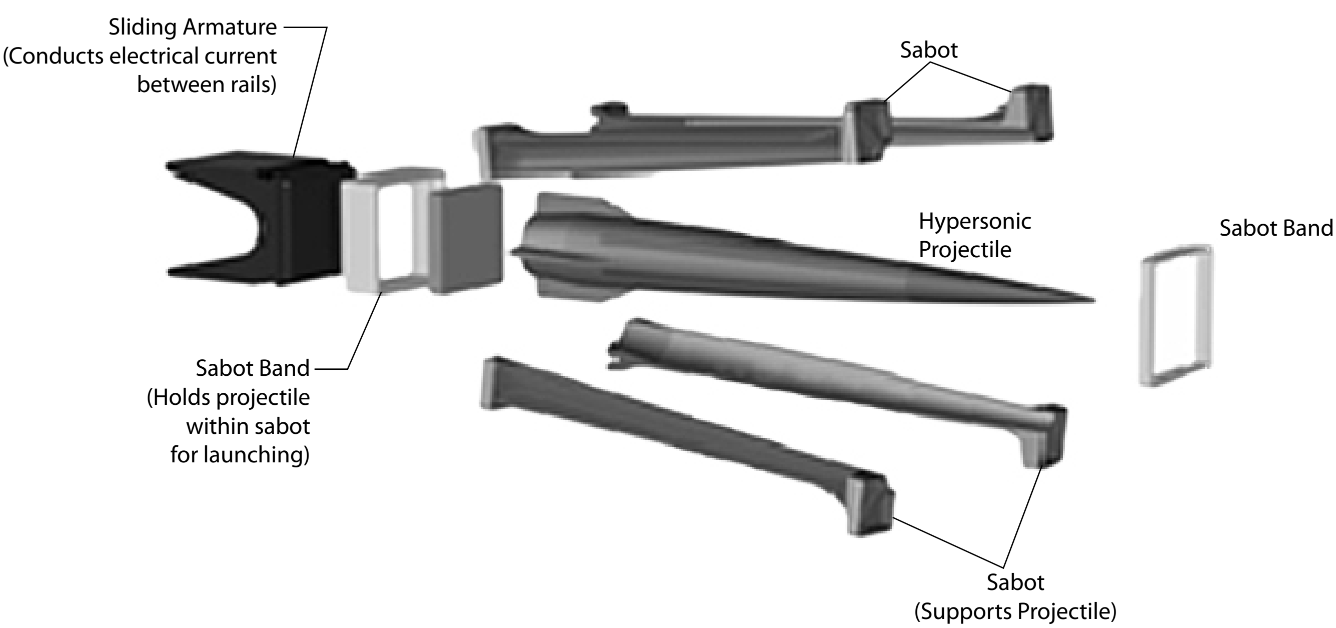
Railgun Projectiles and Projectile Launch Package



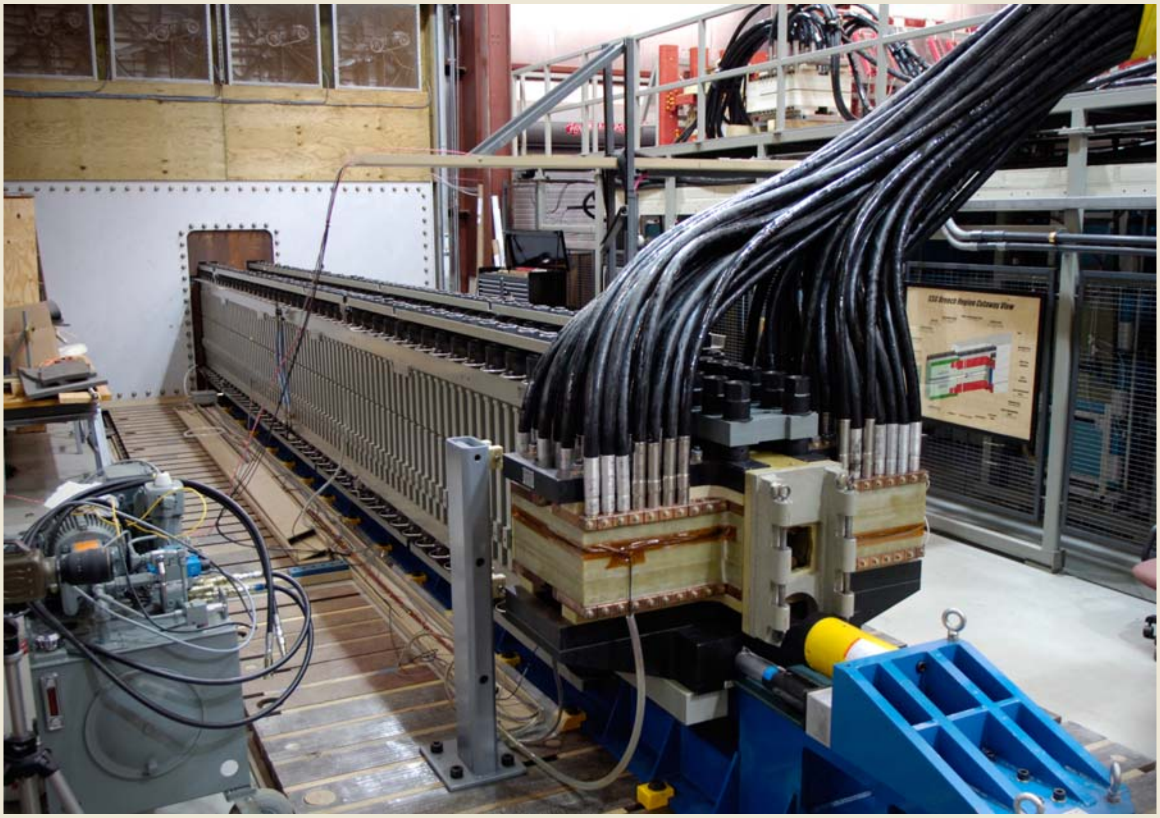
Typical Non-Explosive Hypersonic Railgun Projectiles



Railgun Projectile Launch Package: Projectile separating from supporting sabot.

Figure 2-2

32-MJ Railgun Launcher



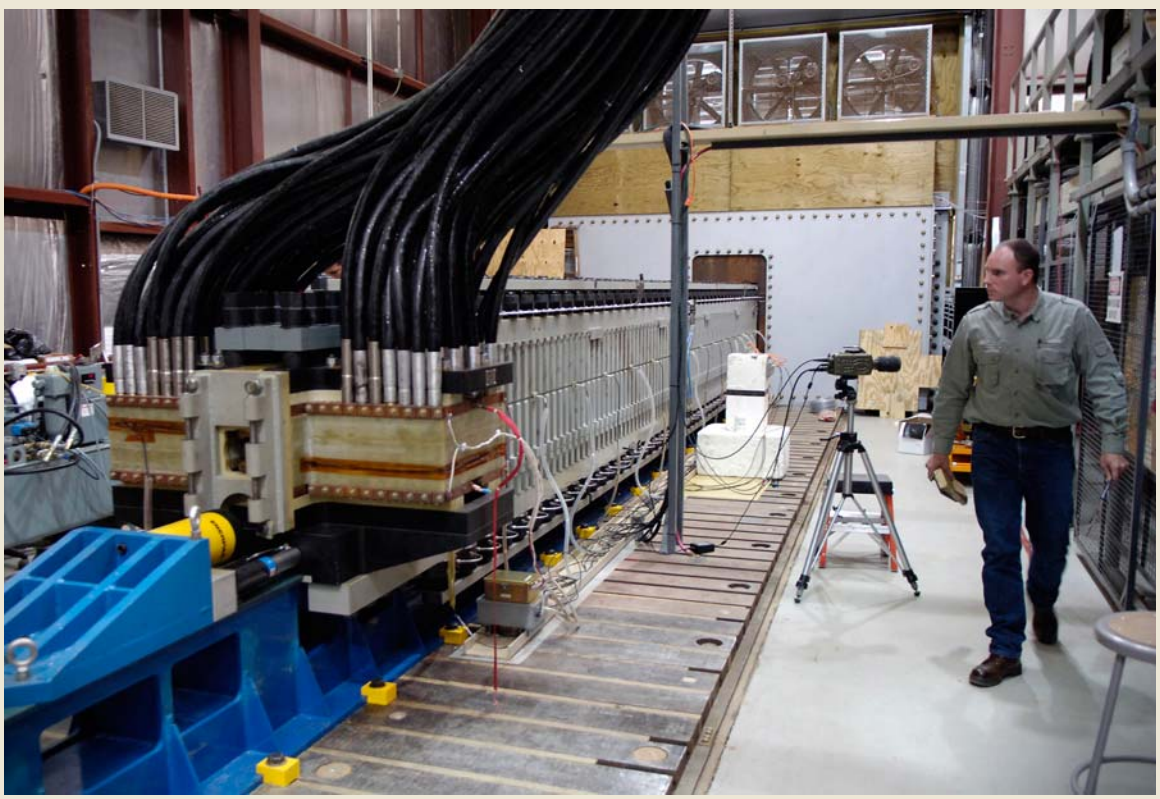
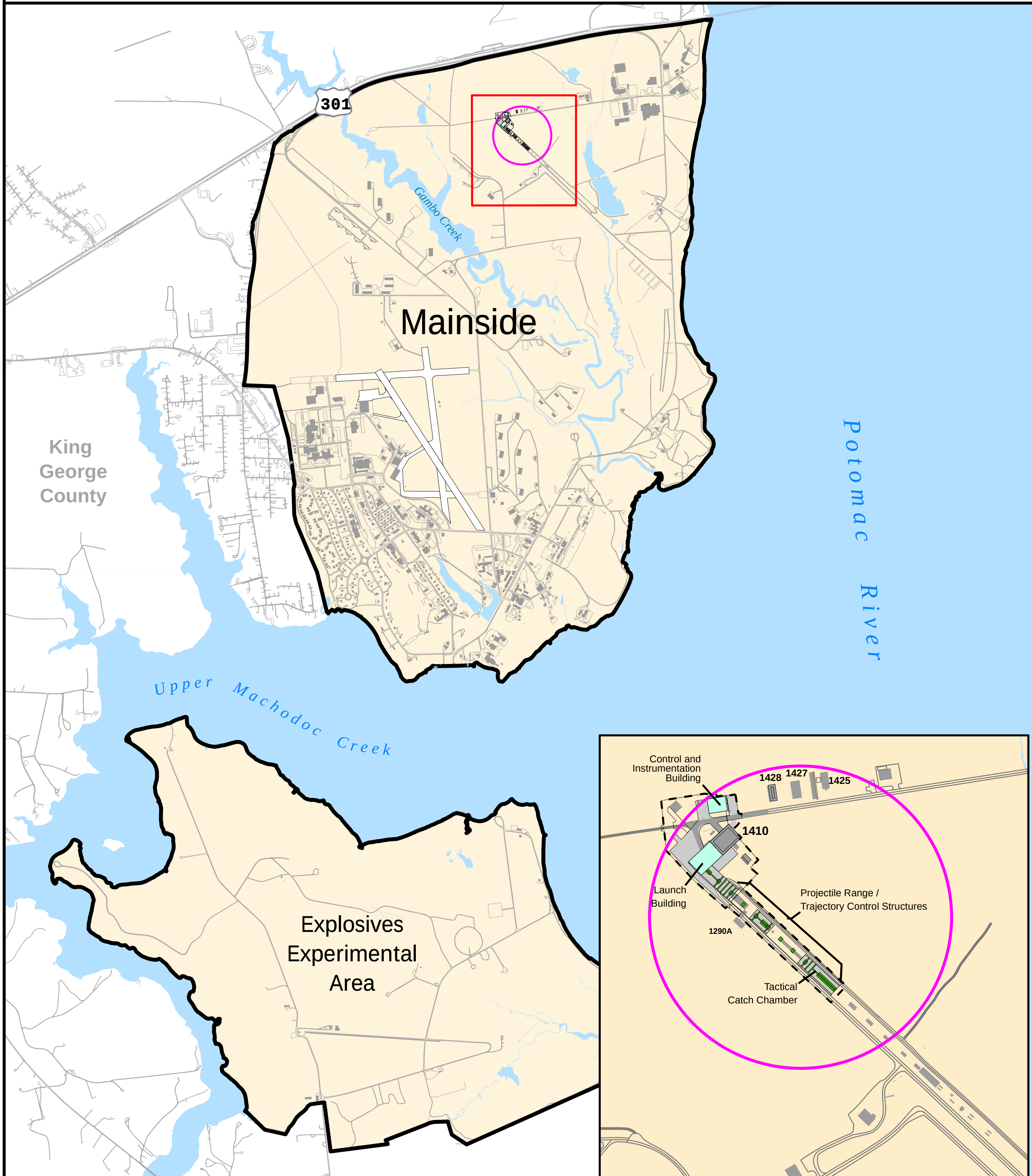


Figure 2-3

Proposed Railgun Site at Dahlgren



Dahlgren

Approximate Location of Proposed Railgun Facility

2,300 1,150 0 2,300 4,600 Feet

475 237.5 0 475 950 Meters

N

Figure 2-4

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Railgun Site Layout

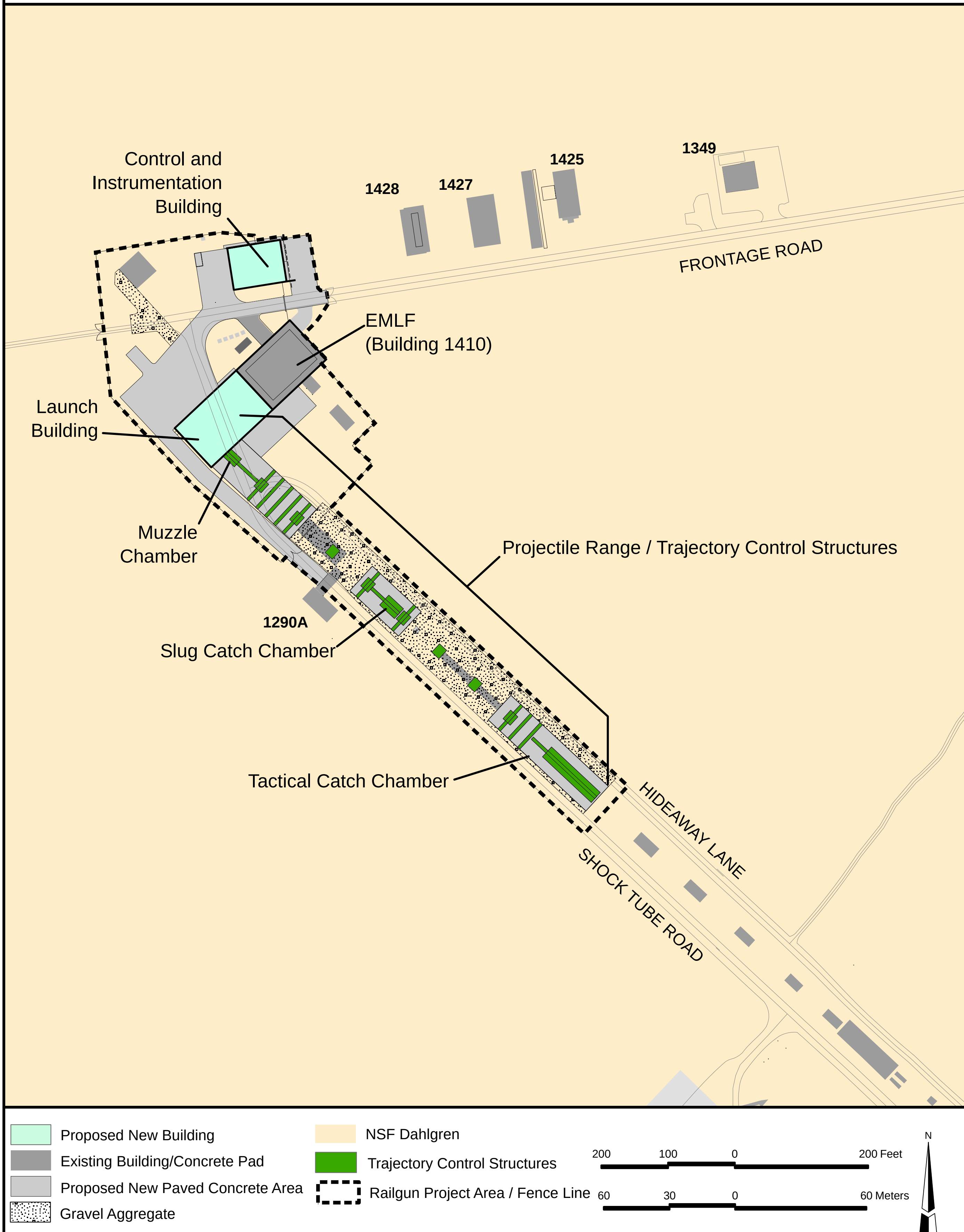

Figure 2-5

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EMLF with Proposed Project Addition

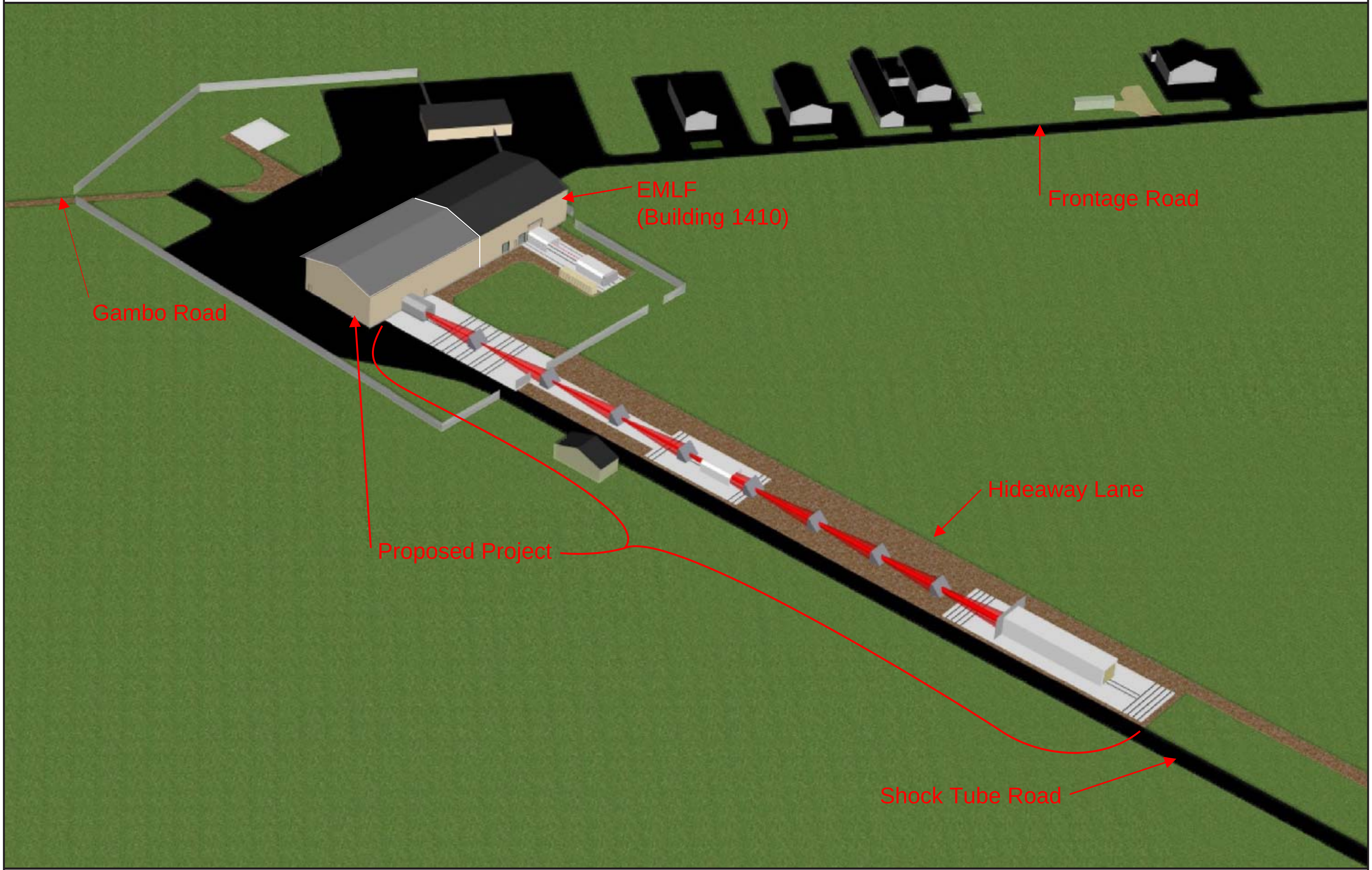

Figure 2-6

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launch building – a distance that has been calculated during operations to be safe for personnel most vulnerable to high-energy EM pulses, which would be anyone using an electronic pacemaker.

- **Projectile Range/Trajectory Control Structures.** A 656-ft above-grade outdoor projectile range extending from the muzzle chamber of the railgun to the entrance of the tactical catch chamber. Both the muzzle chamber and the tactical catch chamber would be constructed of cast-in-place concrete. The muzzle chamber, attached to the railgun in the launch building, directs the projectile. The range includes a series of trajectory control structures to guide projectiles safely into the tactical catch chamber and deflect ricochets. The trajectory control structures would be made of 12-in-thick concrete between 1-in steel plates. This would ensure safe travel of the projectile from the railgun to the tactical catch chamber. Holes in the plates of the trajectory control devices would permit the travel of the projectile only along a very controlled and narrow flight path – 0.202 degree cone of travel from the muzzle to the targeted point of impact. Any deviation of flight would cause immediate deflection of the projectile into the ground by these heavily reinforced structures slanted at an angle towards the railgun muzzle.

- **Slug Catch Chamber.** As testing begins using the 64-MJ railgun, the projectile launch package would include an armature (Figure 2-2) and a blunt or pointed slug (rather than an aerodynamic projectile, as discussed above). The slug is screwed into the top of the nylon bore rider and the integrated launch package is loaded as one piece. The bore riders are designed to tear away upon launch; the slug separates from the armature and is trapped in the slug catch chamber. As the RDT&E on the railgun system advances and aerodynamic projectiles begin to be fired, then this chamber will strip the sabot from the projectile as the projectile speeds through on its way to the Tactical Catch Chamber.

- **Tactical Catch Chamber.** A 200-ft-by-60-ft reinforced concrete structure at the terminus of the projectile range that is designed to safely catch railgun projectiles. The walls of the chamber would be lined with 2 ft of concrete faced with 1-in steel plates. Fifteen feet of fill and soil held in place with 12-ft reinforced retaining walls would cover the chamber. Constructed above grade, the chamber could be used repeatedly. Assessments of the lethality of projectiles would occur within the catch chamber.

The addition to Building 1410 (the ELMF) would be a single-story pre-engineered metal building with a structural steel frame, metal panel exterior wall system, reinforced concrete foundation, with a sloped metal roof system. The structure would include fire and electrical protection and alarm systems; a heating, ventilating and cooling system; plumbing; electrical power distribution and grounding; lighting; integrated data/communication information system; and blast-resistant walls separating the high-bay area from the low-bay area.

Anti-terrorism/force protection measures would include: emergency shutdown features capable of turning off electrical power in designated areas; laminated window glazing; intrusion detection; public announcement system; and heating, ventilating and cooling intakes located at least 3 ft above finished grade.

Sustainable design principles would be integrated into the design, development, and construction of the facilities, and would include low water-usage landscaping; stormwater management; room-occupancy sensors that would turn lights off when the room is not occupied; electrical-usage-monitoring digital direct controls; task lighting, light-emitting diode (LED) exit signs; light switching to segregate banks of lights; use of daylight where and when possible; and use of recyclable regional and non-toxic construction materials.

The 4.4-ac site of the expanded EMLF (indicated by the dashed line on Figure 2-5) would be enclosed by an 8-ft project area fence. Shock Tube Road, Frontage Road, and Gambo Road, which intersect at the EMLF site, would continue on their existing alignments, but would now pass through the fenced area. Before a railgun operation commences, gates on Shock Tube Road, Gambo Road, and Frontage Road would be closed to keep everyone but EMLF operating personnel out of the area. Barricades would be in place prior to and during testing (Figure 2-7, Railgun Barrier Plan) to ensure that no one enters the operations area during railgun firing. Only EMLF personnel would be allowed within the operations area. EMLF personnel would control operations from the proposed control building, outside the EM safety zone buffer.

Approximately 5 ac of land would be disturbed by facility construction, which includes an approximately 10-15 ft construction zone around the construction areas. The proposed construction, including the buildings, new paved surfaces, and the paved areas of the projectile range/trajectory control structures, would add 1.44 ac of impervious surface to the existing 1.12 ac of impervious surface on the 4.4-ac site (the impervious areas include the conical shock tube foundation, described in Section 3.7). The areas between the trajectory control structures on the projectile range would be covered with gravel aggregate (Figure 2-5). Because vehicles would not be compressing the gravel and soil beneath, this area would remain mostly pervious.

All utilities – water, sewer, electrical, and communications – would tap into the existing EMLF infrastructure system. There is a single corridor between Shock Tube Road and Frontage Road in which these utilities would run. The railgun would operate by drawing power from the existing electrical power grid. Since the railgun system would use electrical capacitors to store power in order to generate a large electrical pulse for firing, a managed capacitor charging rate would allow the existing utilities to meet the overall power demand.

The proposed activities would not involve the use of explosives, and thus would not generate any explosives safety quantity distance (ESQD) arcs. Of the various proposed structures, three – the Building 1410 addition, the projectile range/trajectory control structure, and the tactical catch chamber – are within the ESQD arc of Radiography Building 1180. Explosives are stored overnight or over the weekend at Building 1180 when they are in the process of being x-rayed. Because the three proposed structures are within an ESQD arc, a request to build within an ESQD arc (Naval Surface Warfare Center Dahlgren Division [NSWCDD], 2008) was forwarded for approval to the Naval Ordnance Safety and Security Activity (NOSSA). This request was

Railgun Barrier Plan

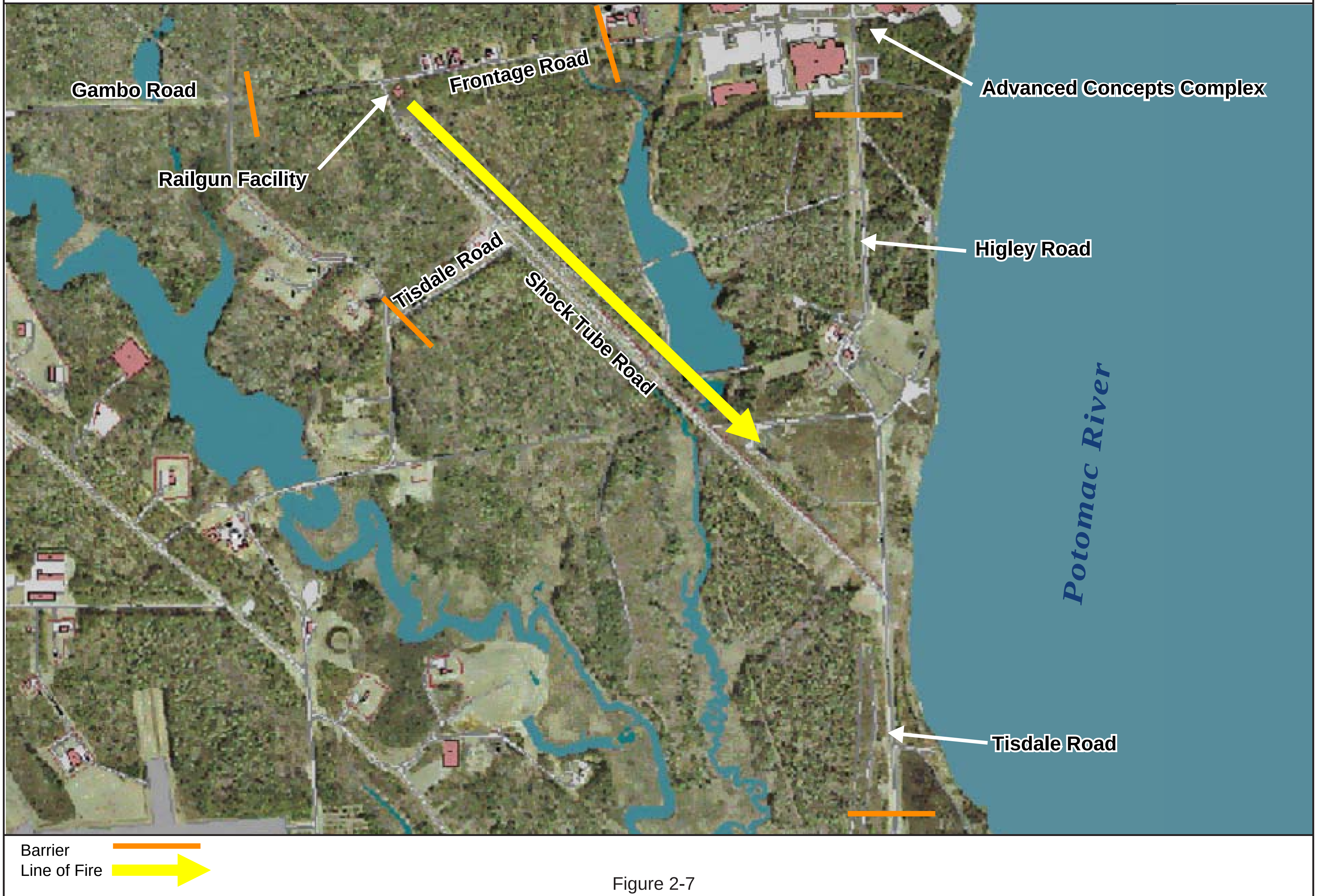

Figure 2-7

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approved, provided that no railgun operations take place when ordnance is present in Building 1180 (NOSSA, 2008). The NOSSA endorsement is included in Appendix B.

The personnel who would operate the proposed facility already work at NSWCDL. Therefore, no additional personnel would be hired or would move to NSF Dahlgren as a result of the proposed action.

2.1.3 Railgun RDT&E Operations

2.1.3.1 Focus of Railgun RDT&E Operations

The process of increasing railgun muzzle energy would take place over several years, leading to and including a full-scale 64-MJ demonstration of the system. The RDT&E program for the 64-MJ railgun would focus on:

- Scaling up to full 64-MJ launcher operation.
- Capability of hypersonic projectiles for multiple mission areas and validation of lethality (effectiveness in destroying the target).
- Barrel life.
- Capability of the PFN.
- Thermal management.
- Firing sequence.
- Design of the sabot that supports the projectile and armature separation.
- Increasing muzzle velocity.
- Repetitive-rate firing validation (six or more shots per day).
- Intermediate ballistics.

Scientists and engineers at Dahlgren would begin RDT&E activities with the proposed 64-MJ railgun at muzzle energy levels around 16-MJ and then progress incrementally up to full-scale launcher muzzle energy levels of 64-MJ. The projectile flight path would be controlled from launch through impact in the trajectory control structure. By its nature, part of RDT&E is to document and understand the effects of actions taken, so it is possible that the actual noise and EM levels generated by the railgun operations may differ from what is anticipated. Therefore, as the scaling-up – the incremental increasing over time – of muzzle energy levels progresses, sound pressure and EM levels would be carefully monitored by scientists and engineers, and noise reduction and shielding measures would be incorporated if needed (as described in Chapter 5, *Mitigation Measures*).

2.1.3.2 Electromagnetic Energy

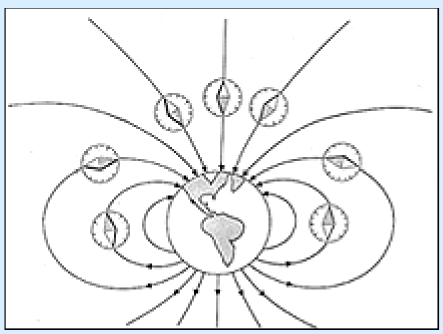
RDT&E of the 64-MJ railgun system requires the use of powerful electric and magnetic fields. Whether large or small, electric fields and magnetic fields can always be found together, as they are linked – magnetism generates electricity, and electricity generates magnetism, which is why the term “electromagnetic fields” is used.

Magnetic fields are a form of naturally-occurring energy in the EM spectrum. Ionizing radiation, including x-rays, is at the top of the EM spectrum and represents the highest energy levels, while EM fields such as those generated by household appliances and office machines are at the opposite end of the spectrum and represent low energy levels. The Earth's natural background magnetic field strength ranges from approximately 0.3 to 0.6 Gauss (G) (direct current [DC]) with higher background concentrations closer to the north and south magnetic poles and variations based on physical location and geological characteristics. This field is thought to be produced by electric currents flowing deep within the earth's core (NIEHS and NIH, 2002).

Magnetic Field (Magnetic Induction) Measurement Units

Gauss (G) Centimeter-gram-second system (cgs)
Tesla (T) International System of Units (SI)
1G = 0.0001 T
1G = 1,000 milliGauss (mG)

Gauss and Tesla measure the concentration of a **magnetic field**, which is equal to the number of magnetic field lines per square meter (sq m). Magnetic field lines describe the structure of magnetic fields in three dimensions. If at any point on such a line an ideal compass needle is placed, free to turn in any direction (unlike the usual compass needle, which stays horizontal), then the needle will always point along the field line, as shown in the figure below (Stern and Peredo, 2001). **Magnetic flux** is the product of the average magnetic field times the perpendicular area that it penetrates. The SI unit of magnetic flux is the **Weber** (Wb), which equals 1 x 10^8 (one hundred million) magnetic field lines (One Tesla is equal to 1 Weber/sq m). One Gauss is equal to about 6.5 magnetic field lines per square inch.



Electric Field Measurement Units

Electric field strength is a quantitative expression of the intensity of an electric field at a particular location. The standard unit is the **volt** per meter (V/m). Field strength of 1 V/m represents a potential difference of one volt (SI unit of electric potential or electromotive force) between points separated by one meter.

EM fields are a vital part of our everyday life, both biologically and technologically: EM fields assist our bodies to function at the molecular level, and are present in all electrical devices and sources in the world. The magnetic field strengths associated with some everyday appliances are listed in Table 2-1, in which their field strengths at distances of 1 and 3 ft are indicated. As shown in Table 2-1, magnetic fields dissipate quickly with distance, typically returning to the natural background strengths within 3 to 4 ft of an appliance (USEPA, 1992; California Department of Health Sciences, 1999). Average 24-hour personal magnetic field exposure for individuals in the US population was measured to be about 0.9 mG (NIEHS, 1999), and a typical American home has a background magnetic field level (away from any appliances) of 0.5 to 4 mG (USEPA, 1992). As a comparison, a magnet on a refrigerator has a field strength of about 100 G (Frese and Engels, 2003).

Table 2-1
Magnetic Field Strengths from Surfaces of Common Household Appliances

Appliance/Device	Milligauss (mG)	
	At 1 ft	At 3 ft
Aquarium pump	0.35-18.21	0.01-1.17
Band saw	0.51-14.24	0.05-0.75
Can opener	7.19-163.02	1.30-6.44
Clock	0.34-13.18	0.03-0.68
Clothes iron	1.66-2.93	0.25-0.37
Computer monitor	0.20-134.7	0.01-9.37
Copier	0.05-18.38	0-2.39
Dishwasher	4.98-8.91	0.84-1.63
Fax machine	0.16	0.03
Microwave oven	0.59-54.33	0.11-4.66
Radio	0.43-4.07	0.03-0.98
Scanner	2.18-26.91	0.09-3.48
Television	1.80-12.99	0.07-1.11
Vacuum cleaner	7.06-22.62	0.51-1.28
Source: California Department of Health Sciences (1999).		

Other common sources of EM field energy in our environment include electrical distribution lines/transmission lines, electrical transformers, and magnetic resonance imaging (MRI) equipment. When performing MRIs, for example, the stronger the magnetic field, the stronger the radio signals that can be elicited from the body's atoms and, therefore, the higher the quality of MRI images[2]. MRIs can generate magnetic fields up to 70,000 G; however, levels experienced by persons inside an MRI usually range from 10,000 to 15,000 G. MRI machines have Tesla unit labels signifying the strength of the MRI magnetic field associated with them. Each set of MRI images takes about 2 to 15 minutes. Depending on the area being studied, an MRI can take an hour or longer. The increased magnetic field exposure is not considered to be significant due to the limited exposure time and low number of tests an individual undergoes.

Table 2-2 provides typical household electric field levels at 50 Hertz (Hz). These measurements were collected at a distance of approximately 1 ft from the appliance/device.

[2] An MRI creates a steady state of magnetism within the human body by placing the body in a steady magnetic field. Then the MRI stimulates the body with radio waves to change the steady-state orientation of protons, after which the MRI machine stops the radio waves and registers the body's electromagnetic transmission. Finally, the transmitted signals are used to construct internal images of the body by computed axial tomography (CAT). An MRI differs from a CAT scan because it uses radio waves whereas a CAT scan uses ionizing radiation.

Table 2-2
Typical Electric Fields

Appliance/Device	Electric Field (volt/meter) at 1 ft
Stereo receiver	180
Iron	120
Refrigerator	120
Mixer	100
Toaster	80
Hair dryer	80
TV	60
Coffee maker	60
Vacuum cleaner	50
Electric oven	8
Light bulb	5
Guideline limit value	**5,000**
Source: (Federal Office for Radiation Safety, Germany, 1999; as cited in WHO, 2008c).	

2.1.3.3 Operations Safety

Because of the high-power EM energy involved in railgun operations, NSWCDL would take all necessary precautions when the proposed 64-MJ railgun is operating to ensure the safety of workers on the site, personnel on the installation, and the public. Dahlgren has a long history of safe testing and this practice would continue with the operation of the proposed facility. All operations at Dahlgren are conducted in accordance with federal and state regulations, stringent DoD policies, and carefully conceived management controls, risk hazard analyses (RHAs) and standard operating procedures (SOPs). These policies and procedures include, but are not limited to, very specific operating parameters for range clearance and scheduling; safety controls; use of personal protective equipment (PPE); environmental preservation; and materials-handling safety procedures.

Operations using EM energy require the identification and incorporation of safe operating parameters with respect to personnel, ordnance, fuels, the environment, and electronic equipment near the test site, as follows (for details, see Section 3.8.2):

- **Hazards of Electromagnetic Radiation to Personnel (HERP).** Safety zones are determined for each EM railgun. Personnel involved with the test inside the safety zone must wear appropriate PPE, leave the HERP safety zone during operations, or limit their time there based on approved exposure limits. Because EM energy dissipates exponentially by distance from the energy source, safety to personnel can be achieved simply by moving RDT&E personnel farther away from the source. EM exposure can also be reduced by housing personnel within a protective structure.

- **Hazards of Electromagnetic Radiation to Fuel (HERF).** Fuel vapors can be ignited by EM energy field-induced arcs during fuel-handling operations close to high-powered radio frequency (RF) radar and transmitting antennas. Therefore, no fuel storage or fueling is permitted within HERF zones.

- **Hazards of Electromagnetic Radiation to Ordnance (HERO).** Safety zones are determined for each EM energy emitter. Ordnance that might detonate for any reason must be kept out of the HERO safety zones during operations using high- frequency and/or higher-power EM emitters. As described in Section 2.1.2, three of the railgun facility structures are within the ESQD arc of Radiography Building 1180, and NOSSA has approved the proposed construction of the 64-MJ facility within this ESQD arc, provided that no concurrent railgun operations take place when ordnance is present in Building 1180 (endorsement in Appendix B).

- The potential for **Electromagnetic Interference (EMI)** is identified prior to operating higher-power, higher-frequency EM energy emitters. EMI includes the potential to affect any nearby device that uses EM energy, ranging from causing static on television screens to interfering with automotive remote-entry control devices or cell phones. Dahlgren’s engineers and scientists mitigate EMI that could affect the public and other operations on Dahlgren by such actions as shielding, using lower power, or changing where the energy is focused.

Increasing distance from the source dramatically reduces energy and power levels, and, therefore, potential HERP, HERO, HERF, and EMI risks.

The dedicated technical facilities and equipment at Dahlgren have features specifically designed to support safety requirements. Every test must be preceded by an approved RHA and SOP signed by senior personnel, who specifically consider human health and safety and the environment. A typical test procedure and the steps that would be followed before, during, and after railgun testing are provided in the “Typical EM Railgun Procedure” textbox on the following page. Implementation of RHAs and SOPs specific to the RDT&E of the proposed EM railgun system is a key component of the proposed action.

2.2 No Action Alternative

Under the No Action Alternative, the proposed railgun structures would not be constructed. Therefore, structures would not be available to allow the Navy to develop a full-scale EM railgun system to 64-MJ muzzle energy that meets Navy requirements. Thus, under the No Action Alternative, the Navy and ONR would be unable to achieve their specific, identified mission (among other missions) of developing and demonstrating a full-scale EM railgun system.

Although the No Action Alternative is not considered to be a reasonable alternative, it provides a baseline condition against which the impacts of the proposed action can be assessed.

Typical EM Railgun Procedure

This text box describes the step-by-step procedures for a typical test. All railgun testing involves pre-test preparation, pre-shot preparation, shot, post-shot procedures, and post-test cleanup. In the example below, the energy source for the launcher is assumed to be a 16-MJ or higher bank of electrical capacitors – the PFN. Detailed operating procedures related to each specific EM Launcher and its required Terminal Area configuration would be provided in the Operation Procedures Supplement (OPS) for that particular EM Launcher.

1. **PFN Control System Checkout**. A set of procedures used to verify the functionality of control-system components for the PFN. No high voltage is applied to the PFN.
2. **Procedures for PFN Trigger System Checkout.** A set of procedures are used to check the functionality and timing of the Trigger system for the PFN. High voltage is present at very small energy levels only in the Trigger system. During this set of procedures, high-voltage trigger pulses will be delivered to the spark-gap switches, but the PFN capacitors will remain discharged.
3. **Procedures for PFN Fire Mode (Discharge to Soft Dump Resistors).** A set of procedures used to verify the PFN charging and discharging process and the functionality of the Soft Dump resistors. Soft dump resistors provide a slow discharge of the residual energy. During this operation, the PFN will be charged to high voltage and then discharged to the Soft Dump resistors. Barricades are put in place for PFN fire modes.
4. **Procedures for PFN Fire Mode (Discharge to Dummy Load).** A set of procedures used to verify the PFN charging and discharging process and the functionality of the Dummy Load (rather than the discharge to the EM Launcher). During this operation, the PFN will be charged to high voltage and then discharged to the Dummy Load.
5. **Procedures for PFN Fire Mode (Discharge to EM Launcher Serving as a Dummy Load).** A set of procedures used to verify the PFN charging and discharging process and to exercise certain EM Launcher diagnostics. During this operation the PFN will be charged to high voltage and then discharged to the EM Launcher serving as a Dummy Load.
6. **Procedures for PFN Fire Mode (Discharge to EM Launcher for Firing a Projectile [or Integrated Launch Package]) into the Terminal Area or Open Range).** A set of procedures used to fire a projectile from the EM Launcher into the EMLF Terminal Area or Open Range. All safety procedures (e.g., barriers, notifications, lights, horns, clearance) have been implemented at this time.
7. **In addition to the steps above, the terminal area and launcher area are prepared prior to operations.**
8. **Post-firing procedures and inspection of the terminal area are performed after each test.**

Note: At any time during the PFN charging and firing sequence, the Firing Director, Launch Director and Pulsed Power Director all have authority to ABORT the process if necessary. If the order to ABORT is given, the PFN Operator will immediately push the PANIC BUTTON on the control console or do a controlled soft dump if the abort is not time-critical. This disconnects the power supplies and initiates the soft dump system.

2.3 Alternative Locations Considered but Eliminated from Further Analysis

2.3.1 Locations Other than NSF Dahlgren

Three locations other than Dahlgren were considered by the Navy for construction and operation of the proposed full-scale 64-MJ EM railgun system because each has existing small-scale EM railgun facilities: the British Ministry of Defence's facility at Kirkcudbright, Scotland; the University of Texas Institute for Advanced Technology; and the US Army's Aberdeen Proving Ground, Maryland. However, these locations and associated facilities, unlike Dahlgren, do not have sufficient real estate and/or infrastructure to upgrade to a 64-MJ EM railgun system. Other factors considered included travel costs, facility ownership, data rights restrictions, and schedule impacts.

In addition, Dahlgren has extensive experience in conducting high-energy EM pulsed-power research and has existing high-energy EM testing capabilities; indeed, EM testing is one of Dahlgren's core capabilities. The proposed full-scale EM railgun system could easily be integrated into Dahlgren's existing RDT&E program. The ONR and others in the Navy already rely on the knowledge of Dahlgren's resident scientists and engineers, who are among the nation's foremost experts in combat and weapons systems, and would greatly benefit from continued reliance on them for RDT&E of a 64-MJ EM railgun system. The personnel who would operate the railgun would be personnel who have already been trained to work with, and are already working at Dahlgren with, high-energy EM systems. Therefore, locations other than Dahlgren were eliminated from further consideration in this EA.

2.3.2 Alternative Sites on NSF Dahlgren

The Navy considered locating the proposed 64-MJ railgun at alternative sites on Dahlgren. The siting criteria included:

- Sufficient land area to accommodate a projectile terminal range, catch chamber, and associated projectile safety hazard zone.
- Sufficient land area outside ESQD arcs so that some proposed operations could occur concurrently with other Dahlgren activities.
- Location on an existing range.
- Minimization of impacts to natural resources.

Sites were evaluated on the following ranges:

Explosives Experimental Area (EEA) Range Complex

The EEA Range Complex was evaluated as a potential site for the proposed facilities. The EEA was found to be unsuitable because the proposed operations would interfere with existing range operations. All potential locations on the EEA were found to be unsuitable for one or more of the following reasons:

- Construction of the proposed facilities would require deforestation.
- Construction of the proposed facilities would be within bald eagle nest protection zones.
- Construction of the proposed facilities would require filling wetlands.
- The proposed EM railgun operations could pose a potential safety hazard because of the amount of unexploded ordnance (UXO) buried in the soil in some parts of the EEA.

Potomac River Test Range Complex Land Ranges

In addition to the EEA, alternative sites on Mainside ranges and mission areas were evaluated. The proposed site on the Missile Test Range, part of the Potomac River Test Range (PRTR) Complex, was the only location on Mainside that featured enough available land to support all components of the proposed project. Furthermore, no site on Mainside, with the exception of the proposed site, featured enough land outside of an ESQD arc so that the proposed railgun operations could occur concurrently with other activities.

Other ways to use the existing EMLF site were also considered, for instance by modifying the existing EMLF rather than building an addition on the southwest side (see Figure 2-5). However, this would:

- Cause substantial impacts to wetlands during construction of the projectile terminal range and catch chamber because wetlands are adjacent to the existing EMLF's northeast side.
- Require that, during construction, all testing currently taking place within the existing EMLF be suspended. This would cause an unacceptable delay in the overall EM railgun program.

For these reasons, this alternative was eliminated from further consideration in this EA.

3 AFFECTED ENVIRONMENT

Council on Environmental Quality (CEQ) regulations (40 CFR Part 1500 et seq.) implementing NEPA require documentation that succinctly describes the environment of the area(s) potentially affected by the alternatives under consideration and discusses the project's impacts in proportion to their significance. The description focuses largely on the north-central part of Dahlgren's Mainside, where the proposed railgun facilities would be constructed. When appropriate, however, this section also includes descriptions of larger areas, including King George County and other nearby counties.

3.1 Land Use and Coastal Zone Management

3.1.1 Land Use

3.1.1.1 NSF Dahlgren Land Use

The Navy has conducted weapon research and testing at NSWCDL since 1918, when proving-ground operations were moved there from the Naval Surface Warfare Center, Indian Head Division in Maryland. The new location was selected because of its remoteness and the availability of open land along the Potomac River for longer-range gun firing. Today, Dahlgren is the Navy's principal center for surface warfare analysis, surface-ship combat systems, and strategic systems.

NSF Dahlgren occupies approximately 4,320 ac in King George County, Virginia. The facility is home to several tenant agencies, the largest of which is NSWCDL. Other tenants include the Joint Warfare Analysis Center; the Aegis Training and Readiness Center/Center for Surface Combat Systems; AEGIS Ballistic Missile Defense; 20th Space Control Squadron Attachment 1; and Public Works Department South Potomac – Dahlgren.

Dahlgren's main range is the Potomac River Test Range (PRTR) Complex, which extends mostly over water but also has a land component along the eastern edge of Mainside that comprises five ranges (see Figure 1-2). From north to south, these are the Missile Test Range, Terminal Range, Main Range, Anti-Aircraft (AA) Fuze Range, and Machine Gun Range. The proposed facilities would be located on the Missile Test Range. Despite this range's historic name, no missiles are fired from it these days. It was used for impact fuze testing during World War II and the Korean Conflict and for land-based bombing targets in the 1930s and early 1940s (RMC, 2003). Currently it is used to conduct overland test and evaluation of vehicles and of special weapon components against targets. The Missile Test Range also encompasses an Explosives Ordnance Disposal (EOD) training range for non-fragmenting energetic training operations.

Almost all existing development at NSF Dahlgren is found on Mainside. Existing land use on Mainside is shown in Figures 3-1 (NSF Dahlgren Functional Areas) and 3-2 (Land Use –

Mainside). There are three RDT&E complexes – Advanced Concepts, Warfare, and Weapons – for which the primary land use is *Operations: RDT&E*, although portions of the Advanced Concepts Complex are designated as *Open Space*. The type of development found in the Advanced Concepts and Warfare complexes is mostly that typical of suburban office parks, with large administrative and research facilities surrounded by parking lots and landscape features. However, the Weapons Development Complex contains three of the PRTR Complex land ranges: Main Range; the AA Fuze Range, and the Machine Gun Range. Despite the land use designation, existing development within these ranges is more industrial in character, similar to what is found within the adjacent Industrial Complex, where the designated land use is *Industrial*. The Industrial Complex contains mostly one-story maintenance and storage structures used by the Public Works Department, along with shops used for weapons fabrication related to testing. Dahlgren's *Area Development Plan* (Navy, 2001) designated the current EMLF site/site of the proposed 64-MJ railgun facilities along Shock Tube Road as the "2,000 meter land test range" (Navy, 2001).

The two other support complexes – Residential/Recreation and Command Support – are characterized by a greater diversity of land uses, including *Family Housing* (along the southwestern edge of Mainside, south of Dahlgren Road) and *Unaccompanied Housing* (across Dahlgren Road) with *Community Support* uses (e.g., fire station) in between. There are some *Administrative* uses along Dahlgren Road. The southern portion of the Residential/Recreation Complex contains *Recreation* uses. NSF Dahlgren's headquarters facility (Building 101) is located at the south end of Mainside, overlooking the Potomac River.

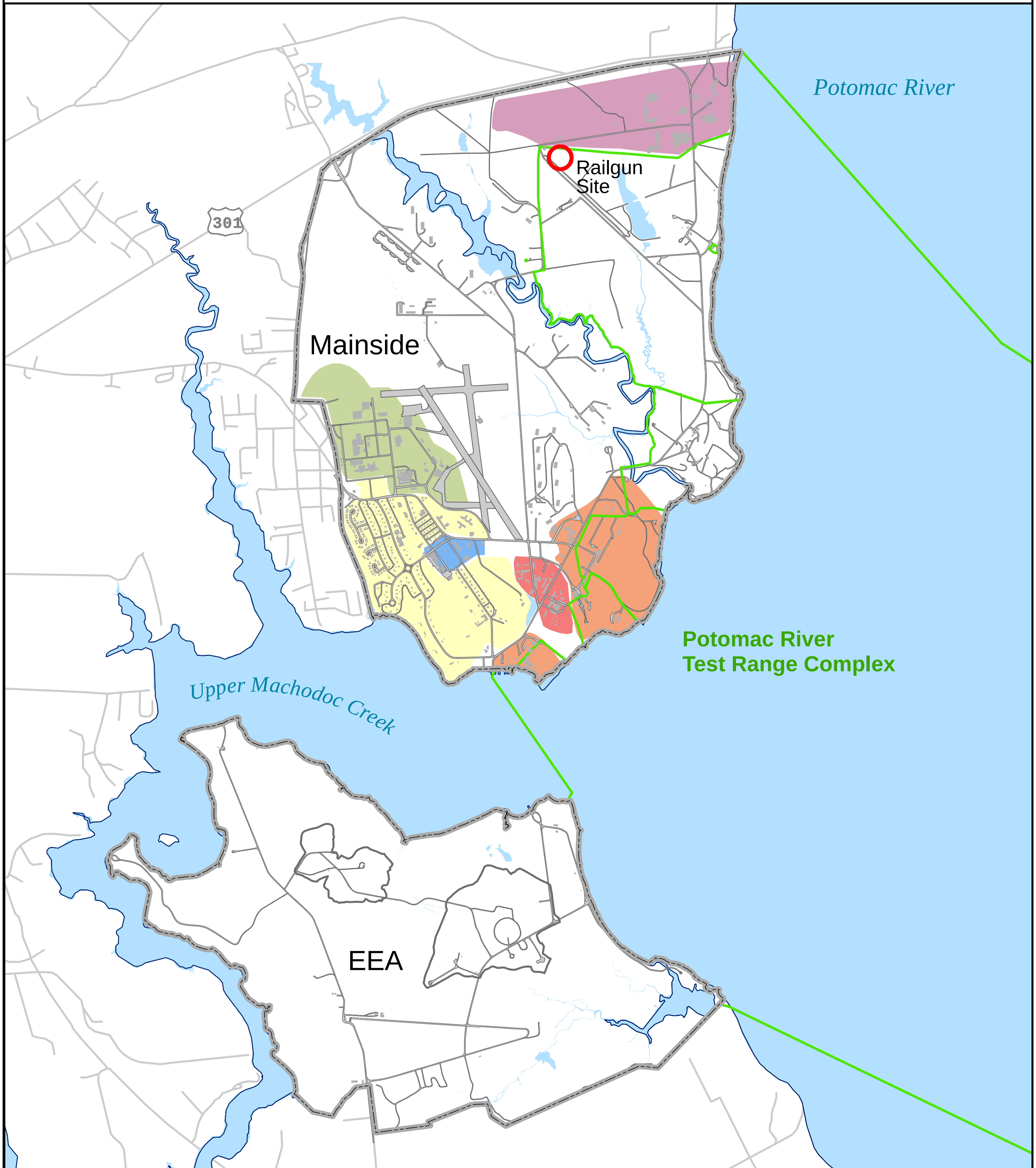
Outside the six functional complexes, the predominant land use designation is *Open Space* (much of it forested) with several significant exceptions, such as the Dahlgren Airfield – the designated *Operations: Airfield* area contains the existing runways and taxiways, hard stand areas, and the designated Clear Zone to the northwest. Although the existing runways are currently inactive, the portion of runway adjacent to Building 150 is used as a helicopter landing pad. Several large munitions-storage areas are found in the central portion of Mainside and are designated as *Operations: Munitions*. There is also an *Operations: RDT&E* area north of the airfield.

3.1.1.2 Project Area Land Use

The 4.4-ac proposed project site currently includes the EMLF, roadways, and upland forest. Shock Tube Road, Frontage Road, and Hideaway Lane pass through the site and will be incorporated into it (see Figure 2-5).

There are several facilities in the vicinity of the proposed site, as shown in Figure 2-5. Approximately 1,300 ft to the northeast is a storage facility (Building 1428). Other buildings stand east of Building 1428, including a Consolidated Hazardous Material Reutilization and Inventory Management Program (CHRIMP) facility (Building 1427) and a hazardous waste storage facility (Building 1425). A shipboard test equipment storage area (Building 1290A) is immediately adjacent to the proposed site. Industrial radiography (Building 1180) is located roughly 1,200 ft to the southwest of the proposed railgun site. As described in Section 1.2.1, ordnance is temporarily stored and handled at this facility, and the facility has an ESQD arc around it that encompasses much of the proposed site.

NSF Dahlgren Functional Areas



Advanced Concepts Complex
Command Support Complex
Industrial Complex
Naval Support Facility Dahlgren
Residential/Recreation Complex
Warfare Systems Complex
Weapons Development Complex

2,000 0 2,000 Feet
500 0 500 Meters
N

Figure 3-1

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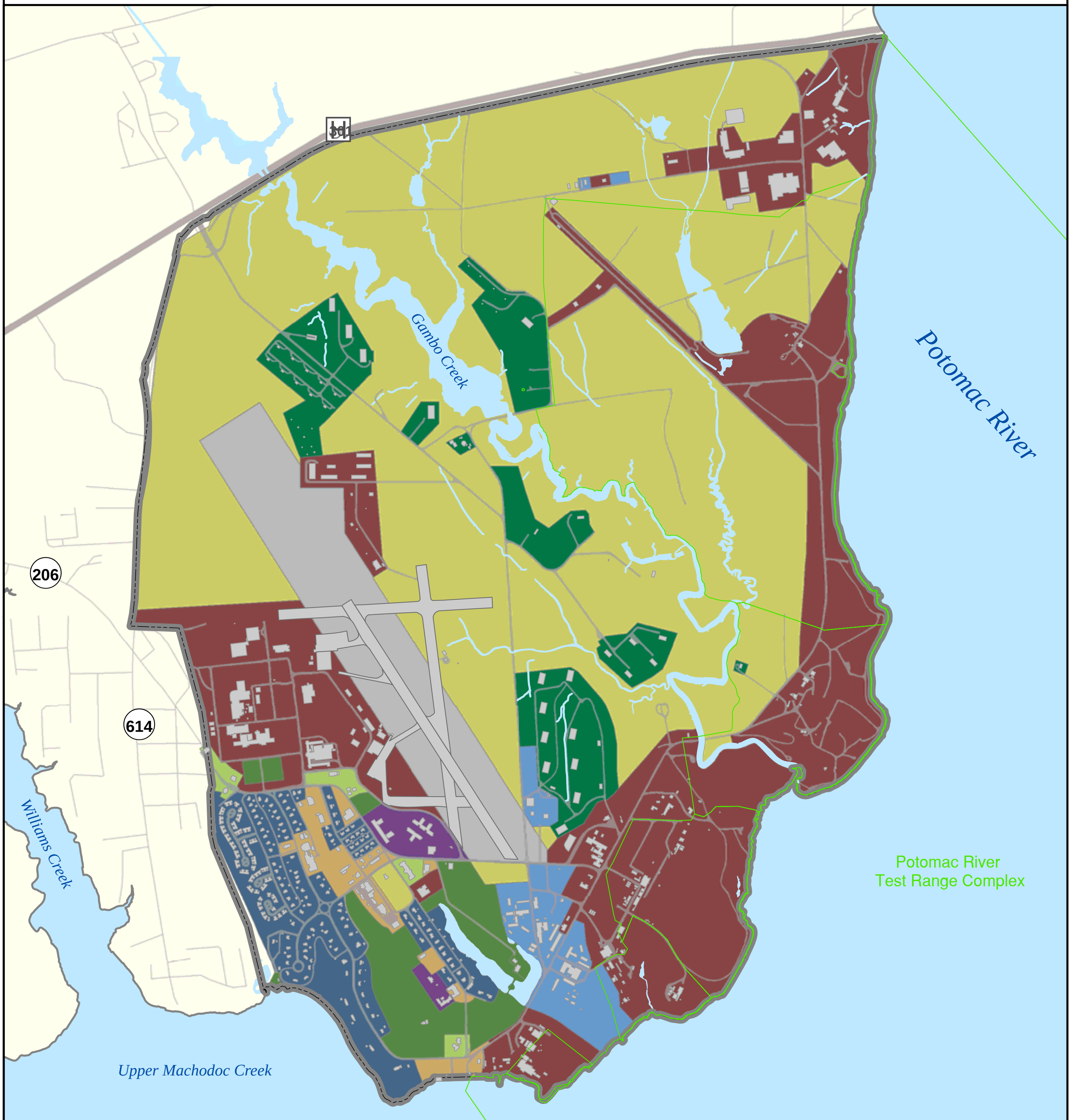
Land Use - Mainside



Administrative
Community Support
Family Housing
Industrial
Open Space
Operations: Airfield
Operations: Munitions
Operations: RDT & E
Recreation
Unaccompanied Housing

2,000 0 2,000 Feet

600 0 600 Meters

N

Source: NSF GIS; Danger Zones defined in CFR 33, Part 33.230.

Figure 3-2

3.1.1.3 Land Use Near NSF Dahlgren

King George County, in which NSF Dahlgren is located, is predominantly rural in character. In 1997, about 61 percent of the land was forested and 30 percent was in agricultural use (King George County, 2006). However, the trend over the last decade has been toward a loss of farm and forest land to development – particularly residential, single-family home development – to accommodate a growing population. Housing units increased from 6,820 in 2000 to an estimated 8,789 in 2006, a 29 percent increase (US Census Bureau, 2000, 2008). Development, especially residential development, is low-density and widely spread out but with clusters of relatively denser residential and commercial uses generally located along the main highways or around employment centers.

A King George County-designated Primary Settlement Area, the area immediately around NSF Dahlgren is the most intensely developed part of King George County, with 14 percent of the county's population and approximately 1,100 housing units. It includes the Dahlgren community, wedged between Williams Creek and NSF Dahlgren, which consists of a commercial core along Route 206 (Dahlgren Road) and Route 614 (Potomac Drive) surrounded by residential uses. Outside of the Dahlgren community, the area contains two large residential subdivisions – Bayberry and Monmouth North. It also has the largest office park in the county (the Dahlgren Technology Center) and the largest concentration of commercial development, including a strip shopping center and several fast food and other restaurants as well as the majority of the county's gas stations (King George County, 2006).

The county's shoreline north of NSF Dahlgren is characterized by widely spread-out residential lots, most with piers into the river. Barnsfield Park, a 154-ac facility, lies just north of the Governor Harry W. Nice Memorial Bridge landing. King George County's primary active recreational resource (King George County, 2006), it features nature trails, picnic areas, a playground, and beach fishing. The adjacent 10-ac Dahlgren Wayside Park at the foot of the bridge houses the Potomac Gateway Welcome Center, which provides tourist information to visitors entering Virginia via the bridge.

3.1.2 Coastal Zone Management

The Coastal Zone Management Act (CZMA) of 1972 (16 USC § 1451, et seq., as amended) encourages states, in cooperation with federal and local agencies, to develop land and water use management programs in coastal zones. Section 307 of the CZMA stipulates that federal projects that affect land uses, water uses, or the resources of a state's coastal zone must be consistent to the maximum extent practicable with the enforceable policies of that state's federally-approved coastal management plan.

The Commonwealth of Virginia has developed and implemented a federally-approved Coastal Resources Management Program (CRMP) describing current coastal legislation and enforceable policies. The enforceable policies are based on current state and federal environmental regulatory programs. As a federal property, Dahlgren is statutorily excluded from the CZMA's definition of the Commonwealth of Virginia's "coastal zone" (16 USC § 1453 (1)). If, however, the proposed actions would affect coastal resources or uses beyond the boundaries of the federal property, CZMA Section 307 applies. Following are Virginia's nine enforceable coastal management policies:

- Fisheries management.
- Subaqueous lands management.
- Air pollution control.
- Wetlands management.
- Dunes management.
- Non-point source pollution control.
- Point source pollution control.
- Shoreline sanitation.
- Coastal lands management.

The Navy submitted a Federal Consistency Determination (FCD) under the Coastal Zone Management Act to the Virginia Department of Environmental Quality (VDEQ) on February 4, 2005 for an early version of the proposed action (included in Appendix C, along with the other three letters described below). The FCD found that the project was consistent to the maximum extent practicable with the policies of the CRMP, despite the need to fill 0.63 ac of non-tidal palustrine wetlands based on the project design at that time. On April 21, 2005, VDEQ concurred with the Navy's assessment provided that the Navy complies with all applicable permitting requirements and any other authorizations that might be required.

The Navy submitted a revised FCD to VDEQ on December 8, 2008, requesting review based on a change in project scope that sited the facility to the southwest of the original site, thus eliminating the need to fill 0.63 ac of wetlands. VDEQ responded on January 5, 2009, concurring that the amended proposal is consistent with the CRMP, but that project activities must be carried out in strict accordance with all other applicable state, federal, and local laws and regulations.

3.2 Socioeconomics

For the purposes of this section, the study area consists of King George County, Virginia, which surrounds NSF Dahlgren and whose population may be affected by the proposed railgun operations. Data for smaller (e.g., census tracts and block groups) or larger (i.e., the state of Virginia) areas will also be provided, as appropriate.

3.2.1 General Demographics

During the period from 1990 and 2006, the total population of King George County went from 13,527 to 21,780, an increase of 8,253 new residents or 61 percent (US Census Bureau, 1990, 2006). While this is a high rate of growth, the county's population remains relatively small.

The racial and age makeup of the population that could be potentially affected by the proposed action needs to be determined in order to establish whether environmental directives regarding minority populations and children apply (see Section 4.2). The ethnic and racial make-up of King George County's population is shown in Table 3-1, where it can be compared to that of Virginia as a whole. White Alone is the largest racial category; the only other major category is Black or African American Alone. Overall, racial and ethnic minorities represent a smaller proportion of the county's population than they do of the state's.

Table 3-1
Race and Ethnicity (2006)
(Percent)

Geography	Percent						
	White Alone	Black or African American Alone	American Indian and Alaska Native Alone	Asian Alone	Native Hawaiian and Other Pacific Islander Alone	Two or More Races	Hispanic*
King George Co.	78.6	17.8	0.4	1.2	0.1	2.0	2.7
Virginia	73.3	19.9	0.3	4.8	0.1	1.6	6.3

*: Hispanic or Latino ethnicity may be of any race and their percentages are already included among other racial categories.

Source: US Census, 2006 Population Estimates.

Table 3-2 shows the age structure of King George County's population as of 2006. The county age structure is similar to that of the state of Virginia as a whole.

Table 3-2
Age Distribution (2006)

Geography	Total 2006 Population	Percent			
		Under 5 years	5-19 years	20-64 years	65 and over
King George Co.	21,780	7.2	20.7	63.3	8.9
Virginia	7,642,884	6.7	19.7	62.0	11.6

Source: US Census, 2006 Population Estimates.

3.2.2 Income and Employment

The 2000 census provides data on income based on 1999 incomes; income and poverty estimates are also available for 2004. These data are shown in Table 3-3. The 22.4-percent increase in King George County median household income between 1999 and 2004 was more than twice the rate for the state as a whole. The percentage of persons living in poverty is lower than for the state as a whole. None of the census tracts in the county had a large portion of the population below the poverty level in 1999.

Table 3-3
Income and Poverty ($)

Geography	Median Household Income			Median Family Income in 1999	Per Capita Income in 1999	Percent below Poverty	
	In 2004	In 1999	Percent Change 1999-2004			In 1999	In 2004
King George Co.	61,066	49,882	22.4	55,160	21,562	5.63	6.6
Virginia	51,103	46,677	9.5	54,169	23,975	9.59	9.5
Sources: US Census 2000 SF3; County Business Patterns, Poverty Estimates 2005.							

3.3 Transportation System

Virginia Routes (VR) 3, 218, and 206 provide access to NSF Dahlgren from I-95, the major highway in the region. VR 206 connects directly to NSF Dahlgren's Main Gate. US Route 301, which forms the northern boundary of Mainside, extends northeastward across the Potomac River to Charles County, MD, and other areas of Maryland, and southwestward to Richmond, VA. Access to NSWCDL is also available through the B Gate from US 301 and VR 614.

NSF Dahlgren has a network of roads on the installation. Four of these roads extend to or pass through the proposed project site: Shock Tube Road, Frontage Road, Gambo Road, and Hideaway Lane (seen on Figures 2-4 and 2-5). A 2003 assessment of needed transportation improvements on the installation determined that although seven locations needed various transportation improvements – intersection upgrades, realignments, straightening, extensions, closures – the intersection of the roads in the project area was not among the areas warranting improvement. The intersection was not identified as a high-traffic area (Navy, April 2003).

3.4 Air Quality

The US Environmental Protection Agency (USEPA), under the requirements of the 1970 Clean Air Act (CAA) as amended in 1977 and 1990, has established National Ambient Air Quality Standards (NAAQS) for six contaminants, referred to as criteria pollutants (40 CFR 50). These are carbon monoxide (CO), nitrogen dioxide (NO_2), ozone (O_3), particulate matter (PM_{10} and $PM_{2.5}$), lead (Pb), and sulfur dioxide (SO_2). The NAAQS include primary and secondary standards and are summarized in Table 3-4. The primary standards were established at levels sufficient to protect public health with an adequate margin of safety. The secondary standards were established to protect the public welfare from the adverse effects associated with pollutants in the ambient air, such as damage to plants and ecosystems.

Areas that meet the NAAQS for a criteria pollutant are designated as being "in attainment." Areas where a criteria pollutant level exceeds the NAAQS are designated as "nonattainment." Based on the severity of the pollution problem, O_3 nonattainment areas are further classified as basic (including areas that formerly were in attainment for the revoked 1-hour O_3 NAAQS), marginal, moderate, serious, severe, or extreme. CO and PM_{10} nonattainment areas are classified as either moderate or serious. A maintenance area is an area that has been redesignated as an attainment area from a former nonattainment status. During the maintenance period, most of the CAA rules for a nonattainment area are still applicable. NSF Dahlgren is located in King George County, an area currently designated as being in attainment for all criteria pollutants.

Table 3-4
Virginia and National Ambient Air Quality Standards for Criteria Pollutants

Pollutant and Averaging Time	NAAQS	
	Primary Standard[1]	Secondary Standard[1]
Carbon Monoxide 8-Hour Maximum 1-Hour Maximum	 9 ppm[3] 35 ppm[3]	 9 ppm 35 ppm
Nitrogen Dioxide Annual Arithmetic Mean	 100[2]	 100
Ozone 8-Hour Average	 0.075 ppm[4]	 0.075 ppm
Particulate Matter[8] PM_{10} 24-Hour Average $PM_{2.5}$ Annual Arithmetic Mean (over 3 years) 24-Hour Average	 150[5] 15[2] 35[6]	 150 15 35
Lead Quarterly Arithmetic Mean	 1.5[7]	 1.5
Sulfur Dioxide Annual Arithmetic Mean 24-Hour Maximum 3-Hour Maximum	 80[2] 365[3] ---	 --- --- 1300[3]

Notes:
1. All concentrations in micrograms per cubic meter of air (μg/m^3) or, except where noted, in parts per million (ppm).
2. Not to be exceeded during any calendar year.
3. Not to be exceeded more than once a year.
4. Standard attained when 3-year average of annual 4th-highest daily maximum 8-hour concentration is below the level.
5. Standard attained when exceedance occurred no more than once per year over 3 years.
6. Standard attained when the annual highest 98th percentile of 24-hour concentration over 3 years is below the level.
7. The quarterly lead standard is not to be exceeded during any calendar quarter.
8. PM_{10} - particulate matter diameter of 10 microns or less; $PM_{2.5}$ - particulate matter diameter of 2.5 microns or less.

Sources: 40 CFR 50 and 9 VAC 5 Chapter 30 (8/1/07).

The USEPA has published final rules on General Conformity (40 CFR Parts 51 and 93) that require federal agencies to ensure that their actions conform to the State Implementation Plan (SIP) in effect in a nonattainment area. An SIP is a document that sets forth the state's strategies for achieving air quality standards. Conformity to a SIP, as defined in the CAA, means conformity to a SIP's purpose of reducing the severity and number of violations of the NAAQS to achieve attainment status. The federal agency responsible for an action is required to determine if its proposed action conforms to the applicable SIP. Because Dahlgren is located in an area in attainment for all NAAQS, the conformity rule does not apply to the proposed action.

Pollutant emissions at Dahlgren result from the operation of various stationary sources, such as diesel generators, boilers, fuel tanks, etc. Based on the type of pollutant emitted – criteria pollutant or hazardous air pollutant (HAP) – the CAA sets forth permit rules and emission standards for sources of certain sizes. The New Source Performance Standards (NSPS) apply to sources emitting criteria pollutants; the National Emission Standards for Hazardous Air Pollutants (NESHAPs) apply to sources emitting HAPs. The USEPA oversees programs for stationary-source operating permits (Title V) for the construction and operation of new or modified major stationary source.

Because Dahlgren's annual emissions levels do not exceed the Title V major source threshold (i.e., 100 tons per year of any criteria pollutants), the installation is operating under a state operating permit (#FSO-043-05) rather than a major source Title V permit. As part of the state operating permit requirements, Dahlgren prepares annually updated Emissions Statements. The most recent on-post annual emissions from stationary sources as reported in the 2006 Emissions Statement are summarized in Table 3-5. As can be seen in Table 3-5, NO_x is the primary pollutant generated at Dahlgren, though emission of NO_x are well below major source Title V permit threshold. Volatile organic compounds (VOCs), which together with NO_x, is a precursor of ozone, are emitted in quantities that are also well below the major source Title V permit threshold.

Table 3-5
NSF Dahlgren 2007 Annual Emissions Statement

Installation Total Emissions (tons/year)					
SO_2	**CO**	**PM_{10}**	**$PM_{2.5}$**	**NO_x**	**VOC**
29.87	8.15	1.95	1.95	36.57	1.3
Source: US Navy Naval Support Facility Dahlgren 2007 Emissions Statement. April 5, 2008.					

3.5 Noise

3.5.1 Fundamentals and Criteria

Noise is unwanted sound that interferes with normal activities or otherwise diminishes the quality of the environment. Noise is one of the most common environmental issues associated with military operations such as gun firing, explosions, and aircraft operations.

Sound results from the variation of air pressure about a mean atmospheric pressure (14.7 pounds per square inch [psi]) expressed in Pascal (100,000 Pascal equals 14.7 psi). The variation can range from approximately 0.0006 Pascal for a whisper at 4.9 ft to 1,000 Pascal for firing of a M16 rifle near the firer’s ear. The loudest sounds the human ear can hear comfortably have one trillion (1,000,000,000,000) times the acoustic energy of sounds the ear can barely detect. Because of this vast range, a logarithmic unit called the decibel (dB) is used to represent the intensity of sound, or sound pressure level (SPL). A given SPL in decibels is defined as 20 times the common logarithm of the ratio of sound pressure in Pascal to the reference pressure (0.00002 Pascal). Therefore, 180 dB is equivalent to 2.9 psi, 160 dB is equivalent to 0.29 psi, 140 dB is equivalent to 0.029 psi, etc. As a reference, the firing of a M16 rifle would result in approximately 154 dB peak sound level near the firer’s ear.

3.5.1.1 Noise Frequency

A number of factors affect people’s perception of sound. These factors include the actual level of noise, the frequencies involved, the period of exposure to the sound, and changes or fluctuations in the sound level during exposure. In order to measure sound in a manner that accurately reflects human perception, several measuring systems or scales have been developed, including:

- **A-weighted scale –** This scale reflects the fact that the human ear does not perceive all pitches or frequencies equally: therefore, decibel measurements are adjusted (or weighted) to compensate for the human lack of sensitivity to low-pitched and high-pitched sounds. The adjusted unit is known as the A-weighted decibel, or dBA. The dBA is used to evaluate noise sources related to transportation (e.g., traffic and aircraft) and to small arms.

- **C-weighted scale -** The C-weighted scale measures more of the low-frequency components of noise than does the A-weighted scale. It is used for evaluating impulsive noise and vibrations generated by large weapons such as artillery, mortars, guns (20 millimeters [mm] or greater) and explosive charges. C-weighted noise levels are measured in C-weighted decibels or dBC.

- **Peak sound level -** The peak sound level scale is a flat-weighted scale that can be used to measure the noise generated by the firing of small arms (0.50 caliber and smaller), heavy artillery, and explosives. Peak sound level is measured in dBP (Pater, 1996).

Noise levels measured in one scale cannot be added or compared mathematically to levels measured in another scale.

Noise Metrics

Another factor that needs to be taken into account when noise is characterized and analyzed is whether the noise is continuous or impulsive. Continuous noise includes the noise generated by highways, construction sites, and heavy urban traffic. Impulsive noise includes such things as explosions or gun firing. Ambient noise conditions at Dahlgren are characterized primarily by impulsive noise generated by the testing of explosives and live firing.

Continuous noise is fundamentally different from impulsive noise and impact thresholds for the two types of noise differ substantially. According to the Navy (OPNAVINST 5100.23G), regions and activities shall consider personnel at risk if routinely exposed to sound levels greater than 84 dB(A), or for impact or impulse noise, 140 dB peak noise. Hearing protection should be implemented if the working noise environment exceeds those two thresholds.

To take into account the difference between continuous and impulsive noise, the variations in frequency and periods of noise exposure, and the fact that the human ear cannot perceive all pitches and frequencies equally well, noise from military operations is best measured using two different noise metrics: the day-night noise level (DNL) and the dBP. The DNL metric is normally used for evaluating cumulative effects from both continuous and impulsive noise sources, such as aircraft noise and cumulative weapons firing. The dBP metric is used to assess event peak noise from impulsive noise sources such as the firing of explosives.

Noise Guidance

The DoD has developed guidelines to define, identify, and assess noise impacts. To measure these impacts, the DoD uses the DNL metric, which is recommended by the USEPA and used by most federal agencies.

Additionally, the Department of the Army has developed weapons-noise guidelines to measure peak impulsive noise from weapon firing, though these guidelines have not been officially adopted by the DoD. Both the DNL metric and the Army-developed guidance on peak impulsive noise are used in this document to discuss the potential noise impacts from the proposed action.

DoD DNL Guidelines

Measurements in DNL specifically account for the difference in response to noise depending on the time of day, either during sleeping hours or waking hours. The DNL metric measures the average sound level in decibels during a 24-hour period, with a 10 dB weighting applied to nighttime sounds. The 10 dB weighting accounts for the fact that noises at night sound louder than they do during the day. As noted above, the DNL descriptor is recommended by various federal agencies – DoD, US Department of Transportation (DOT), Housing and Urban Development, and USEPA – to measure the degree of nuisance or annoyance that noise causes in residential neighborhoods. Annoyance generally increases with the number of noise events and with the number of such events occurring at night.

In June 1980, the Federal Interagency Committee on Urban Noise (FICUN) published guidelines relating DNL to compatible land uses. This committee was composed of representatives from the aforementioned agencies and the Veterans Administration. Although these guidelines are not mandatory, they provide a good method to determine noise impact based on DNL. According to the guidelines, in general, residential land uses are not compatible with outdoor DNLs above 65 dBA. Consistent with these guidelines, noise impact analysis focuses on the land area and population that would be exposed to DNLs of 65 dBA or higher.

DNL measurements can be A- or C-weighted, to better reflect noise frequency and what people actually hear or feel. C-weighted DNL and A-weighted DNL can be compared in term of annoyance response: for example, a DNL of 62 dBC can be expected to provoke the same response as an A-weighted DNL of 65 dBA; similarly, a DNL of 70 dBC can be expected to provoke the same response as an A-weighted DNL of 75 dBA. The C-weighted DNL metric is most commonly used for evaluating noise from large guns (larger than a 20-mm gun).

Army DNL and Peak Impulsive Noise (dBP) Guidelines

The US Army Center for Health Promotion and Preventive Medicine (USACHPPM) has developed guidelines to evaluate blast impulsive noise levels generated by military tests and training (USACHPPM, June 2005) (Table 3-6). The peak-noise thresholds were developed differently for small arms and large weapons based on the dBP metric. The Army has used these guidelines for many years, although they have not been officially adopted by DoD. USACHPPM conducted a study to correlate annoyance with measured dBP (US Army National Guard Bureau, 1996) and concluded that:

- dBP criteria are useful for noise-complaint management and investigations.
- The dBP metric provides a good estimate of the perceived vibration of typical residential structures resulting from blasts.

Table 3-6
Army Noise Limits

Noise Zone	Aviation ADNL	Impulsive CDNL	Small Arms PK15 (dBP)
LUPZ	60 – 65	57 - 62	N/A
I	< 65	< 62	< 87
II	65 – 75	62 – 70	87 – 104
III	>75	>70	> 104

Notes: LUPZ – Land Use Planning Zone (used to predict noise impacts when levels of operations at airfields or large-caliber weapons ranges are above average).
ADNL – A-weighted Day-Night Level.
CDNL – C-weighted Day-Night Level.
N/A – Not Applicable.
Source: USACHPPM, June 2005.

While small-arms peak noise was correlated to noise zones, the guidelines for large-weapon firing related noise levels to the risk of complaints (Table 3-7). According to the large-weapon noise guidelines, peak noise levels below 115 dBP at a receptor can be expected to generate a low risk of complaints. Levels between 115 and 130 dBP generate a moderate risk of complaints. Levels between 130 and 140 dBP generate a high risk of complaints and a possibility of structural damage to buildings. Above 140 dBP, there is a high risk of physiological damage to the ear and a high risk of physiological and structural damage claims.

Table 3-7
Army Guidance
Risk of Noise Complaints and Peak Noise Events for Large Weapons

Risk of Noise Complaints	Large Caliber Weapons Noise Limits (PK15)
Low	< 115
Moderate	115 – 130
High	>130
Risk of physiological damage to unprotected human ears and structural damage claims.	>140
Source: USACHPPM, June 2005.	

3.5.2 Existing Noise Conditions

Ordnance testing, which is a source of impulsive noise, is the only major source of noise at Dahlgren. The airfield is not a major noise source since it is closed to fixed-wing aircraft until such time as it is upgraded to meet current standards. The airfield is only sporadically used to land helicopters.

Dahlgren utilizes ordnance and ordnance components for proof-and-acceptance testing of ammunition and for RDT&E. Unlike the training exercises at most military installations, Dahlgren's testing does not have fixed firing schedules, weapon types, or number of rounds used during each test. The uncertainties inherent in weapons RDT&E activities make it impossible to calculate representative DNL levels around the base. The dBP metric and large-weapon-associated complaint risk thresholds provide a more appropriate method to evaluate potential noise effects.

Noise-Management Procedures for Large-Gun Firing

Dahlgren has established Noise Management Procedures (NMP) to address noise and related impacts associated with its mission activities. This effort focuses on the management of impacts by proactively identifying, measuring, tracking, planning, predicting, and minimizing impacts, and includes the following main actions:

- **Scheduling** – Test operations are conducted year-round except holidays from Monday through Friday, primarily between the hours of 8 am and 5 pm. Weekend and evening testing takes place very infrequently.

- **SIPS –** A Sound Intensity Prediction System (SIPS) is used to assess the likelihood that planned gun-firing events could result in excessive noise anywhere within the area surrounding the PRTR. The SIPS, developed by NSWCDL, is a unique tool for predicting noise propagation from large guns that has been deployed at other DoD large-weapon use sites (e.g., Air Force Test and Training Range at Ogden, Utah and Naval EOD Technical Division at Indian Head, Maryland). When SIPS indicates that atmospheric conditions may result in excessive noise over a populated area, large-weapon operations are postponed until conditions improve.

- **Meteorological Data** – A weather balloon is launched prior to and during certain gun-firing testing. The meteorological data from the balloon is then imported into SIPS, to help generate a prediction of the peak noise levels expected over the surrounding communities. Based on the predicted peak noise levels, Dahlgren's range operations personnel decide whether to proceed with testing or postpone it until conditions improve sufficiently to result in acceptable noise impacts.

- **Public Relations –** The Public Affairs Office (PAO) closely monitors any complaints involving noise or reported property damage. An investigation is made into the claim, if necessary.

- **Ambient Peak Noise Measurements –** Nine noise-measurement sites (Figure 3-3, Large Gun Firing Peak Noise Measurement Locations) are located around Dahlgren and along the PRTR Middle Danger Zone to monitor peak noise levels during gun firing and explosive test events. The noise measurements provide feedback for the SIPS model predictions.

When no testing is going on, ambient background noise levels at Dahlgren can be characterized as those encountered in suburban environments.

In 2007, noise monitors measured peak noise levels at one-second intervals for gun-firing events at Dahlgren, including both inert and live firings. The resulting peak-noise measurements for the largest guns are summarized in Table 3-8. The highest peak-noise measurements for all of 2007 at off-base sound meter locations ranged from 122 dBP to 134 dBP. Based on a further review of these samples, it was found that:

- One (1) sample from a total of 1,093 (0.09 percent) exceeded 130 dBP on the meter located at Range Station 7.

- Five (5) samples from a total of 1,706 (0.29 percent) exceeded 130 dBP on the meter located at Range Station 9.

Given such a low frequency of exceedances of 130 dBP – the threshold for high risk of noise complaints – the 2007 peak-noise measurements indicated that those off-base sound meter locations are within the area with moderate risk of noise complaints as defined in Table 3-7.

Table 3-8
Range of Measured 2007 Large-Gun Firing Event Peak Noise Levels (in dBP)

Measurement Location	Number of One-second Samples	Range of Recorded Peak Noise Levels (dBP)			
		5”/62 Gun	5”/54 Gun	76-mm Gun	Maximum
#1 – Building 997	706	107 – 147	106 – 148	103 – 127	148
#2 –Range Station 3B	1,139	105 – 139	100 – 134	73 – 134	139
#3 – Range Station 8	731	102 – 139	97 – 121	76 – 140	140
#4 – Swan Point Buoy	600	105 – 124	98 – 126	64 – 118	126
#5 – Range Station 7	1,093	101 – 129	100 – 132	81 – 121	132
#6 – Range Station 9	1,706	110 – 131	100 – 134	107 – 125	134
#7 – Range Station 12	1,113	90 – 125	92 – 129	109 – 122	129
#8 – Range Station 13	853	96 – 119	95 – 123	84 – 115	123
#9 – Range Station 21	1,121	101 – 119	79 – 118	65 – 122	122

Past Railgun Tests and Noise Measurements

NSWCDL has collected three sets of noise measurements from operation of the existing 32-MJ railgun system located in the EMLF in the following periods: from October 2006 to January 2007; from April 2007 to October 2008; and from December 2008 to January 2009. For all noise measurements, the system was operating at power levels considerably below 32-MJ because the PFN did not support higher power levels. Power levels increased from 0.8 MJ in the early tests to 16 MJ in the latest group of tests.

October 2006 to January 2007 Noise Measurements

Between October 2006 and January 2007, a total of 18 railgun tests were conducted at Dahlgren using various muzzle energy levels. Nine on-installation receptor locations were selected for peak impulsive noise measurements (Figure 3-4, Railgun Firing Peak Noise Measurement Locations). These receptors were located at various distances and firing azimuths from the 32-MJ railgun housed in the EMLF to characterize the sound-propagation conditions. The 18 shots were made with various combinations of the following:

- Projectile weights of 5.3 lbs, 6.4 lbs, and 7.1 lbs.
- Muzzle energy levels, ranging from 0.8 MJ to 7.6 MJ.

Peak impulsive noise levels at each receiving location, which ranged from 0 to 7,000 ft from the railgun, were measured and are summarized in Table 3-9.

Large Gun Firing Peak Noise Measurement Locations

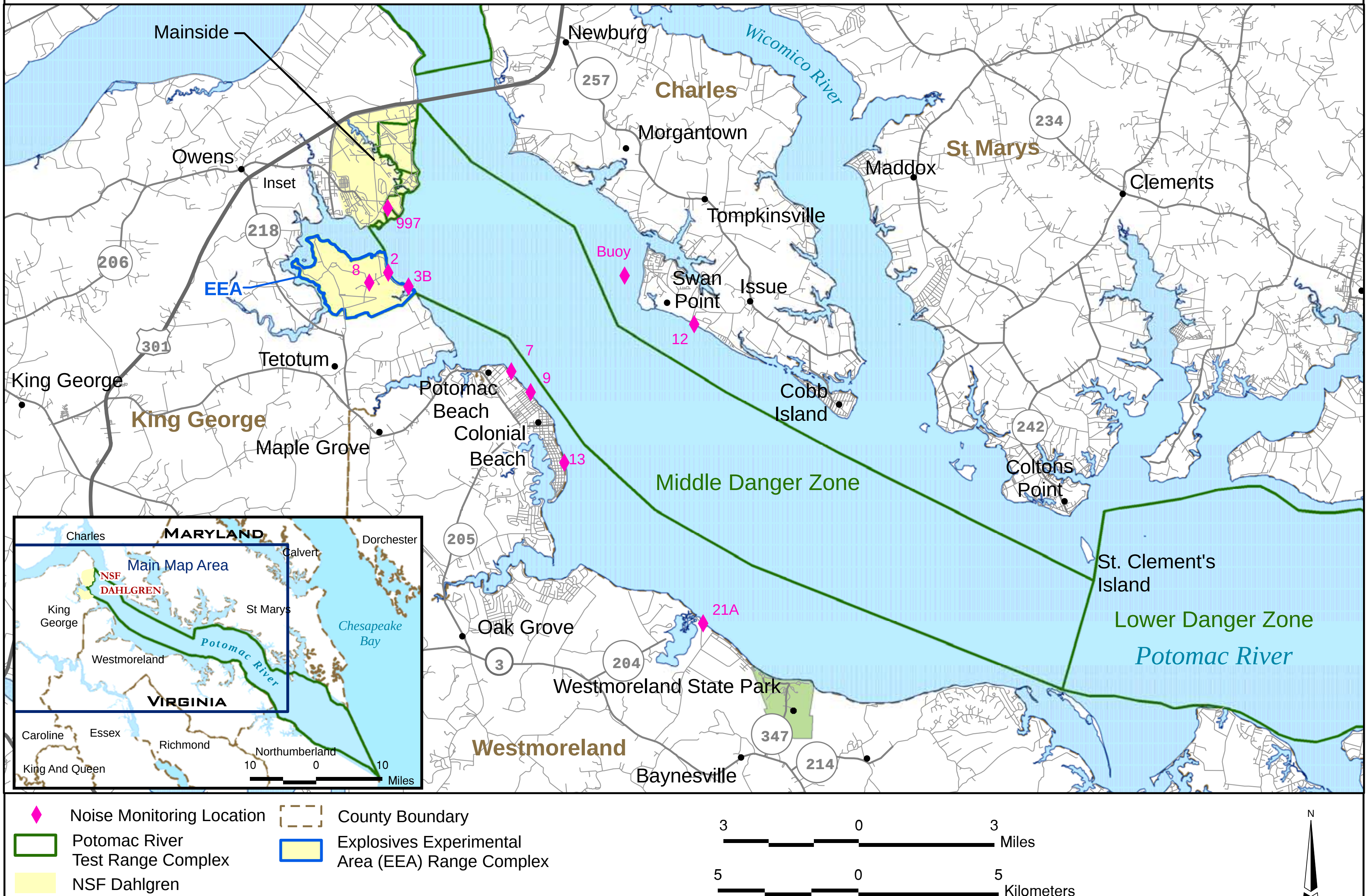


Figure 3-3

Source: BNOISE2 Model & NSWCDL SIPS Model

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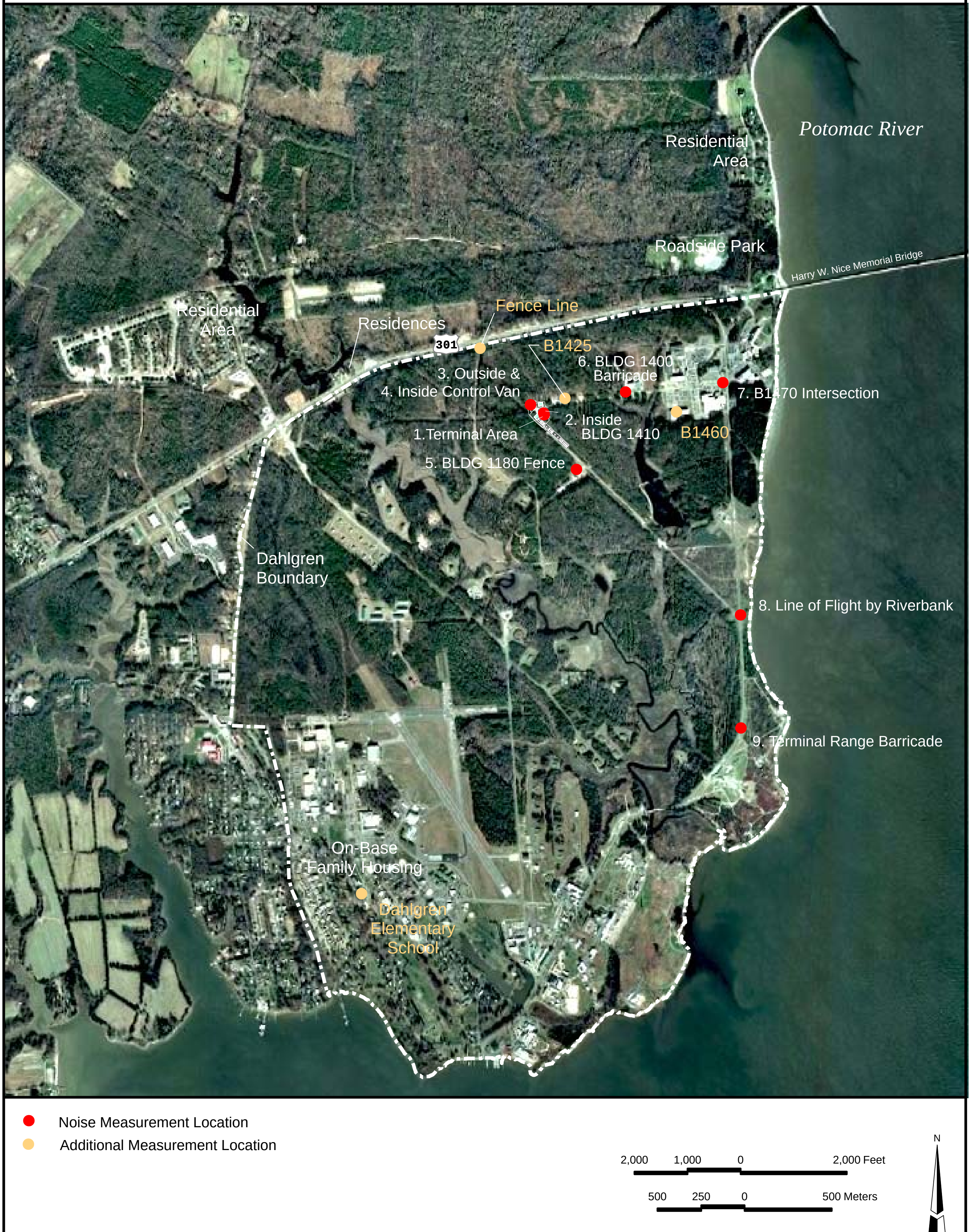
Railgun Firing Peak Noise Measurement Locations



Source: Dahlgren

Figure 3-4

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Table 3-9
Measured Peak Noise Range from Railgun Shots
(October 2006 – January 2007)

Receptor Location	Distance from EMLF (ft)	5.3 lb Projectile (6 Shots) Muzzle Energy – 0.8 – 5.4 MJ (dBP)	6.4 lb Projectile (2 Shots) Muzzle Energy - 6.2 – 6.3 MJ (dBP)	7.1 lb Projectile (10 Shots) Muzzle Energy - 3.7 – 7.6 MJ (dBP)
#1 Terminal Area	0	154 - 171	n/a	168 – 169
#2 Inside Bldg. 1410	33	152 – 154	n/a	164 – 169
#3 Outside Control Van	302	117 – 131	128 – 129	120 – 133
#4 Inside Control Van	302	100 – 113	114 – 115	104 – 117
#5 Bldg. 1180 Fence	1,217	121 – 129	131 – 131	130 – 139
#6 Bldg. 1400 Barricade	1,591	117 – 126	126 – 126	119 – 130
#7 Bldg. 1470 Intersection	3,425	106 – 118	118 – 125	112 – 123
#8 Line of Flight by Riverbank	5,302	102 – 115	106 – 111	93 – 123
#9 Terminal Range Barricade	6,998	99 – 109	112 – 115	103 – 120
Note: 1 mi = 5,280 ft.				

Existing noise monitoring stations were used to represent sensitive receptors:

- **Locations Used to Represent Off-Installation Sensitive Receptors**. Sound levels measured at on-base Receptors 3, 6, 7, 8, and 9 (Figure 3-4) were used to estimate off-base levels, including at potential receptors located on the Potomac River. Sound levels below 115 dBP are associated with a low risk of generating complaints and levels between 115 dBP to 130 dBP have a moderate risk of generating complaints. For example, a maximum peak noise of 133 dBP was measured at Receptor 3, which is approximately 300 ft due north of the launch site (Table 3-9). Given that the distance of the closest off-installation sensitive receptor is approximately 3,700 ft from the EMLF feet, beyond the northern boundary of the installation, it is expected that the maximum peak noise at off-installation receptors would be below 130 dBP.

- **Locations Used to Represent On-Installation Housing**. Receptors 8 and 9 were used to represent on-installation housing. Sound levels below 115-dBP are associated with a low risk of generating noise complaints and levels between 115 dBP to 130 dBP have a moderate risk of generating complaints. A maximum of 120 dBP was measured at Receptor 9, which is 7,000 ft from the EMLF. The closest on-base housing area is located approximately 9,000 ft southwest of the EMLF, approximately 2,000 ft farther away from the EMLF than Receptor 9.

These measurements indicate that:

- Peak noise resulting from each test varies slightly, depending on the muzzle energy level and the projectile velocity.

- For a given distance from the EMLF, sound propagation is generally not sensitive to the launch direction, except for those receiving locations behind the EMLF and to the rear of the railgun's firing direction. The bulk of the high-bay EMLF building creates a shielding effect that attenuates launch noise. It is anticipated that the buildings behind the launch site as well as the surrounding forested area (Figure 3-4) would effectively attenuate peak noise from railgun shots at off-installation locations beyond the northern boundary of the installation. This is supported by the relatively low peak-noise levels measured at Receptor 3 as compared to other receptor locations (Table 3-9).

- The peak noise conditions measured at Receptors 8 and 9 give some indication of the likely conditions at the on-installation housing areas. It is anticipated that the peak noise levels at the housing area would be below the measurements at Receptors 8 and 9 because the distance from the EMLF to the housing area is greater and the housing area is peripheral to the railgun's direction of fire.

- The peak noise levels generated from the railgun shots are lower than the existing large-caliber gun firing event noise measured along the Potomac River (Table 3-8). Given the greater peak noise generated from large-gun firing on the PRTR, as well as the existing explosive detonations at the EEA Range, the peak noise levels at on-installation housing and other areas are expected to be dominated by the existing large-gun firing and EEA Range detonation activities.

April 2007 to October 2008 Noise Measurements

Between April 2007 and October 2008, Dahlgren collected peak-noise measurements resulting from railgun test firing at muzzle energy levels ranging from 8 MJ to 16 MJ, or up to twice the muzzle energy of the earlier measurements. Three alternate measurement sites (Building 1425, Building 1460 – exterior, and Building 1460 – interior) were used during this round of sampling (Figure 3-4). The recorded peak noise levels are summarized in Table 3-10. These additional data show patterns consistent with those observed during the first 18 shots. Sensitive receptors were represented by the following measurement locations:

- Receptor 8 represented off-base locations, including potential receptors located on the Potomac River. Measured levels were below 115 dBP, indicating a low risk of generating complaints, or between 115 dBP and 130 dBP, indicating a moderate risk of generating complaints.

- The on-installation housing area was also represented by Receptor 8. Measured levels were below the 115-dBP level, indicating a low risk of generating noise complaints, or between 115 dBP and 130 dBP, with a moderate risk of generating complaints under high muzzle energy levels. Noise levels would likely be lower at installation housing because it is separated from the EMLF by a greater distance than Receptor 8.

Table 3-10
Measured Peak Noise Range from Railgun Shots
(April 2007 – October 2008)

Receptor Location	Number of Measure-ments	Peak Noise (dBP) Under Lowest Muzzle Energy (0.84 MJ)	Peak Noise (dBP) Under Highest Muzzle Energy (13.49 MJ)	Lowest Range		Highest Range	
				Peak Noise (dBP)	Muzzle Energy (MJ)	Peak Noise (dBP)	Muzzle Energy (MJ)
#5 Bldg. 1180 Fence	205	121	--	110	2.35	144	6.73
#6 Bldg. 1400 Barricade	172	117	134	114	3.30	139	11.95
#8 LOF by Riverbank	179	102	115	91	6.54	123	7.38
Additional Sites							
Bldg. 1425	170	--	142	111	3.39	147	3.99
Bldg. 1460 Exterior	100	--	--	113	4.01	134	3.99
Bldg. 1460 Interior	73	--	--	85	9.67	123	6.31
Note: -- indicates that no readings were taken, as readings were limited to a total of three sites during each test.							

It should be noted that these additional measurements were collected over 18 months and encompassed a wide range of weather conditions and diverse seasonal conditions, which can influence noise levels. For example, atmospheric-focusing conditions can enhance noise propagation and increase noise levels by as much as 15 dBP. Typical focusing conditions include: 1) clear days during which smoke or fog layers are observed; 2) cold, hazy, or foggy mornings; 3) days following a day when large extremes of temperatures (68^{o}F or more) between day and night occur; and 4) days with steady winds of 5-10 miles per hour (mph) with gusts greater than 20 mph in the direction of receptors (USACHPPM, 2005).

December 2008 to January 2009 Noise Measurements

In December 2008 and January 2009, Dahlgren measured additional peak noise levels (Table 3-11) as the muzzle power levels of the existing 32-MJ railgun increased to a level around 16 MJ. Despite the increase in muzzle energy, measured noise levels were similar to those observed for earlier, lower-energy tests (Tables 3-9 and 3-10), suggesting that measurements vary only slightly depending on the muzzle energy level.

Table 3-11
Measured Peak Noise Range from Railgun Shots
(December 2008 – January 2009)

Receptor Location	Number of Measurements	Peak Noise Range Muzzle Energy ~ 16 MJ (dBP)
#5 Bldg. 1180 Fence	19	137 – 151
#6 Bldg. 1400 Barricade	17	130 – 138
#8 LOF by Riverbank	18	110 – 121
Additional Sites		
Bldg. 1425 Office Area (Interior)	15	122 – 131
Bldg. 1425 Warehouse Area (Interior)	9	129 – 137
Bldg. 1460 Exterior	21	123 – 138
Fence Line @ US Route 301	24	109 – 120
Dahlgren Elementary School	17	91 - 113

Two new receptors were added for this round of sampling: the installation's northern fence line along US 301 as an additional off-installation receptor; and the Dahlgren Elementary School – in the installation housing area – as an additional on-installation receptor (Figure 3-4). Based on the measurements recorded at the two new sites, it can be concluded that:

- With measurements ranging from 109 to 120 dBP at the installation fence line just south of US 301, sensitive receptors north of the installation boundary would likely experience peak noise levels below 115 dBP. Peak noise levels below 115 dBP typically have a low risk of generating noise complaints.

- All noise measurements at Dahlgren Elementary School had peak noise levels below 115 dBP, which indicates a low risk of generating noise complaints.

These measurements again indicate that there is no clear relationship between peak noise level and muzzle energy level, although they suggest that there is a tendency for higher muzzle energy to generate slightly higher peaks. A sample plot of noise measurements depicting the distribution of peak noise measured at Receptor 8 (Figure 3-5, Measured Peak Sound for Various Muzzle Energies) illustrates the lack of correlation between peak sound and muzzle energy.

3.6 Infrastructure

3.6.1 Electricity

Electrical power at Dahlgren is provided by Dominion Virginia Power (DVP) via two 34.5-kilovolt (kV) feeders; the main substation is located near the Main Gate; from there, power is distributed through ten substations and switching stations. Four of the substations are 13.8 kV secondary, four substations are 4.16 kV secondary, plus there are two 35 kV switching stations.

NSF Dahlgren's average annual electrical consumption for fiscal years 2005-2007 was approximately 110,500 megawatt-hours (MWH), with NSWCDL accounting for about 57,700 MWH (52 percent) of the usage (Prunty, 2008).

3.6.2 Potable Water

Potable water is supplied to the site via a base-wide distribution system. Water for this system is derived from three deep wells located within NSF Dahlgren. The potable water system is protected by means of backflow-prevention devices located on incoming potable water lines.

3.6.3 Sanitary Sewage

Wastewater is collected and transported to a Navy-owned municipal sewage treatment plant located at the southern end of Mainside via gravity sewers, force mains, lift stations, and pumping stations. There are approximately 22 mi of gravity sewers and 34 pumping stations. The treatment plant discharges into Upper Machodoc Creek in accordance with a Virginia Pollutant Discharge Elimination System (VPDES) permit issued by VDEQ. Under the permit, the wastewater effluent from the outfall at Upper Machodoc Creek is monitored periodically and the results are reported to VDEQ.

The treatment plant's permitted flow/average design flow is 0.72 million gallons per day (gpd). It can handle up to 1.4 million gpd on a short-term basis. However, the highest average daily flow in the period from 2004 to 2006 was only 0.315 million gpd. Dewatered sludge is disposed of at the King George County landfill (Navy, February 2006 and August 2007).

3.7 Cultural Resources

A number of federal laws, executive orders, and regulations require that cultural resources meeting the criteria for eligibility to the National Register of Historic Places (NRHP) be identified, evaluated, and considered when planning federal actions, including:

- Sections 106 and 110 of the National Historic Preservation Act (NHPA) of 1966, as amended.
- Executive Order 11593, Protection and Enhancement of the Cultural Environment.
- OPNAVINST 5090.1C, Environmental Readiness Program Manual.

Federal agencies must comply with the NHPA. The intent of Sections 106 and 110 of the NHPA is to integrate consideration of historic preservation issues into the early stages of project planning by a federal agency.

Based on a 1993 architectural survey of the structures on the installation (Navy, 1993), four historic districts at Dahlgren may be eligible for listing in the NRHP: Airfield, Main Battery, Residential Area, and Wharf Area. All four are located in the southern portion of Mainside at least one mile south of the proposed railgun project area. While archaeological sites have been identified within NSF Dahlgren, none are located in the vicinity of the proposed railgun facilities.

Lying within the project area, however, is the concrete foundation of a Cold War relic, the conical shock tube, which was constructed in 1967 to collect data on nuclear weapon air blast phenomena. At the time it was constructed, the 2,400-ft test facility was the world’s largest nuclear blast simulator, and allowed testing in an enclosed environment without resorting to full-scale nuclear tests. It duplicated pressures and durations of nuclear air blasts up to 20 kilotons and was able to support testing that simulated altitudes up to 100,000 ft. Telescopic in shape and weighing 1,775 tons, the metal components of the conical shock tube had four 16-in gun barrels coupled in tandem by means of metallic sleeves that comprised the firing chamber at the smallest end. The sleeves helped to prevent the escape of explosive gases. The detonation chamber was 180 ft long. The muzzle end of the telescopic structure measured approximately 24 ft across. A three-stepped, concrete structure was poured behind the conical shock tube to absorb the recoil thrust of the explosive testing, estimated to reach 2.5 million pounds at peak thrust. This structure was 25 ft wide and 130 ft long, used about 4 million lbs of concrete in its construction, and is still in existence in the project area. The conical shock tube that was built above the concrete foundation was dismantled in 1993 under a large, base-wide scrapping effort, as it was deemed obsolete for its original purpose (Navy, December 2008). More details about the conical shock tube, including photographs, are included in Appendix D. The remains of the concrete foundation are shown in Figure 2-5 as “Existing Building/Concrete Pad” located between Hideaway Lane and Shock Tube Road, within the path of the proposed Projectile Range/Trajectory Control Structures and continuing down Shock Tube Road beyond the project area.

Measured Peak Sound for Various Muzzle Energies

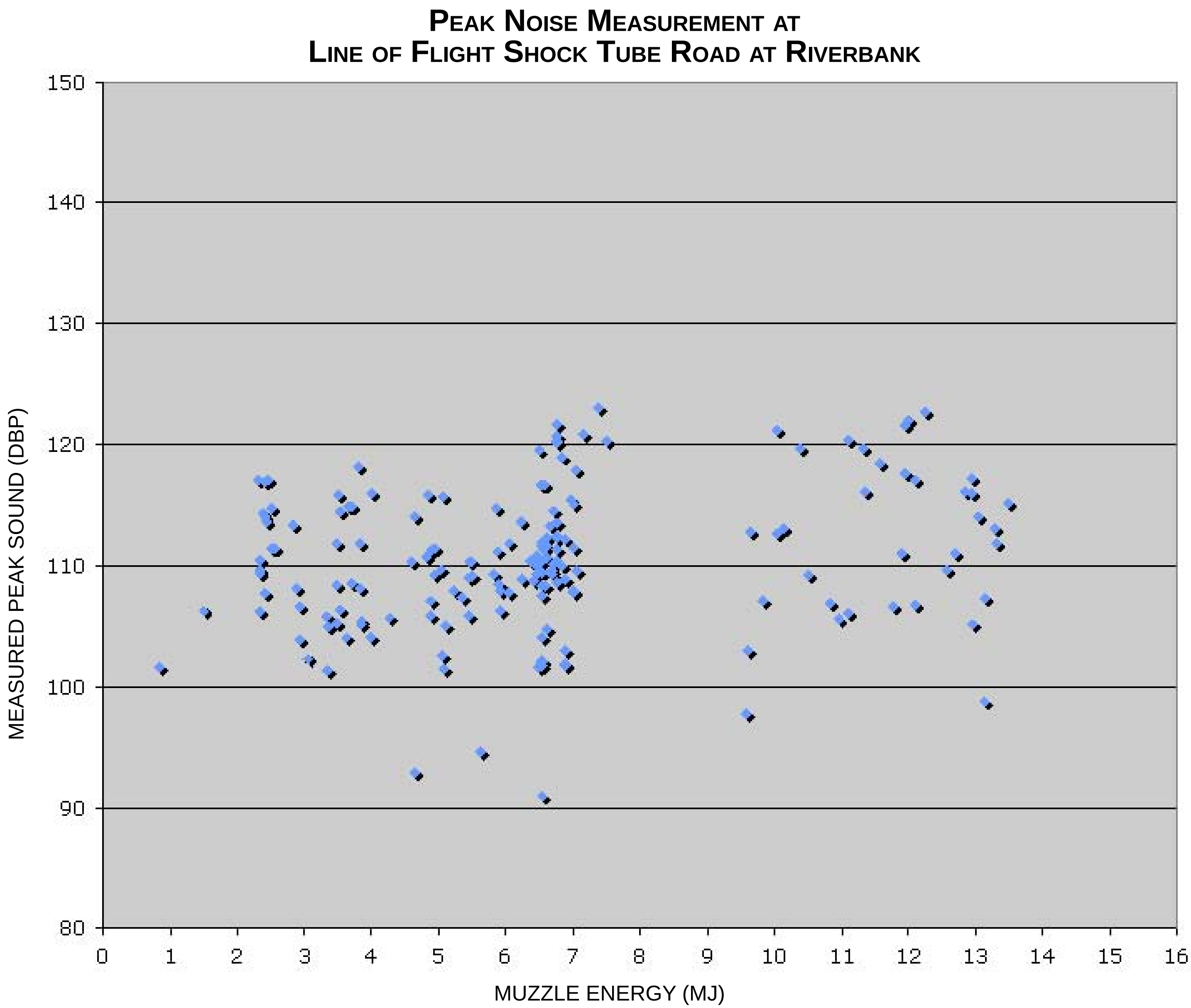

Figure 3-5

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The conical shock tube foundation was not included in the base's 1993 architectural survey and thus was not identified as a historic structure or included in a historic district. Because it may meet the criteria for a Cold War asset as a stand-alone structure, Naval Support Activity South Potomac sent a letter to the Virginia Department of Historic Resources (VDHR) on December 8, 2008 (included in Appendix D) requesting its review of the project to satisfy NHPA requirements under NEPA. The VDHR responded (letter dated December 18, 2008; included in Appendix D) that no further identification efforts are warranted, as no historic properties will be affected by the action.

3.8 Health & Safety

3.8.1 Biological Effects

Electromagnetic fields can interact with the human body in several different ways, by

- Generating electric fields and induced currents around the heart, and slightly impeding the flow of blood.
- Affecting metallic implants and possibly some biological molecules and cell structures in the body.
- Possibly interfering with some chemical reactions in the body.

The interaction of biological tissue with a magnetic field depends on the physical properties of the field, such as its strength and direction at a given location inside the body. Interactions with the body are likely to be of most health consequence when there is movement in the field because of body motion or blood flow. Possible health effects from electromagnetic field exposure include an increase in body temperature at high strengths (WHO, 1993). Instantaneous health effects of exposure to higher magnetic field strengths (>1,500 G) include dizziness, nausea, and metal taste; but these effects do not require medical treatment and have no lasting consequences; nor have cumulative effects been observed (Frese and Engels, 2003). The World Health Organization (WHO) found that exposure to low levels (10 milliampere [mA]/m^2) of time-varying magnetic fields has not been shown to produce any significant biological effects (WHO, 1987). In the range of 10 - 100 mA/m^2 (from fields higher than 50 – 500 mG at 50/60 Hz), biological effects have been established. Induced-current densities from short-term exposure (a few hours) may cause minor transient effects on health. Above 100 mA/m^2 (greater than 500 mG at 50/60 Hz), various stimulation thresholds are exceeded, and hazards to health may occur.

The International Agency for Research on Cancer (IARC) has classified extremely low frequency (ELF) electromagnetic fields as "possibly carcinogenic to humans" or Group 2B. In 1979, a study by Wertheimer and Leeper (1979) suggested an association between magnetic fields and childhood leukemia. Since then, many other studies have been conducted and have found no consistent relationship between childhood brain tumors or other cancers and exposure to electromagnetic fields at home (e.g., Linet et al., 1997; Kleinerman et al., 2000). The current consensus is that there is limited evidence for the carcinogenicity of electromagnetic fields in relation to childhood leukemia (Wertheimer and Leeper, 1979); however, there is inadequate evidence for all other cancers in children and for all cancers in adults (National Cancer Institute [NCI], 2006).

Several studies conducted in the 1980s and early 1990s reported that people who worked in some electrical occupations, such as power station operators and phone line workers, had higher-than-expected rates of some types of cancer, particularly leukemia, brain tumors, and breast cancer. Some occupational studies showed very small increases in risk for leukemia and brain cancer, but these results were based on job titles and not actual measurements. More recent studies that have included both job titles and individual exposure measurements reported no consistent finding of an increased risk of leukemia, brain tumors, or breast cancer with increased exposure to magnetic fields at work (NCI, 2006).

3.8.2 Electromagnetic (EM) Hazard Arcs and Exposure Standards

As discussed in Section 2.1.3, an electromagnetic hazard occurs when transmitting equipment produces an electromagnetic field sufficient to trigger explosive devices (HERO), ignite fuels (HERF), or harm personnel (HERP). Consequently, arcs are defined around sites producing EM energy to ensure that personnel and sensitive materials are not within range of potential adverse effects. Considerations bearing on the potential for these effects include (DoN, 2003):

a. Characteristics of the electromagnetic fields produced (amplitude and frequency of electric and magnetic fields).

b. Reduction of electromagnetic fields by distance.

c. Reduction of electromagnetic fields by shielding or containment structures.

d. Duration of electromagnetic fields produced compared to response times of ordnance, personnel, and electronics.

Evaluating each of these factors allows for the prediction of EM energy at various distances, which can then be compared to applicable standards or limits, as listed in Table 3-12. These standards are presented for the magnitude of the electric field component of an electromagnetic wave expressed in units of volts per meter (V/m) and the magnetic field component of an electromagnetic wave expressed in Gauss or units of amperes per meter (A/m).

Table 3-12
Electric and Magnetic Field Exposure Limits

	Electric Fields (Volts/meter)	Magnetic Field Strength (Gauss)
HERO	100	N/A
HERP	614	2
EMI	> 3*	0.004

Notes:
N/A- NAVSEA OP3565 does not specify magnetic field limits for HERO at any frequency.
* There is no electric field limit prescribed in either military or commercial standards at frequencies below 100 kHz. 3 V/m is prescribed for medical equipment (IEC, 2007), but applies to frequencies from 80 to 2,500 MHz. The implication is that electric field limits would be much higher than 3 V/m -- likely 100s of V/m.
Sources: DoN, 2003, 2002, and IEEE, 2002, 1999.

Many countries and organizations have established exposure limits for electromagnetic fields and in some cases, these exposure limits have been created for two categories: occupational exposure (e.g., known controlled exposure) and non-occupational exposure (e.g., general public or those who do not know they are being exposed to such fields). WHO maintains a website that lists all known and recognized international exposure standards for magnetic fields (WHO, 2008a). WHO also funds and operates the International Electromagnetic Field (IEMF) Project which has compiled a vast database of research, studies, exposure guidelines and limits, and many other types of information on both electric and magnetic fields (WHO, 2008b).

The exposure limits applicable to the United States were developed by the Institute of Electrical and Electronics Engineers (IEEE, 1999, 2002). Time-varying fields are produced by alternating currents (AC) having a frequency above zero and up to about 300 Hz, and may also be referred to as extremely low frequency (ELF) magnetic fields. For static magnetic fields, protection limits tend to be stated in terms of the external field strength, or magnetic flux density, and the duration of exposure. Since time-varying magnetic fields induce eddy currents within the body, evaluation may be based on the current density (electric field strength) in critical organs. Derived protection limits are then expressed as exposures to external magnetic fields, whereby field strength, pulse shape (rise and decay time) and frequency, orientation of the body, and duration of the exposure need to be specified. Table 3-13 provides the IEEE magnetic field controlled and uncontrolled exposure limits for the head and torso.

Table 3-13
IEEE Exposure Limits for the Head and Torso

Frequency Range (Hz)	Magnetic Field Strength Controlled (*G*)	Magnetic Field Strength Uncontrolled (*G*)
<0.153	3530	1180
0.153-< 20	543/f	181/f
20 - < 759	27.1	9.04
>759-3000	20600/f	6870/f

Notes:
f = frequency; Hz = Hertz; G = Gauss
Source: IEEE (2002).

The American Conference of Governmental Industrial Hygienists (ACGIH, 2001) and the International Commission on Non-Ionizing Radiation Protection (ICNIRP, 1998) have established guidelines for magnetic field exposure to pacemakers (Table 3-14).

Table 3-14
Established Guidelines for Magnetic Field Exposure to Pacemakers

Organization	Static Magnetic Field (G)	Time-Varying Field (G)
ICNIRP	5	0.833
ACGIH	5	1

Notes: G = Gauss
Source: AGCIH (2001) and ICNIRP (1998).

3.8.3 Hazardous Substances

Hazardous substances at Dahlgren include hazardous waste (HW), hazardous materials (HM), such as chemicals of various types, and explosives and ordnance (including the various components of individual pieces of ordnance such as propellants and explosive powder). NSF Dahlgren and NSWCDL adhere to federal and state laws and regulations governing HM and HW. The following federal and state statutes and their implementing regulations are relevant to the management and control of HM and HW at Dahlgren:

- Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA)
- Superfund Amendments and Reauthorization Act (SARA) of 1986 to CERCLA
- Resource Conservation and Recovery Act of 1976 (RCRA)
- Hazardous and Solid Waste Amendments (HSWA) to RCRA, 1984
- Toxic Substances Control Act of 1978 (TSCA)
- Clean Water Act (CWA)
- Occupational Safety and Health Administration (OSHA) Regulations
- US Department of Transportation Hazardous Materials Regulations
- Virginia Hazardous Waste Regulations
- Maryland Hazardous Waste Regulations (Potomac River only)
- Military Munitions Rule of 1997

Through CERCLA, SARA, RCRA, and TSCA, the USEPA promulgates and enforces regulations regarding past and present HM and HW management. These regulations establish mandatory procedures and requirements that must be followed by federal facilities that use, accumulate, transport, treat, store, or dispose of HW or HM. RCRA allows for each state to establish and enforce its own HW management program, provided that the state's requirements are no less stringent than the USEPA's. The USEPA will grant primacy – the authority to implement and enforce regulations – to each state that can demonstrate that it can statutorily implement and fund a program equivalent in scope and coverage to the RCRA regulations. The Commonwealth of Virginia (through VDEQ) has been granted such primacy.

NSF Dahlgren is regulated as a large-quantity hazardous-waste generator, with NSWCDL as one of the largest contributors of HW. In the course of conducting RDT&E activities, NSWCDL uses and disposes of a variety of materials considered hazardous by USEPA such as corrosive solutions, waste paint-related materials, lead-contaminated floor mats and rags, solvents, petroleum products, ordnance and explosive materials.

NSF Dahlgren and NSWCDL have in place a number of programs, plans, and processes to safely use, transport, handle, store, and dispose of HM and HW. Dahlgren has a pollution prevention program aimed at reducing the use of, controlling, managing, and reutilizing HM. The Defense Reutilization and Marketing Office (DRMO) manages materials that are reused or recycled. Generally, each department, division, or tenant orders HM through the Dahlgren Environmental Office from outside vendors. The storage, use, and ultimate disposal of these materials are then tracked by Dahlgren.

The proposed railgun site has been disturbed for construction of roads and the conical shock tube and EMLF facilities. A thorough investigation of past hazardous waste activities indicates that this location is free from hazardous waste contaminants. Also, there is no known or suspected buried ordnance at the site.

3.9 Natural Resources

Unless otherwise noted, the information in this section comes from the *Integrated Natural Resources Management Plan (INRMP), NSF Dahlgren* (Navy, 2007). The INRMP was prepared in response to the Sikes Act, which stipulates that environmental management and species protection are a core part of the military's responsibility on their lands.

3.9.1 Topography, Geology and Soils

NSF Dahlgren and the surrounding area are located within the Coastal Plain physiographic province, which in Virginia is characterized by low relief with elevations ranging from sea level to 400 ft above mean sea level (MSL). The Chesapeake Bay and Potomac River are prominent features of the coastal plain in the vicinity of Dahlgren. Dahlgren's topography is generally low and flat, with elevations ranging from MSL near the Potomac River and its tributaries to 28 ft above MSL in the northwestern part of Mainside and the southwestern parts of the EEA.

The Nanjemoy Formation is the geologic formation that underlies Dahlgren and adjoining areas of the Coastal Plain. The Tetotum-Bladen-Bertie formation is the primary soil association at Dahlgren. It consists of deep, moderately well drained or poorly drained soils having clay loam, sandy clay loam, or clay subsoil, and occurring in broad, low-lying areas. The natural, undisturbed soil in the vicinity of the project area is Bladen Loam. The US Department of Agriculture characterized this soil in the 1974 *King George County Soil Survey* as a hydric soil, meaning a soil that typically occurs in wetland areas (USDA, 1974). Bladen loam has a clay texture with slow permeability, is strongly acidic, is low in natural fertility and organic matter, and has a seasonal high water table that remains near the surface for long periods. The construction decades ago of the conical shock tube facility described in Section 3.7 and of the roadways that traverse the project site – Frontage Road, Shock Tube Road, Gambo Road, and Hideaway Lane –disturbed and filled the Bladen Loam soil. The result is that the project site is no longer covered with natural Bladen Loam soil but rather with disturbed fill of unknown origin, probably mixed with the natural soil.

3.9.2 Water Resources

Water Quality is regulated by federal, state, and local laws and regulations. The Federal Water Pollution Control Act of 1972, or Clean Water Act (CWA), is the principal US law that regulates pollutant discharges into the nation’s streams, lakes, and estuaries. The National Pollutant Discharge Elimination System (NPDES) established national standards under the CWA to eliminate discharges of pollutants into waterways. VDEQ regulates point and nonpoint source discharges through VPDES permits issued by the State Water Control Board. The CWA prohibits the discharge of pollutants into state waters without a VPDES permit. Issuance of a permit is contingent on the applicant’s use of the “best available control technology” in order to comply with water quality standards.

NSF Dahlgren has in place stormwater pollution prevention plans as a requirement of VPDES that addresses sources that contribute to the contamination of stormwater discharges as well as management controls and best management practices (BMPs) to maintain and protect water quality. The installation has a VPDES permit for discharges that meets or exceeds federal guidelines established under the CWA.

Groundwater

Three aquifers underlie Dahlgren and King George County. The shallow Yorktown-Eastover aquifer lies between 20 ft and 140 ft below the ground surface and provides water for many private wells and light industrial wells. It is a confined aquifer and is recharged in the western portions of King George County (Navy, 1993). The Nanjemoy-Marlboro Confining Unit Aquifer lies between 140 ft and 210 ft below ground. The Middle Potomac Aquifer lies at a depth of roughly between 210 ft and 806 ft. The Middle Potomac Aquifer is the only consistently productive aquifer in the vicinity of Dahlgren. The deep wells of Dahlgren and surrounding areas draw primarily from this aquifer. The Middle Potomac Aquifer is recharged through a 253 sq-mi area located approximately 25 mi west of Dahlgren (US Geological Survey [USGS], 2001).

Surface Water

Dahlgren includes approximately four miles of shoreline on the Potomac River, and about six miles of shoreline on Upper Machodoc Creek. Gambo Creek flows northwest to southeast through Mainside, which it divides into two approximately equal tracts. Small, unnamed tributaries to the Potomac River, Upper Machodoc Creek, and Gambo Creek flow through Dahlgren as well. Black Marsh Creek, Rosier Creek, and Goldman Creek enter the Potomac River south of Dahlgren. In addition, two manmade freshwater impoundments, Hideaway Pond and Cooling Pond, are located within the installation.

The Potomac River, with a watershed of almost 14,760 sq mi, flows to the Chesapeake Bay about 50 mi southeast of Dahlgren. In the area adjacent to Dahlgren, the Potomac River is tidal and classified as an estuary. Salinities in the vicinity of Dahlgren range from 5 to 12 parts per thousand (ppt), and vary with season, rainfall, and tidal stage.

There are no surface water bodies at or near the proposed railgun site.

Wetlands

Approximately 368 ac (8.5 percent) of the installation are tidal wetlands (estuarine system) and 240 ac (5 percent) are non-tidal, freshwater wetlands (palustrine system). Wetlands at Dahlgren are primarily associated with the Potomac River, Upper Machodoc Creek, Gambo Creek, and unnamed tributaries to these waterways. A number of federal laws, regulations, and policies regulate activities in wetlands, including Section 404 of the CWA, Executive Order 11990, *Protection of Wetlands*, and the North American Wetlands Conservation Act.

With respect specifically to the proposed 64-MJ railgun site, wetland delineations were conducted in 2003 and 2006 east, west and north of the proposed site in accordance with the 1987 Army Corps of Engineers (USACE) Wetland Delineation Manual (Navy, June 2003, Navy, December 2006). Initial designs for the EMLF and the currently-proposed facilities led to changes in siting to avoid and minimize impacts to wetlands. The surveys found that there are several acres of wetlands near the proposed railgun project site (Figure 3-6, Wetlands), but the proposed facilities have been located to avoid them. The wetlands delineated to the west are on average 36 ft from the proposed site fence line, with the closest point at 31 ft from the fence. Wetlands on the east are on average 75 ft from the proposed project site fence, with the closest point at 5 ft from the fence. Wetlands to the northwest are on average 65 ft from the proposed fence, with the closest point at 62 ft.

The following subclasses of non-tidal palustrine wetlands were identified:

- **Palustrine forested wetlands**: Palustrine forested wetlands of the broad-leaved deciduous (PFO1) subclass comprise 2.09 ac of wetland near the proposed railgun site (Navy, June 2003, Navy, December 2006). Loblolly pine, red maple, and sweetgum dominate the canopy cover in the PFO1 communities near the project site.

- **Palustrine scrub-shrub wetlands**: Palustrine scrub-shrub wetlands of the broad-leaved deciduous (PSS1) subclass comprise 0.08 ac near the proposed site. PSS1 wetlands are early successional communities associated with seasonally inundated forested depressions that will eventually transition to forested wetland over time (Navy, June 2003). The dominant species are loblolly pine, buttonbush (*Cephalanthus occidentalis*), and persimmon (*Diospyros virginiana*). The palustrine scrub-shrub wetland of the needle-leaved evergreen (PSS4) subclass comprises 0.06 ac near the proposed site. The dominant scrub species in this system are loblolly pine, wax myrtle (*Myrica cerifera*), and bushy bluestem (*Andropogon glomeratus*).

- **Palustrine emergent wetlands**: Palustrine persistent emergent (PEM1) wetlands comprise 0.02 ac near the proposed site. This subclass is characterized by erect, rooted, herbaceous hydrophytes, excluding mosses and lichens, where the vegetation is present for the majority of the growing season in most years (Navy, June 2003). PEM1 wetlands are usually dominated by perennial plants and include all water regimes except subtidal and irregularly exposed. Common species found in this community type include rushes, bulrushes, needlerushes, and sedges (Navy, June 2003).

Stormwater

Dahlgren follows three regulatory programs that are intended to protect water resources from degradation caused by stormwater runoff: the Virginia Stormwater Management Regulations (4VAC3-20), the Virginia Erosion and Sediment Control Regulations (4VAC50-30), and the Chesapeake Bay Preservation Act and Regulations (VR 173-02-01).

The Commonwealth of Virginia passed the Chesapeake Bay Preservation Act in 1988, applicable to 14 tidewater counties, to improve water quality in the bay. The regulations promote wise resource management practices in the use and development of environmentally sensitive land features. Although federal landowners are exempt from the provisions of the Chesapeake Bay Preservation Act, Dahlgren complies with this regulation to the greatest extent practicable. Section 3.1.2 describes Virginia's Coastal Zone Management Program.

The quantity and quality of stormwater leaving the installation is controlled by a stormwater management system. The system consists of water retention ponds, gravity storm mains, laterals, drainage ditches, culverts, inlets, and catch basins. Most of the lines and culverts are reinforced concrete or corrugated metal ranging in diameter from 4 to 60 in (Navy, December 2006). Natural features such as streams, wetlands, and floodplains also are part of the stormwater management system at Dahlgren (Navy, 1993, as cited in Navy, December 2006). A VPDES permit covers the small quantities of stormwater discharged into receiving water bodies.

Floodplains

The proposed railgun site and the surrounding areas are all well outside the 100-year floodplain, as may be seen on Figure 3-7 (Floodplains in the Railgun Area).

Wetlands

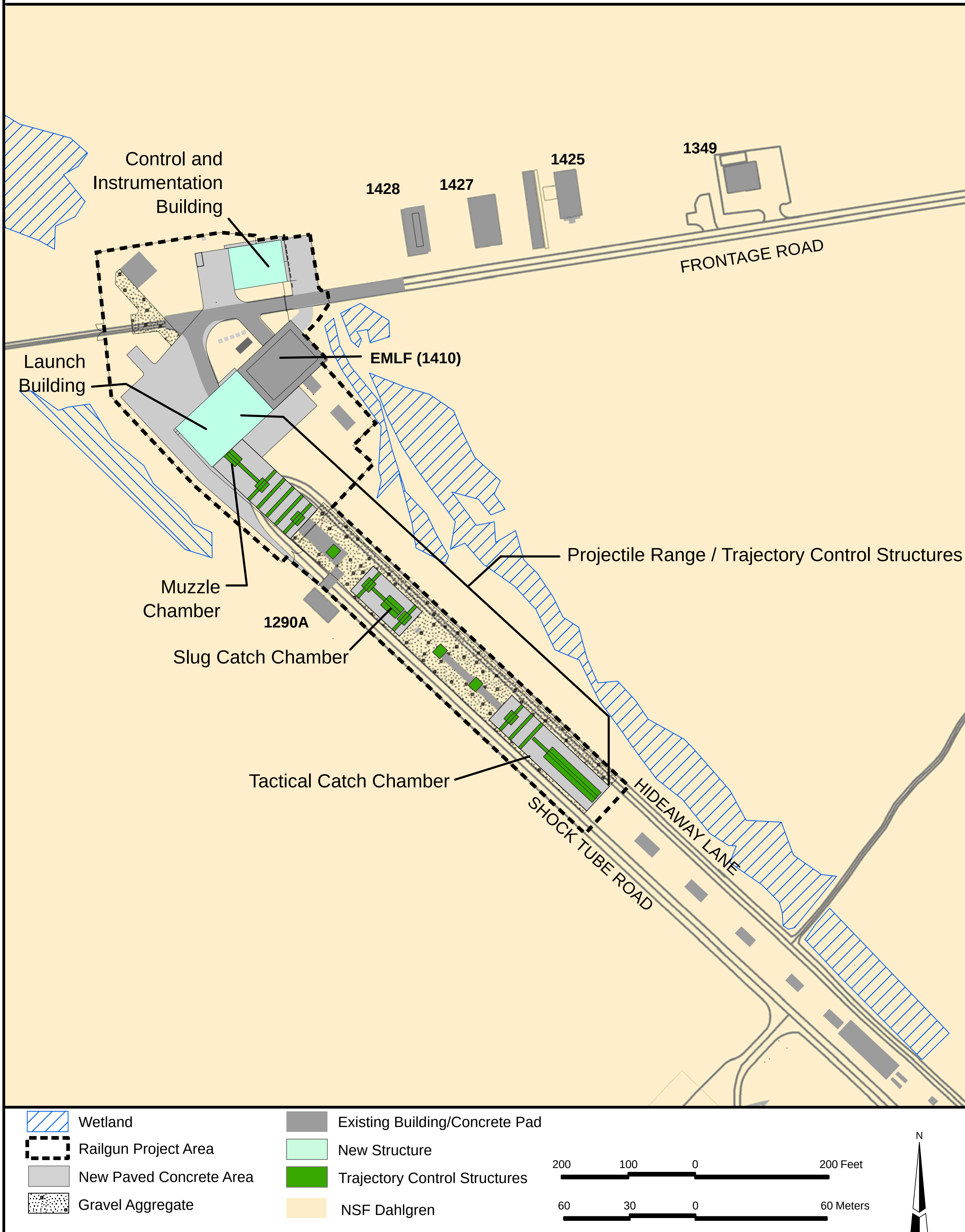

Figure 3-6

Source: NSWC Dahlgren

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Floodplains in the Railgun Area

Figure 3-7

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3.9.3 Vegetation

Natural or maintained upland vegetation covers nearly 86 percent of Dahlgren's 4,319 ac, with wetlands covering the remaining 14 percent. Approximately 2,223 ac (52 percent of the installation) are forested. Mixed pine-hardwood forest is the predominant forest cover type (31 percent of the installation), followed by hardwood forest (15 percent), then pine forest (6 percent). Maintained open uplands comprise 1,431 acres (34 percent of the installation) and include grasslands (6 percent) and developed/maintained areas (28 percent).

Most of the project site is developed, with roads, the EMLF, and the remains of the conical shock tube occupying the middle of the area. The edges are forested with pine forest along the northeastern part and pine-hardwood forest along the remainder of the site, as may be seen on Figure 3-8 (Forest Cover Types in the Railgun Area). The forest is not mature and includes scrub-shrub areas. The forest types are described below.

- **Pine Forest.** Pine forests in the Atlantic Coastal Plain are mid-successional in nature and are indicative of disturbance or intensive maintenance. The dominant overstory species in these forests include loblolly pine (*Pinus taeda*) and Virginia pine (*Pinus virginiana*) with lesser amounts of yellow poplar (*Liriodendron tulipifera*) and sweetgum (*Liquidambar styraciflua*). Older pine stands may support an understory with oak (*Quercus* spp.) and other hardwood seedlings. The shrub and herbaceous components of pine forests are often sparse, but may include Japanese honeysuckle (*Lonicera japonica*), trumpet creeper (*Campsis radicans*), poison ivy (*Toxidendron radicans*), Virginia creeper (*Parthenocissus quinquefolia*), and blueberry (*Vaccinium* spp.).

- **Hardwood Forest.** Many hardwood forests in the Atlantic Coastal Plain are late successional communities. Common overstory species that occur on poorly drained sites include blackgum (*Nyssa sylvatica*), red maple (*Acer rubrum*), willow oak (*Quercus phellos*), and water oak (*Quercus nigra*). On drier sites, oaks such as black oak (*Quercus velutina*), southern red oak (*Quercus falcata*), and chestnut oak (*Quercus prinus*) and hickories (*Carya alba* and *Carya ovata*) dominate the overstory. Understories often include American holly (*Ilex opaca*), flowering dogwood (*Cornus florida*), sassafras (*Sassafras albidum*), Virginia creeper, partridge berry (*Mitchella repens*), blueberry, and ground pine (*Lycopodium* spp.).

- **Pine-Hardwood Forest.** Mixed forests are transitional between pine and various hardwood types; in the absence of disturbance, succession will strongly be towards the hardwoods. Site index and hydrologic regime strongly influence the hardwood component of a stand. On moist sites, sweetgum, red maple, and tulip poplar colonize the site along with loblolly pine. In these stands, hardwoods grow quickly and form a single stratum canopy with the pines. On drier sites, several oak species, including southern red oak (*Quercus rubra*) and white oak (*Quercus alba*), may invade areas that were first colonized by pines and, over time, become canopy codominants. The understories of these forests are varied and depend on site conditions.

3.9.4 Wildlife

Wildlife surveys conducted in 1978 documented 16 amphibian, 16 reptilian, 157 avian, and 20 mammalian species at Dahlgren (Navy, 1979). Species that commonly frequent forests on the installation include:

- Amphibians and reptiles – Species likely to occur in the area include the American toad (*Bufo americanus*), eastern box turtle (*Terrapene carolina*), black racer (*Coluber constrictor*), black rat snake (*Elaphe obsoleta obsoleta*)**,** rough green snake (*Opheodrys aestivus*), garter snake (*Thamnophis sirtalis*), green frog (*Rana clamitans*), bullfrog (*Rana catesbeiana*), and spring peeper (*Pseudacris crucifer*).

- Birds – NSF Dahlgren provides a variety of habitats for avian species. The avian population at and near Dahlgren is diverse and includes a large number of migratory waterfowl that over-winter in the area as well as many neotropical migrant birds, which nest in the region or farther north and over-winter in the Caribbean or South America. The hardwood forests found on the installation and along the Potomac River are strategically important for local breeding populations of neotropical migrants and, as stopover areas, for the northern populations moving through the region in the fall and spring.

  Examples of common avian species occurring in forested and open uplands similar to those found at the proposed railgun site include mourning dove (*Zenaida macroura*), American crow (*Corvus brachyrhynchos*), blue jay (*Cyanocitta cristata*), eastern phoebe (*Sayornis phoebe*), Carolina chickadee (*Poecile carolinensis*), tufted titmouse (*Baeolophus bicolor*), white-breasted nuthatch (*Sitta carolinensis*), Carolina wren (*Thryothorus ludovicianus*), house wren (*Trodlodytes aedon*), eastern bluebird (*Sialia sialis*), American robin (*Turdus migratorius*), wood thrush (*Hylocichla mustelina*), downy woodpecker (*Picoides pubescens*), red-bellied woodpecker (*Melanerpes carolinus*), northern mockingbird (*Mimus polyglottos*), European starling (*Sturnus vulgaris*), northern cardinal (*Cardinalis cardinalis*), common grackle (*Quiscalus quiscula*), house finch (*Carpodacus mexicanus*), American goldfinch (*Carduelis tristis*), and house sparrow (*Passer domesticus*).

  In addition, raptors, including red-shouldered hawk (*Buteo lineatus*), red-tailed hawk (*Buteo jamaicensis*), bald eagle (*Haliaeetus leucocephalus*), turkey vulture (*Cathartes aura*), and American kestrel (*Falco sparverius*) are common residents on the facility. The northern harrier (*Circus cyaneus*) and sharp-shinned hawk (*Accipiter striatus*) are also common from fall through spring, but are rare during the hotter summer months. Ospreys (*Pandion haliaetus*) are common on the installation from early March to late July or early August (USFWS, 2008).

- Mammals – The forested habitats around the railgun site can be expected to support a variety of mammals, such as white-tail deer (*Odocoileus virginianus*), opossum (*Didelphis virginiana*), raccoon (*Procyon lotor*), grey fox (*Urocyon*

Forest Cover Types in the Railgun Area

Figure 3-8

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cinereoargenteus), red fox (*Vulpes vulpes*), striped skunk (*Mephitis mephitis*), grey squirrel, and white-footed mouse (*Peromyscus leucopus*).

3.9.5 Rare, Threatened and Endangered Species

The Endangered Species Act (ESA) of 1973 and subsequent amendments provide for the conservation of threatened and endangered species of animals and plants, and the habitats in which they are found. The ESA prohibits jeopardizing endangered and threatened species or adversely modifying critical habitats essential to their survival without specific authorization from the US Fish and Wildlife Service (USFWS) or the National Marine Fisheries Service (NMFS), depending on the species and the area within which it occurs. The Navy ensures that consultations are conducted as required with the USFWS or NMFS under Section 7 for any action which “may affect” a threatened or endangered species according to guidance provided in the *Environmental Resources Program Manual* (OPNAVINST 5090.1C).

Until being delisted from the ESA in 2007, the bald eagle was the only federally-listed (threatened or endangered) species known to occur at Dahlgren (Geo-Marine, Inc., April 2007). There are three bird species that the Commonwealth of Virginia lists as threatened – the bald eagle, loggerhead shrike (*Lanius ludovicianus)*, and upland sandpiper (*Bartramia longicauda*) – and 21 other bird species that are listed as federal or state species of special concern that potentially could be found on Dahlgren, as detailed in Table 3-15. The bald eagle remains listed as a state “threatened” species under Virginia law and VDGIF regulations (USFWS and VDGIF, 2001; VDGIF, 2007).

Both migratory and residential breeding bald eagle populations inhabit Dahlgren and surrounding area year-round (Geo-Marine, Inc., April 2007, October 2007). The installation’s proximity to open water and the presence of forests combined with an upswing in the bald eagle population throughout the region and a loss of suitable habitat in the areas surrounding the installation, have resulted in an increase in the resident population. Between 1983 and 2007, the number of nests documented at Dahlgren went from one to eleven, with six of these nests active in 2008.

Dahlgren's Bald Eagle Management Plan includes the establishment and/or maintenance of protection zones (PZs) around nesting eagles (Geo-Marine, Inc., April 2007), following recommendations contained in the Bald Eagle Protection Guidelines for Virginia (USFWS and VDGIF 2000). Two circular bald eagle protection zones are established around occupied nests. The primary protection zone (PZ1) has a radius of 750 ft; the secondary protection zone (PZ2) extends 570 ft beyond the PZ1, for a total radius of 1,320 ft (1/4 mi). Within these zones, bald eagle protection practices are followed, as detailed in Geo-Marine, Inc. (April 2007). If a particular nest shows no activity by March 15 of each year, Dahlgren may request from the USFWS that time-of-year restrictions be lifted for that nest for the remainder of the season.

Table 3-15
Federal and State Status of Protected Species Potentially Present in or within a 4-mile Radius of NSF Dahlgren's Land Ranges

Federal/State Status	Common Name	Scientific Name
	Fish	
FE, SE	Shortnose sturgeon	*Acipenser* brevirostrum
Candidate	Atlantic sturgeon	*Acipenser oxyrhynchus*
	Turtles	
FS	N. diamond-backed terrapin	*Malaclemys terrapin terrapin*
	Birds	
FS, ST	Loggerhead shrike*	*Lanius ludovicianus*
FS	Black rail	*Laterallus jamaicensis*
FS	Cerulean warbler	*Dendroica cerulean*
ST	Bald eagle*	*Haliaeetus leucocephalus*
ST	Upland sandpiper	*Bartramia longicauda*
SS	Winter wren*	*Troglodytes troglodytes*
SS	Little blue heron	*Egretta caerulea caerulea*
SS	Least tern	*Sterna antillarum*
SS	Northern harrier*	*Circus cyaneus*
SS	Tricolored heron	*Egretta tricolor*
SS	Yellow-crowned night heron	*Nyctanassa violacea violacea*
SS	Barn owl	*Tyto alba pratincola*
SS	Sedge wren*	*Cistothorus platensis*
SS	Brown creeper	*Certhia Americana*
SS	Forster's tern	*Sterna forsteri*
SS	Dickcissel	*Spiza Americana*
SS	Great egret*	*Ardea alba egretta*
SS	Purple finch*	*Carpodacus purpureus*
SS	Golden-crowned kinglet*	*Regulus satrapa*
SS	Common moorhen	*Gallinula chloropus cachinnans*
SS	Magnolia warbler*	*Dendroica magnolia*
SS	Red-breasted nuthatch	*Sitta Canadensis*
SS	Caspian tern	*Sterna caspia*
SS	Hermit thrush	*Catharus guttatus*
	Plants	
FT, SE	Swamp pink	*Helonias bullata*
ST	Narrow-leaved spatterdock	*Nuphar sagittifolia*
FT, SE	Small-whorled pogonia	*Isotria medeoloides*
FE, SE	Harperella	*Ptilimnium nodosum*
ST	New Jersey rush	*Juncus caesariensis*
FT, ST	Sensitive joint-vetch	*Aeschynomene virginica*
SE	Tropical water hyssop	*Bacopa innominata*

Notes:
FE = Federal Endangered; FT= Federal Threatened; FS= Federal Species of Concern
SE = State Endangered; ST = State Threatened; SS= State Species of Concern
* Species observed at Dahlgren.
Source: Navy, 2007; Townsend, 2007; NMFS, 2008.

Figure 3-9 (Bald Eagle Nests in Relation to the Railgun Area) shows the approximate locations of the known bald eagle nests on NSF Dahlgren. There have been five nests documented on Mainside since 1983 (Geo-Marine, Inc., October 2007). One of the nests was active in 2008, but the remaining four have not been active since at least 2006. The closest nest to the proposed EM railgun facility is approximately 3,025 ft away, well beyond the established protection and buffer zones (VDGIF coordination letter in Appendix E).

Terrestrial threatened or endangered species potentially occurring within a four-mile radius (VDGIF, 2008) of NSF Dahlgren include seven plants and one reptile. In 2004, a rare plant survey was completed by ESA, Inc. for state-listed and federally-listed plant species that are known to occur in the vicinity of Dahlgren (Navy, 2004). Surveyors searched for swamp pink (*Helonias bullata*), narrow-leaved spatterdock (*Nuphar sagittifolia*), small-whorled pogonia, harperella (*Ptilimnium nodosum*), New Jersey rush (*Juncus caesariensis*), sensitive joint-vetch, and water hyssop (*Bacopa innominata*). Although potential habitat exists for these rare plants, none of the target species or any other rare plants were found on the installation (Navy, 2004).

A terrestrial reptile, the northern diamond-backed terrapin, (*Malaclemys terrapin terrapin*), is a federal species of concern that may occur within a four-mile radius of the installation based on information from the VDGIF database (Navy, 2007). No diamond-backed terrapins have been observed on the installation to date.

At the current time, no rare, threatened, or endangered species are known to utilize the proposed railgun site, nor does the site feature specialized habitats for any species.

USFWS, the Virginia Department of Game and Inland Fisheries (VDGIF), and the Virginia Department of Conservation and Recreation Division of Natural Heritage (VDCR-DNH) were contacted regarding the presence of federally and state-listed species on or near the project area on November 18, 2008 (letters in Appendix E).

USFWS responded in a letter dated December 9, 2008 (copy in Appendix E), listing four federally endangered, threatened, proposed, and candidate species found in King George County, Virginia, but not necessarily on or near the project site: shortnose sturgeon (*Acipenser brevirostrum*); dwarf wedge mussel (*Alasmidonta heterodon*); sensitive joint-vetch (*Aeschynomene virginica*); and small-whorled pogonia (*Isotria medeoloides*). The shortnose sturgeon occurs in the Potomac River and the dwarf wedge mussel in creeks, neither of which are found near the project area. As noted above, a survey done in 2004 found no specimens of small whorled pogonia or sensitive joint-vetch on the installation. USFWS also noted that bald eagles nest on NSF Dahlgren, and while they are no longer protected by the ESA because their populations have largely recovered, they are still protected by the Migratory Bird Treaty Act (16 USC §§ 703-712) and the Bald and Golden Eagle Protection Act (16 USC §§ 668-668d).

VDGIF responded in a letter dated January 8, 2009 (copy in Appendix E), indicating that: “There are a number of State Threatened (ST) bald eagle nests known from the project area. The project site is approximately 3,045 ft from the nearest bald eagle nest, outside the protection zone for bald eagle nests.” VDGIF also noted that the Caledon Winter Concentration Area for bald eagles lies along the river just north of the US 301/Gov. Harry W. Nice Bridge and that the project area is 4,673 ft from it. The agency concluded that it does not anticipate project impacts to bald eagles.

VDCR-DNH responded in a letter dated December 22, 2008 (copy in Appendix E), noting the presence of bald eagle nests and recommending coordination with VDGIF about them. The agency concluded that “the current activity will not affect any documented state-listed plants or insects. “

3.9.6 Special Interest Areas (SIAs)

Five SIAs totaling approximately 1,033 acres have been established by NSF Dahlgren on the installation (Figure 3-10, Special Interest Areas in the Railgun Area). SIAs are areas with unique ecological characteristics and/or high quality habitat for rare species. Of the five, two are wetland areas on Mainside. The remaining three are areas on the EEA that provide nesting habitat for bald eagles. The five SIAs are briefly characterized below.

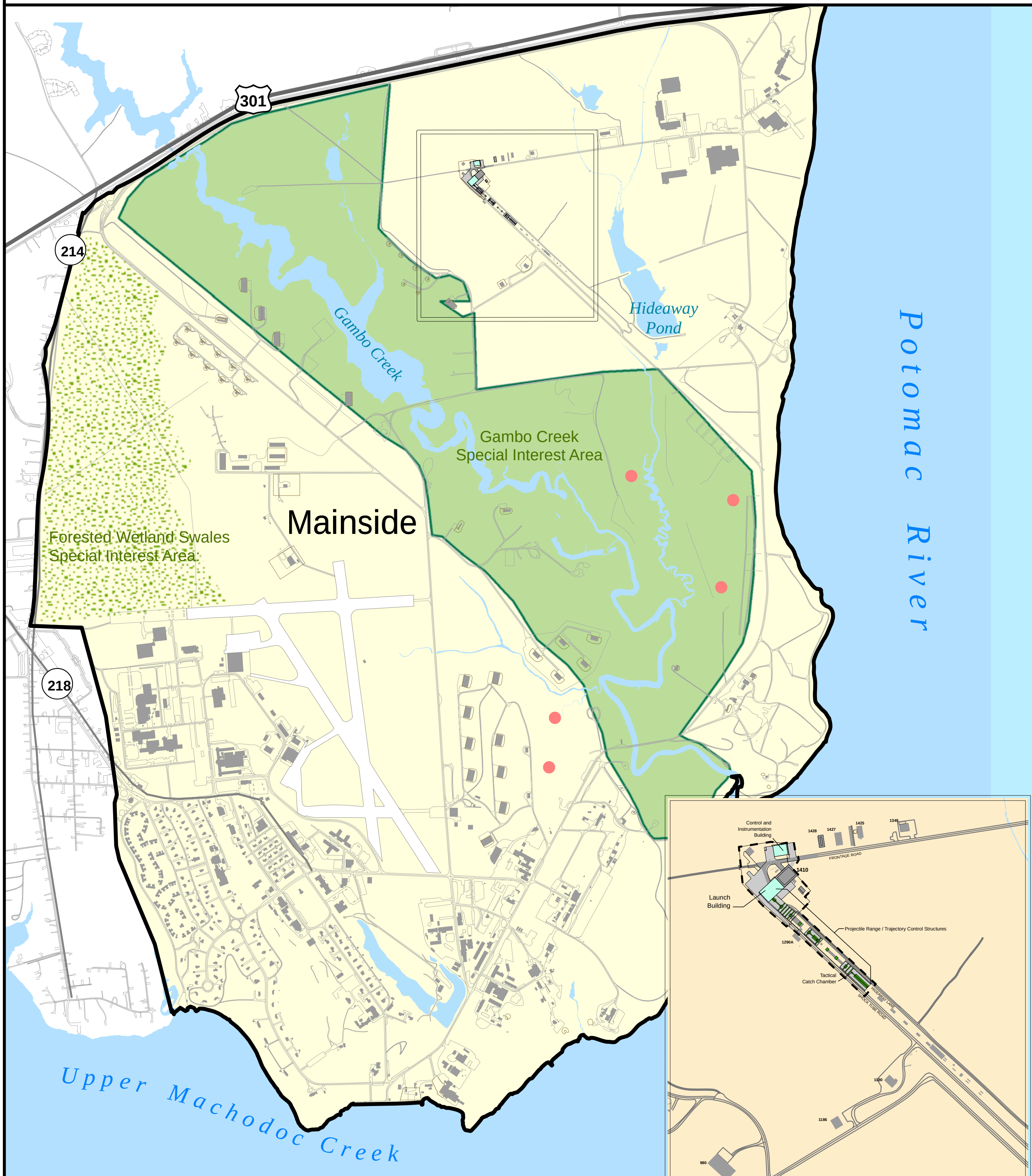
- **Forested Wetland Swale -** The 167-ac Forested Wetland Swale SIA is located in the northwestern portion of Mainside. It consists of several parallel, seasonally-flooded low troughs in a flat topography and includes an extensive forested wetland and herbaceous wetlands along firebreaks. Tree species in the forested wetland include red maple, black gum, willow oak, and pin oak (*Quercus palustris*). The shrub layer is sparse to non-existent. The herbaceous layer includes sedges and peat moss (*Sphagnum* spp.). Coyle’s purse-web spider (*Sphodros Coylei*), a funnel-web spider listed on Virginia’s Natural Heritage watch list, was documented in this area during VDCR-DNH surveys conducted in 1991 and 1992 (Navy, November 2007).

- **Gambo Creek -** This SIA is approximately 643 ac in size and consists of a brackish-intertidal emergent marsh community along Gambo Creek. The extensive marshes along Gambo Creek are dominated by saltmarsh cordgrass (*Spartina alterniflora*), marsh elder (*Iva frutescens*), and pigweed (*Amaranthus cannabinus*). The area is well-buffered by mixed hardwood and pine forests. In addition to providing valuable wetland habitat, three of the five known Mainside bald eagle nests are in this area; one of the nests was active during the 2007 nesting season. The area provides important roosting and foraging habitat for eagles, ospreys, and other birds; nursery habitat for fish; and habitat for uncommon invertebrates.

- **Tetotum Flats North -** This SIA includes approximately 124 forested ac adjacent to Upper Machodoc Creek. Bald eagles have nested in this area intermittently since 1983 and have utilized at least two separate nest sites.

- **Tetotum Flats South -** The Tetotum Flat South SIA is in the southwestern corner of the EEA, adjacent to Upper Machodoc Creek. It consists of approximately 44 forested ac and has also supported an active bald eagle nest site.

Special Interest Areas in the Railgun Area



Forested Wetland Swales Special Interest Area

Gambo Creek Area Special Interest Area

Bald Eagle Nest

Proposed New Paved Concrete Area

Existing Building

Proposed New Building

NSF Dahlgren

Trajectory Control Structures

1,500 750 0 1,500 Feet

500 250 0 500 Meters

N

Figure 3-10

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- **Tetotum Flats East -** This SIA is in the interior portion of the EEA and includes approximately 55 forested ac. Bald eagles have consistently nested here since 1997.

None of the SIAs is within or near the proposed project site.

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4 IMPACTS OF THE PROPOSED ACTION AND ALTERNATIVES

This chapter describes the potential direct, indirect, and cumulative environmental effects that could result from the proposed construction and operation of an EM railgun facility at Dahlgren. Chapter 4 follows a format similar to that of Chapter 3. Sections 4.1 to 4.9 address the environmental impacts of the No Action Alternative and the Preferred Alternative. Section 4.10 addresses the cumulative impacts of the proposed construction and operation of an EM railgun facility and other proposed or ongoing activities at NSF Dahlgren.

4.1 Land Use and Coastal Zone Management

4.1.1 No Action Alternative

Under the No Action Alternative, the proposed 64-MJ railgun facilities would not be constructed and the EMLF would continue to operate with a 32-MJ railgun. There would be no new impacts on land use or coastal resources from implementing the No Action Alternative.

4.1.2 Preferred Alternative

The construction and operation of the proposed EM railgun facility would be consistent with the existing RDT&E land uses at Dahlgren, the Navy's principal center for surface warfare analysis, surface ship combat systems, and strategic systems. It would be consistent with Dahlgren's *Area Development Plan* (Navy, 2001) in that the specific site for the proposed facility is already designated as the "2000 meter land test range" in the plan. The EMLF (Building 1410), built for a purpose identical to that of the proposed facility, is already present on the site and the new structures would be constructed adjacent to it. No land use incompatibilities would be created.

With respect to coastal zone management, federal agency activities affecting a state's coastal zone must be consistent to the maximum extent practicable with the enforceable policies of the state's coastal management program, as explained in Section 3.1. On December 8, 2008, the Navy sent a Federal Consistency Determination (FCD) to VDEQ, which administers the Virginia CRMP; the FCD concluded that the Preferred Alternative is consistent to the maximum extent practicable with the enforceable policies of the Virginia CRMP. VDEQ responded on January 5, 2009 that the Preferred Alternative is consistent with the Virginia CRMP provided that project activities are carried out in strict accordance with all other applicable state, federal, local laws and regulations.

It should be noted that, as indicated in Section 3.1.2, an earlier version of the FCD was submitted to VDEQ in February 2005 and approved in April 2005. In that original FCD, 0.63 ac of non-tidal palustrine wetland were expected to be affected by the construction of the proposed facility. Since that time, however, new plans have been developed, as included in this EA, to avoid filling wetlands. This change was reflected in the 2008 FCD. Therefore, a Virginia Water Protection Permit for impacts to wetlands is not required, as stated in the VDEQ response. (The four letters are included in Appendix C).

4.2 Socioeconomics

4.2.1 No Action Alternative

Under the No Action Alternative, there would be no change in existing socioeconomic conditions.

4.2.2 Preferred Alternative

Economics

Under the Preferred Alternative, the proposed railgun testing facility would be constructed at a cost of approximately $10 million. This would result in a short-term economic benefit for the contractors who would build the new facility. This would in turn generate spin-off benefits for the communities in which the contractors work or are based. That is, direct gains in jobs and associated earnings can be expected to have positive effects further down the line, as workers and businesses spend their income in the local economy on such things as food, furnishings, gasoline, cars, other merchandise, and services. Thus, the impact on the local and regional economy would be positive.

Environmental Justice and Protection of Children

Signed on February 11, 1994, Executive Order (EO) 12898, *Federal Action to Address Environmental Justice in Minority Populations and Low-Income Populations*, directs all federal departments and agencies to incorporate environmental justice considerations in achieving their mission. Each federal department or agency is to accomplish this by conducting programs, policies, and activities that substantially affect human health or the environment in a manner that does not exclude communities from participation in, deny communities the benefits of, or subject communities to discrimination under such actions because of their race, color, or national origin.

Demographic and economic information on the potentially affected area (King George County) is provided in Section 3.2. As noted in Section 3.2, King George County is not home to a disproportionately high number of minorities or low-income persons. Additionally, as explained elsewhere in this chapter, the proposed action is not expected to have significant adverse impacts that could disproportionately affect populations protected under the EO. Nor would any persons be displaced as a result of implementing the proposed action. Therefore, the Preferred Alternative is consistent with EO 12898.

EO 13045, *Protection of Children from Environmental Health Risks and Safety Risks*, was signed on April 12, 1997. Because the scientific community recognizes that children may suffer disproportionately from environmental health and safety risks, each federal agency is directed to identify and assess such risks, and consequently to ensure that its policies, programs, activities, and standards address effects on children. “Environmental health risks and safety risks” are defined as “risks to health or to safety that are attributable to products or substances that the child is likely to come in contact with or ingest.”

The site where the proposed railgun facility would be constructed is not accessible to children, nor is it near any facility, such as a school or a daycare center, where children congregate. Moreover, no potentially harmful substances would be introduced in the environment as a result of the proposed construction. During EM launcher firings, access to the entire EMLF area is controlled and there is no potential for children to be present on or near the site.

The noise readings taken so far for operation of the 32-MJ railgun (Section 3.5) suggest that areas where children live and play outdoors (installation housing area and residences north of the installation) would be no more affected by noise from the proposed 64-MJ railgun than they are now by large-gun firing noise, which is within acceptable limits. If noise from operation of the 64-MJ proves to be louder than anticipated, measures would be taken to reduce it to acceptable levels (Chapter 5, Mitigation Measures). Thus, implementation of the Preferred Alternative would not pose disproportionate environmental health risks and safety risks to children.

4.3 Transportation

4.3.1 No Action Alternative

Under the No Action Alternative, existing traffic conditions would remain the same as described in Section 3.3.

4.3.2 Preferred Alternative

Under the Preferred Alternative, pavement would be added to Shock Tube Road and Frontage Road to provide personnel parking and turnaround space for users of the proposed facilities, but the roads would continue to allow traffic through this part of the installation (see Figure 2-5). During test operations, the gates that would be installed across the roads would be closed; however, base personnel would be alerted ahead of time and be able to take an alternative route to their destination, if needed. Emergency vehicles would always be allowed to pass through the site. Barriers would also be erected at intersections of roads leading to the facilities prior to tests (Figure 2-7); again, installation personnel would be notified ahead of time to avoid this route. The impact of closing the gates and erecting barriers during test events is expected to be minimal.

There would be short-term, temporary minor impacts to traffic near the project area during the period of construction. These impacts would be largely mitigated by posting signs to alert drivers during the construction period.

Construction activities would generate some additional traffic on and off base, as construction vehicles and equipment travel to and from the project site, and workers commute back and forth. However, this increase in traffic would be temporary and no larger than that associated with similar construction projects on or near Dahlgren. Because operating personnel already work at the EMLF or in other Dahlgren facilities, there would be no long-term increase in traffic due to the operation of the new facility.

4.4 Air Quality

4.4.1 No Action Alternative

Existing air quality conditions would remain unchanged under the No Action Alternative.

4.4.2 Preferred Alternative

Construction of the proposed EM railgun facility would temporarily increase air pollutant emissions, including emissions of flying dust and vehicle emissions from personnel vehicles and construction equipment. These impacts would cease after construction is complete and would not be significant.

With respect to long-term emissions, while a new facility would be constructed, no new stationary source (e.g., a boiler to produce heat) would be required. Also, the new EM railgun facility would utilize existing power sources and no new power-producing source (e.g., an electrical generator) would be added. As indicated in Section 3.4, NSF Dahlgren is currently operating under an air quality State Operating Permit rather than a Major Source Title V permit. No significant impacts to air quality are anticipated and no change to the existing air permit would be needed.

As just mentioned, at this time no additional power source is needed to support the proposed EM railgun facility. The existing power grid would supply the PFN's electrical capacitors. Engineers and scientists determine the amount of power required for a particular railgun test and control the amount of energy released by the charged PFN accordingly. The time required to charge the PFN is proportional to the power available in the grid. Hence, the time between firings of the railgun is limited to the time it takes the PFN to charge. With a managed capacitor charging rate, sufficient power would be available to provide up to 64 MJ of muzzle energy multiple times per day.

4.5 Noise

4.5.1 No Action Alternative

Under the No Action Alternative, NSWCDL would continue to conduct RDT&E activities as at present. Noise conditions around Dahlgren would remain the same as described in Section 3.5.

4.5.2 Preferred Alternative

Operational Activities

Under the Preferred Alternative, projectiles launched from the proposed EM railgun would be contained within a projectile range/trajectory control structure and terminate in a tactical catch structure. These structures are expected to attenuate sound pressures, and, therefore, noise from the launcher and projectile flight.

The type of noise generated by the operation of the proposed EM railgun would be very short in duration for each event (i.e., audible to a listener for less than a second with a quick rise and fast decay of noise levels); therefore, peak noise measurements and USACHPPM guidelines applicable to impulsive noise provide the appropriate approach to discuss the noise impacts of the proposed action. The guidelines state that large weapon events with peak noise levels below 115 dBP are at low risk of generating noise complaints, while events with peak sound levels between 115 dBP and 130 dBP are at moderate risk of generating complaints. Above 130 dBP, there is a high risk of generating noise complaints; above 140 dBP, physiological and structural damage claims are possible.

As explained in Section 3.5.2, the peak noise levels currently generated by railgun shots are lower than those resulting from large-caliber gun firing events along the Potomac River. For example, a 139-dBP maximum peak noise level from large gun firing was measured at the off-installation Range Station 3B (see Figure 3-4) along the river, while a 123-dBP maximum peak noise level from railgun firing was recorded at the on-installation river bank receptor, Line of Flight by Riverbank (see Figure 3-4). Yet, the distance from Range Station 3B to the large gun firing point is approximately twice that separating Line of Flight by Riverbank from the railgun firing position. Based on these observations, peak noise levels are expected to continue to be dominated by the existing large gun firing as well as the EEA Range detonation activities.

As discussed in Section 3.5, peak noise levels do appear to increase slightly when muzzle energy increases. However, the magnitude of the increase is relatively small and no clear correlation can be established from the measurements taken so far. Dahlgren will continue to measure noise levels as the muzzle power levels of the existing 32-MJ railgun are increased. Under the proposed action, power levels would ultimately increase up to a muzzle energy of 64 MJ.

Because the EM railgun system is a new type of large weapon that is still under RDT&E, no noise model exists to predict noise impacts, as, for example, can be done for a conventional large weapon by using the DoD’s BNOISE2 model. The purpose of RDT&E is precisely to test technology to its limits to ensure human safety and the success of the technology. As RDT&E of any new technology progresses, impacts are identified and mitigation techniques are developed concurrently, to ensure that the technology operates within accepted standards. This particularly applies to noise, because personnel onboard ships will be working extremely close to the weapon being tested once it is installed on ships.

Therefore, more tests and subsequent noise measurements under a range of conditions are needed before it is possible to draw reliable conclusions about the potential noise impacts from greater muzzle energy levels. These measurements will be used to: 1) develop a mathematical noise prediction model to forecast peak noise for higher muzzle energies, if possible; 2) ensure that noise levels likely to generate noise complaints (i.e., greater than 130 dBP at noise sensitive receptors) are minimized and/or mitigated in the future; and 3) ensure that all noise impacts are minimized and/or mitigated.

Construction Activities

Impacts on noise levels in the vicinity of the project site during construction of the proposed facilities would include noise from construction equipment, generators, power tools, and vehicles driven to and from the construction site. These impacts would vary widely depending on the phase of construction and the type of equipment being used. The noise generated would be similar to that generated by similar construction projects in the area. Furthermore, the project site is adjacent to ranges that already experience high levels of routine operational noise, and there are no sensitive receptors (such as residences, schools, churches, hospitals, etc.) in the immediate area. Therefore, noise impacts from construction activities would be insignificant.

4.6 Infrastructure

4.6.1 No Action Alternative

Under the No Action Alternative, existing utility systems and demands on their capacity would remain unchanged.

4.6.2 Preferred Alternative

The proposed addition to the EMLF, Building 1410, as well as the proposed control building, would require electrical, sewer, water, and communications utility services, as described in Chapter 2. These services would come from existing service connections within the EMLF building. Service capacities are adequate to support the additional loads.

The existing utility grid would support the operation of the 64-MJ railgun system. At maximum muzzle energy, the number of firings per day and the recharging time between shots may be limited by the existing electrical grid. Supplemental NEPA analysis and documentation would be required if RDT&E of the railgun reveals that additional power beyond the capability of the existing electrical infrastructure is necessary.

4.7 Cultural Resources

4.7.1 No Action Alternative

There would be no impacts to architectural or archaeological resources under the No Action Alternative.

4.7.2 Preferred Alternative

The proposed 64-MJ railgun project site has been previously disturbed by the construction of Shock Tube Road, Frontage Road, Gambo Road, Hideaway Lane, and the conical shock tube (dismantled in 1993) as well as of the existing EMLF. Therefore, no archaeological resources are likely to be present at the site and there is no potential for adverse effects to such resources.

As described in Section 3.7, the foundation of the Cold War conical shock tube facility and some above-ground features (see photos in Appendix D) remain on the proposed 64-MJ railgun project site. The proposed action would require demolishing the foundation and above-ground features to slightly below grade. The underground portions of the massive conical shock tube foundation would be left in place to minimize ground disturbance and expense. An 8-in topping slab of concrete would be placed on some of the remaining foundations to form the new 656-ft projectile terminal range for the 64-MJ railgun.

Because the conical shock tube foundation and site were not included in the installation's 1993 architectural survey (Navy, 1993), the historical significance of the site is being evaluated as part of an updated installation architectural survey currently underway. Results are expected to be sent to VDHR for their review within the next few months. The Navy sent a letter to VDHR on December 8, 2008 asking for their comments on the proposed impacts to the conical shock tube site and structures (letter in Appendix D). VDHR responded (letter dated December 18, 2008; included in Appendix D) that no further identification efforts are warranted, as no historic properties will be affected by the action. Therefore, there would be no impacts to architectural or archaeological resources under the Preferred Alternative.

4.8 Health and Safety

4.8.1 No Action Alternative

Under the No Action Alternative, Dahlgren would continue to conduct weapon/explosive testing at various locations, as at present. Dahlgren would continue its long history of safe testing. Operations would continue to be conducted in accordance with federal and state regulations, stringent DoD policies, and carefully-conceived management controls and SOPs.

4.8.2 Preferred Alternative

Explosives Safety

Operation of the proposed facility would not involve the use of explosives and, therefore, would not generate any ESQD arcs. Of the various railgun facility structures, three structures – the launch building, the projectile control structure, and the tactical catch chamber – are within the ESQD arc of Building 1180, as discussed in Section 2.1.2. Explosives in the process of being x-rayed are stored overnight or over the weekend at Building 1180. Since the three proposed structures are within an ESQD arc, a site approval request (NSWCDD, 2008) was forwarded to NOSSA, which granted both explosives safety site and final safety approvals for this project, provided that no railgun operations take place when ordnance is present in Building 1180 (NOSSA, 2008). The restriction that no ordnance will be present in Building 1180 during the firing at the launch facility is included in SOPs for operations at Building 1180 as well as for operations of the 32-MJ railgun in the EMLF (Building 1410). Further, the Dahlgren Range Operations Center coordinates the operations of both facilities, and based on the SOPs, would ensure that no ordnance is present in Building 1180 before EMLF operations would be approved. The NOSSA endorsements are included in Appendix B.

General Occupational Safety and Health

Dahlgren has a long history of safe testing, and this practice would continue with the construction and operation of the proposed railgun. All operations at Dahlgren are conducted in accordance with federal and state regulations, stringent DoD policies, and carefully-conceived management controls and SOPs. These policies and SOPs include, but are not limited to, very specific operating parameters for range clearance and scheduling, safety controls, environmental preservation, materials handling safety procedures, and control hazard briefings. Additionally, the dedicated technical facilities and equipment at Dahlgren have features specifically designed to support safety requirements.

Magnetic Fields

The operation of the EM railgun system presents a potential EM hazard resulting from the magnetic fields generated during the operation of the railgun. Magnetic fields predicted to result from the operation of the proposed 64-MJ railgun are presented in Figure 4-1 (Magnetic Field Predictions) (Balchin, 2007).

As shown in Figure 4-1, the magnetic field strength would be intense close to the launcher during firing. Since the EMLF would be vacated during launcher firings, and site personnel would be located in the proposed control building, 80 ft behind the EMLF and with a thick wall facing the EMLF, the magnetic field strengths experienced by these site personnel would be well below the applicable exposure standards. Using the prediction of magnetic field intensity as a function of distance shown in Figure 4-1, Dahlgren selected the lowest time-varying exposure limit from IEEE, ICNIRP, and ACGIH as its limiting magnetic field level for the planned railgun operations. According to Figure 4-1, this level occurs at approximately 80 feet away from the railgun during firing, where the magnetic field intensity is equal to 0.833 G, the ICNIRP guideline for time-varying magnetic field exposure to pacemakers (Table 3-14). Any personnel having an active implantable medical device (AIMD), such as pacemakers and implantable

Magnetic Field Predictions

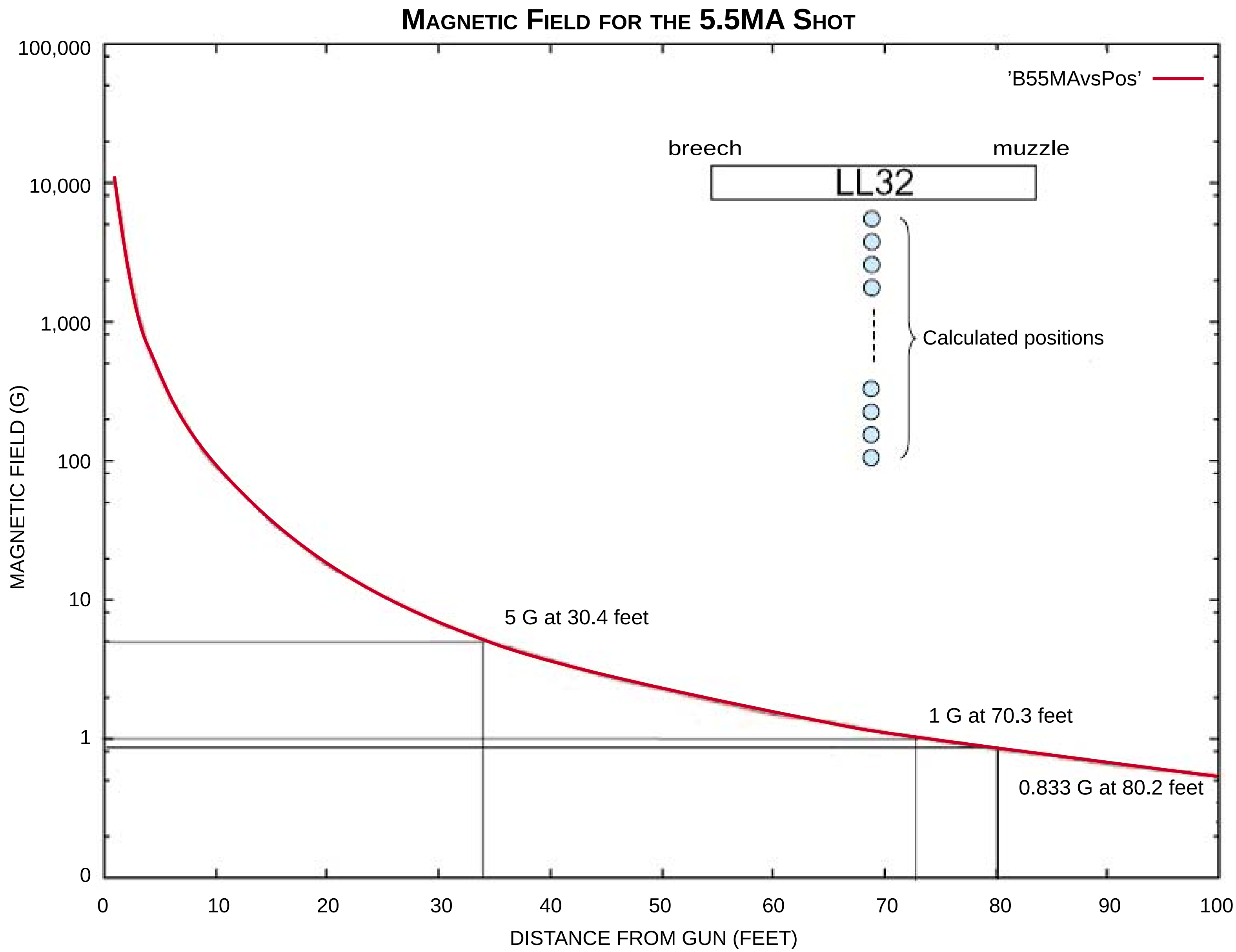

Figure 4-1

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cardioverter defibrillators, must inform the Process Supervisor prior to the firing of the railgun. These individuals would not be allowed to be closer than 80 ft from the muzzle during firing, but could be in the proposed control building, which would be more than 80 ft from the railgun muzzle.

The 80-ft buffer zone around the launcher would include only a small area outside of the EMLF (Building 1410) (Figure 4-2, Relationship of Safety Buffer Zone to Other Land Uses). At 80 ft from the launcher during firing, there would be a magnetic field strength of 0.833 G (Figure 4-1). For comparison, this magnetic field strength level is slightly more than five times the magnetic field strength experienced by an individual at one foot from an operating electric can opener. Table 4-1 compares the launcher magnetic field strength levels to the established IEEE exposure limits at 80 ft away from the firing launcher at specific representative frequencies.

Table 4-1
Magnetic Field Strength Levels Comparison

Frequency (Hz)[1]	Uncontrolled Environment Exposure Limit[3] (G)	Launcher Magnetic Field Levels (G)	Magnitude Below Exposure Limit	Controlled Environment Exposure Limit[3] (G)	Launcher Magnetic Field Levels (G)	Magnitude Below Exposure Limit
0.076	1180	0.833	1416 times	3530	0.833	4237 times
10	18.1	0.833	21.7 times	54.3	0.833	65.1 times
370[3]	9.04	0.833	10.8 times	27.1	0.833	32.5 times
1120	0.613	0.833	-[4]	18.3	0.833	21.9 times

[1] The mid-point frequency from the IEEE C95.6 frequency ranges was selected for illustrative purposes.
[2] Exposure limits as cited in IEEE C95.6 *Standard for Safety Levels with Respect to Human Exposure to Electromagnetic Fields, 0-3 kHz* (2002).
[3] Includes the common 60 Hz electricity associated with electrical systems used in the US.
[4] Exceeds the uncontrolled (general public) exposure limit at 80 feet by 1.3 times; however, the general public and site personnel will not have access to the launcher during firing activities. Therefore, no overexposures would occur.
Hz = Hertz
G = Gauss

The predicted magnetic field levels represent the worst-case exposure potential. However, the launcher would be constructed with a series of steel plates along its length on both sides, which would provide a degree of shielding from the radiated electric and magnetic fields. Additional protection would be provided by the metal walls of the existing EMLF and the proposed launcher building addition because metal substantially shields from and attenuates magnetic fields.

Electrical Fields

The planned testing of the EM railgun system would involve the generation and discharge of electrical energy at levels that would eventually reach 5.5 mega amps (MA), resulting in a muzzle energy of 64 MJ. The duration of the firing pulse is approximately 8 milliseconds (ms), which results in a very short exposure time.

The electric field generated by the EM railgun was measured in a series of eight pulses during 32-MJ launcher firings (but below 32 MJ muzzle energy) at probes placed inside and directly outside of the EMLF (Balchin, 2007). The electrical fields observed were below the established IEEE exposure limits in IEEE C95.1 *Standard for Safety Levels with Respect to Radiofrequency Electromagnetic Fields, 3 kHz to 300 GHz*. Measurements showed that the highest electric field reading inside the EMLF was 17 kV per meter (kV/m). The IEEE exposure limit applicable to electric fields associated with the EM railgun system testing is 100 kV/m. Thus, the highest measurement within the EMLF during launcher testing was approximately 5.8 times lower than the exposure limit.

The highest electrical field measured outside the EMLF during a test was 0.3 kV/m (Balchin, 2007), which is about 17 times lower than the household guideline limit value of 5 kV/m (WHO, 2008c) and approximately 333 times lower than the 100 kV/m exposure limit applicable to electric fields associated with the existing EM railgun system testing.

Electric and magnetic field levels were also predicted for the closest locations where ordnance and persons may be present (DoN, 2003). As discussed in Section 2.1.2, the closest on-site facility in which ordnance is stored and handled is Building 1180. The electric and magnetic field levels reaching this building (located at a distance of 1,250 ft from the railgun facility) were modeled, even though no ordnance would be present at this building during railgun operations (NOSSA, 2008). Also modeled were the nearest occupied building, Building 1426, at a distance of 435 ft; and the portion of US 301 closest to the railgun building, 1,601 ft away.

The results, presented in Table 4-2, show that both electric and magnetic field strengths are more than an order of magnitude below exposure limits at all locations.

Table 4-2
Electrical and Magnetic Field Exposure Limits

		Electric Fields (Volts/meter)		Magnetic Field Strength (Gauss)	
Location	**Concern**	**Limit**	**Predicted**	**Limit**	**Predicted**
Control Van	HERP	614	0.60	2.3	0.32
	EMI	> 3.0		4.5	
Building 1426	HERP	614	0.4	2.3	0.068
Building 1180	HERO	50	0.97	74.5	0.008
US Route 301	EMI	> 3.0	0.40	4.5	0.005

Notes:
N/A- NAVSEA OP3565 does not specify magnetic field limits for HERO at any frequency.
* There is no electric field limit prescribed in either military or commercial standards at frequencies below 100 kHz. 3 V/m is prescribed for medical equipment (IEC, 2007), but applies to frequencies from 80to 2500 MHz. The implication is that electric field limits would be much higher than 3 V/m, likely hundreds of V/m. Ambient environment from AM broadcast stations are on the order of a few V/m.
Sources: Bean, 2006, DoN, 2003, 2002, 1999 and IEEE, 2002, 1999.

Therefore, it is expected that magnetic field and electrical field exposures for personnel on-site and on-installation, as well as for the public off-installation, during firing of the 64-MJ railgun,

Relationship of Safety Buffer Zone to Other Land Uses

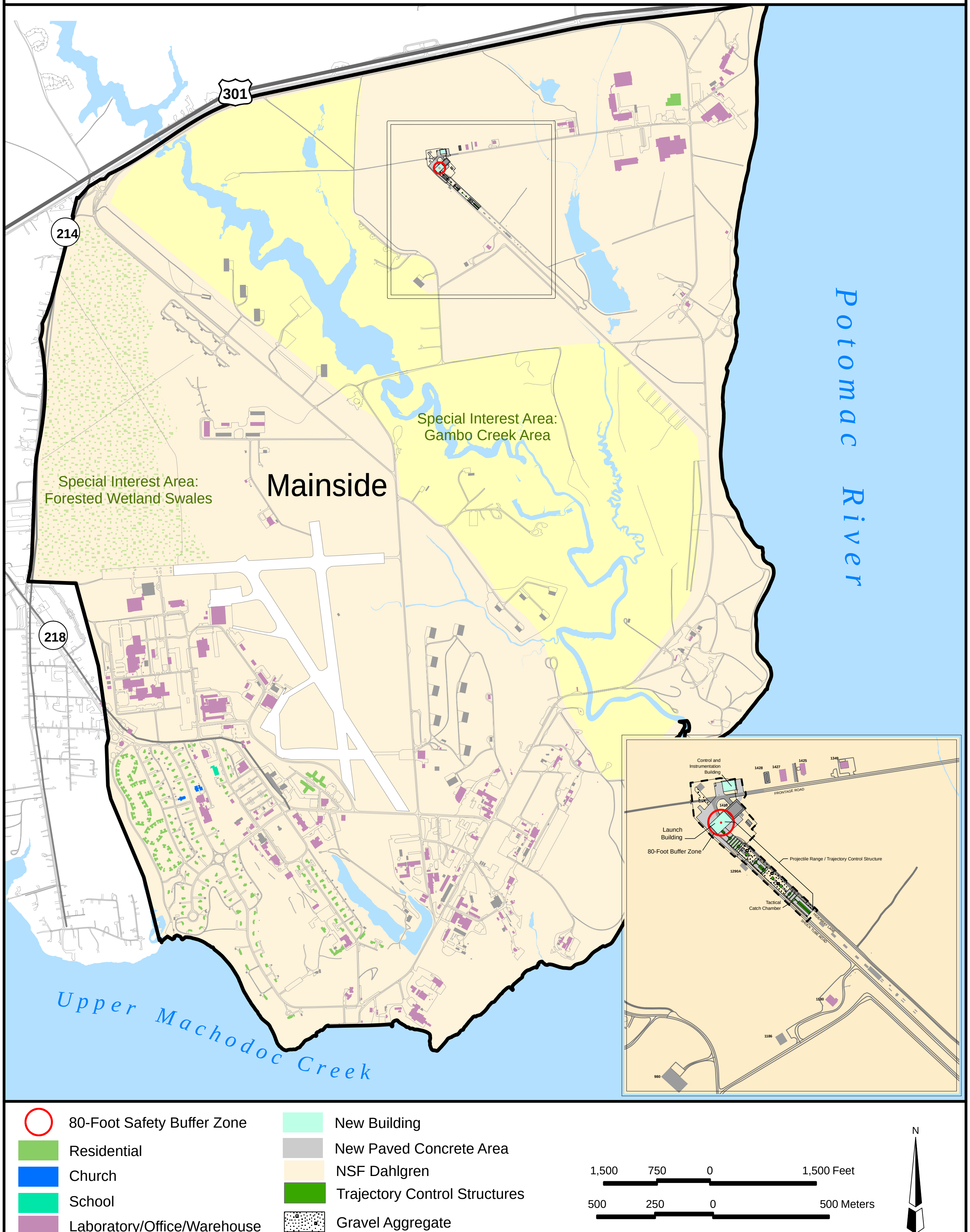

Figure 4-2

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would not exceed established and scientifically-based exposure limits. Field measurements would be conducted during actual testing to validate these predictions.

Hazardous Substances

The proposed project site has been disturbed in the past to construct roads, the conical shock tube, and the EMLF; it is unlikely that any hazardous waste or unexploded ordnance (UXO) exists at the site. However, because of the installation's history as a weapons testing facility, the potential for UXO exists throughout NSF Dahlgren and all ground-disturbing activities have the potential to expose live ordnance. NSWCDL has SOPs to deal with UXO when ground is disturbed, and an Explosives Ordnance Disposal Team to detect, secure, and dispose of any ordnance found.

The project site is not near any identified installation restoration sites. During construction, it would be NSF Dahlgren's responsibility to determine whether any generated solid waste meets the criteria of a hazardous waste; if the criteria are met, NSF Dahlgren would manage the waste as a hazardous waste. Soil suspected of contamination would be tested. Any hazardous waste and contaminated soil would be disposed of in accordance with applicable federal and State laws and regulations. The applicable laws and regulations include, but are not limited to, the Virginia Waste Management Act (*Virginia Code* sections 10.1-1400, *et Seq*.), the Virginia Hazardous Waste Management Regulations (9 VAC 20-60), and the Virginia Solid Waste Management Regulations (9 VAC 20-80).

As described in Section 3.8.3, NSF Dahlgren has a fully-developed hazardous materials management program in place, in accordance with OPNAVINST 5100.23G procedures and regulations. Use of hazardous materials other than oils for lubricating or for high voltage insulation would not be routine at the new facility. Holding tanks for oil would not be connected to the building's drainage system and would be protected from accidental leaks and spills. Any hazardous waste would be disposed of in accordance with applicable federal and State laws and regulations.

4.9 Natural Resources

4.9.1 No Action Alternative

The No Action Alternative would maintain the status quo. The proposed railgun structures would not be constructed and natural resources would remain as described in Section 3.9.

4.9.2 Preferred Alternative

4.9.2.1 Topography, Geology, and Soils

The ground in the vicinity of the proposed railgun structures is mostly level, so there would be no significant change to topography with implementation of the proposed action. Construction activities would have no impact on geological formations.

About 3.5 ac of soils would be disturbed to prepare the project site for construction of the new buildings and pavement (existing pavement and the EMLF occupy part of the 5 ac that would be disturbed). The suitability of the soil type, which was originally Bladen Loam but is now probably a mixture of natural soil and fill, to support structures is being investigated as part of the on-going design phase of the project. Construction activities would include earthmoving to remove vegetation and level the site as well as excavation to prepare for the placement of building foundation footings. Short-term soil erosion could result from these activities as soils are exposed to wind and stormwater. In the long-term, impervious surfaces on the site would increase by 1.44 ac, which could lead to some soil erosion at the edge of the new pavement during storms. Impacts on soils and potential increased soil erosion would be largely mitigated, however, by employing soil erosion and sedimentation control best management practices (BMPs), such as seeding exposed soils with grass seed; building silt fences and holding ponds during construction; and designing and putting in place permanent stormwater management features.

In accordance with Virginia Stormwater Management Regulations, because land disturbance to build the new facilities would exceed one acre, a General Permit for Stormwater on Construction Sites would be required. Clearing and grading activities, installation of staging areas, parking lots, roads, buildings, utilities, or other structures, soil/dredge spoil areas, or related land conversion activities that disturb 2,500 square feet or more are regulated by the Erosion and Sediment Control Law and its implementing regulations. NSF Dahlgren would prepare and implement Erosion and Sediment Control Plans that are consistent with state law.

As a component of the General Permit, the construction contractor would develop a stormwater pollution prevention plan. The permit requires the use of BMPs for erosion and sediment control at the construction site. The permit also requires the contractor to regularly inspect stormwater discharges from the site to ensure that the BMPs are controlling the discharge of pollutants to the maximum extent practicable, and are meeting water quality standards. In addition, the pollution prevention plan requires the contractor to manage other wastes on site, such as building materials, garbage, and debris, and to have controls to minimize the exposure of these materials to stormwater in order to minimize the discharge of pollutants to state waters.

4.9.2.2 Water Resources

Groundwater

As discussed in Section 3.9, the Middle Potomac Aquifer is the only consistently productive aquifer in the vicinity of Dahlgren. The deep wells of Dahlgren and surrounding areas draw primarily from this aquifer. The static water level of the aquifer was found to range from approximately 116 to 123 ft below ground surface (Navy, 2001). The proposed construction and operation activities would not penetrate the aquifer. If the project site serves as part of the aquifer recharge area, the addition of 1.44 ac of impervious surface would have no noticeable effect on the amount of groundwater recharge because stormwater management plans include directing stormwater runoff into grassy swales to be absorbed into the ground.

Surface Waters

As the proposed railgun site does not include any ponds, streams, or wetlands, there would be no direct impacts to surface waters from implementation of the proposed action. Indirect impacts to wetlands and stormwater-related impacts are described below.

Wetlands

Although there are no wetlands on the proposed railgun site, there are delineated wetlands approximately 65 ft to the northwest, 36 ft to the west, and 75 ft to the east of the site. The wetlands to the east come within 5 ft of the proposed site fence line. VDGIF, in their January 8, 2009 response to the Navy coordination letter (in Appendix E), recommended that "Based on the proximity of the project area to water resources, we recommend maintaining undisturbed wooded buffers of at least 100 feet in width around all on-site wetlands." While NSF Dahlgren strives to maintain a 100-ft buffer around wetlands, in this case it would not be possible because of the proximity of the wetlands to the project area.

VDGIF also recommended implementation of, and adherence to, strict erosion and sediment control measures. During construction, the removal of soil to accommodate construction activities could have temporary adverse impacts on the water quality of the adjacent wetlands. Exposure of soils during construction could result in erosion and the transport of sediments in stormwater runoff to the wetlands. In addition, construction debris and materials associated with project development could impact water quality if transported to the wetland by wind or stormwater runoff. To avoid and minimize these indirect impacts, NSF Dahlgren would prepare, implement, and enforce soil and sediment erosion control and stormwater pollution prevention plans, as described in Section 4.9.2.1 and in the Stormwater section below. A key measure in these plans would be to install a standard silt fence consisting of wood stakes covered with fabric, or a super silt fence consisting of metal chain link fence covered with fabric, around the construction area to stop wind-blown soil and water-borne sediments from entering the wetlands during construction. These fences would also serve to keep construction equipment within the construction zone and out of the wetlands.

After construction, the silt fences would be left in place until the area where construction occurred is stabilized with adequate vegetation cover to deter stormwater from entering the wetlands. The main long-term method for minimizing the transport of sediments into the wetlands, however, in this relatively flat area would be the construction of grassed swales that would slow down stormwater and allow time for sediments to settle out of the stormwater before reaching the wetlands. Development, application, and enforcement of soil erosion and sediment control and stormwater pollution prevention plans thus would minimize indirect impacts to wetlands, resulting in negligible adverse short- and long-term impacts.

Stormwater

With respect to stormwater, construction of the various railgun structures (as described in Chapter 2 and depicted in Figure 2-5) and the addition of pavement to Shock Tube, Gambo, and Frontage Roads for parking and turnaround space would result in an increase of 1.44 ac of new impervious surface added to the existing 1.12 ac of such surface already present on the project site, which, after construction, would cover 4.4 ac within the fence line. The proposed grading of the site would maintain existing drainage patterns and would not concentrate runoff. A low impact stormwater management design would be used, consisting of vegetated swales and outlet spreaders that would help maintain the existing EMLF's overland flow of stormwater. As described above, flows to adjacent wetlands would be avoided to the maximum extent practicable to minimize indirect adverse impacts.

Section 319 of the CWA requires NSF Dahlgren to be consistent with Virginia non-point source pollution abatement programs that implement the act. The proposed development would require adherence to state criteria for stormwater management and water quality as stipulated in Virginia Stormwater Management Regulations and Virginia Erosion and Sediment Control Regulations. The area of land disturbance associated with project development would exceed one acre; therefore, a General Permit for Stormwater on Construction Sites would be required. A stormwater management plan would be developed in accordance with the VDCR Soil and Water Conservation Program guidelines. This plan would be consistent with the stormwater management plans already in place for Dahlgren. Development, implementation, and enforcement of these plans would result in minimal adverse impacts to water resources.

Floodplains

Because the proposed railgun site and the surrounding area are well outside the 100-year floodplain level, the proposed action would have no floodplain impacts.

4.9.2.3 Vegetation

Construction of the proposed facility would result in minor, long-term, adverse impacts to the mixed hardwood and pine forest that exists along the edge of the site and Frontage, Shock Tube, Gambo Roads, and Hideaway Lane (see Figure 2-5). Approximately one acre of trees, shrubs, and understory plants would be cleared. The forest vegetation that would be removed would not be within the delineated wetland areas. The affected forest is edge habitat because of the roads that run through the site and the EMLF; therefore, the acre of forest that would be cut would essentially create a slightly larger clearing. Because it is on the edge of the forest, and is not deep forest habitat, the affected vegetation does not provide suitable habitat for species that require large tracts of undisturbed forest. The loss of less than one acre of forest, when compared to the whole forested area at NSF Dahlgren, which is more than 1,550 ac, would be a negligible adverse impact on the natural resources of the installation. Application of the mitigation measures to minimize stormwater impacts during construction, which would include construction of a silt fence around the construction site, would also protect the remaining, undisturbed forest from damage by construction equipment, minimizing impacts on the remaining forest.

4.9.2.5 Wildlife

Construction of the proposed facilities and the resultant removal of approximately one acre of mixed hardwood and pine forest would have short- and long-term adverse effects on wildlife species that inhabit the edges of regenerating mixed hardwood and pine woodlands (such as the bird, mammal, amphibian and reptile species listed in Section 3.9.2.5) and use the area for nesting, cover, water, and as a food supply. Wildlife that previously inhabited or foraged in this area would be displaced. More mobile creatures would leave the area, but some small, slow-moving creatures might be destroyed during construction. Competition from within their own species and with other species may limit the ability of displaced individuals to find new homes or habitat. Removal of trees and undergrowth in the immediate vicinity of construction would reduce the amount of protective cover for species that travel and feed on the ground; nesting sites for tree-, shrub- and ground-nesting bird species; denning sites for mammalian species; and food sources now provided by forest trees, shrubs, and herbs. Woody forage and mast (acorns) for deer and turkeys, for example, would be reduced in the project area.

The long-term impact on wildlife at NSF Dahlgren, however, would be tempered by two factors: (1) the amount of wildlife habitat directly affected by the project – one acre – is small in comparison to the natural areas on the installation, which are estimated to cover more than half of the base’s 2,384 ac, and (2) the project area is on the edge of the forest and is already cut through by four roads and the EMLF. The site is not deep forest, where neotropical migrant birds might find nesting sites relatively safe from nest predators. The species of wildlife that thrive on forest edges, such as deer, turkey, cardinal, mockingbird, and crow, are not likely to change because a new edge would be created. Therefore, aside from short-term adverse impacts during construction, in the long-term, adverse impacts on wildlife in the larger project area, and especially on the installation, would be minor.

During operation of the EM railgun facility, wildlife entering the 80-ft buffer zone could be exposed to high magnetic field levels. However, impacts to wildlife during operation of the facility would be negligible for the following reasons. First, the EM railgun facility would be cleared of all vegetation providing little to no habitat for wildlife species. Second, an 8-ft fence would be constructed and maintained around the site, preventing large wildlife (e.g., fox or deer) from coming within 80 ft of the launcher. Finally, as discussed in Section 4.8, the high magnetic field levels experienced within 80 ft of the launcher quickly dissipate and return to background levels beyond 80 ft. The magnetic field levels outside of the 80-ft buffer zone would be below the most stringent guidelines for humans (i.e., people with pacemakers or AIMD).

Even birds flying above the facility are unlikely to be exposed to high magnetic fields, as exposure levels 30 ft from the railgun have already dissipated to 5 G (Figure 4-1), a level well below exposure limits for the general population (Table 3-13). In addition, the duration of the tests is extremely short (about 8 ms), which makes it quite unlikely that a bird would fly over at the precise moment of firing. The short duration of each test also means that the likelihood of affecting any animal using magnetic fields for orientation is extremely small.

As was mentioned in Section 3.9, the proposed EM railgun facility is more than one mile from the nearest bald eagle nest, well beyond the 80-ft buffer for magnetic field levels, and well outside any area that would experience noise levels greater than 130 dB. Furthermore, the location of the facility does not offer any specialized habitats for bald eagles, either for nesting or foraging. Therefore, the likelihood of a bald eagle’s entering the 80-ft buffer area of the EM railgun facility during operation is extremely small.

4.9.2.6 Threatened and Endangered Species

There would be no impact to threatened and endangered species with implementation of the proposed action, as no such species or their habitats occur at the proposed railgun site.

4.9.2.7 Special Interest Areas

The closest SIA is Gambo Creek, which is located approximately 1,000 ft from the railgun site. All other SIAs are at least 4,000 ft away. Because of the distance between Gambo Creek and the other SIAs and the EM railgun facility, no impacts are expected from construction of the EM railgun facility.

Noise levels as a result of the operation of EM railgun facility are expected to be similar to those associated with past and ongoing large-gun operations at NSF Dahlgren. As shown in Section 3.5.2, noise levels at 1,700 ft are expected to be below 130 dBP. In addition, wildlife species tend to habituate or acclimate to changes in noise levels in their environment. Wildlife occurring in the vicinity of the test ranges on NSF Dahlgren has likely habituated to noise levels associated with large-gun test firings. As discussed in Section 4.5, noise levels at NSF Dahlgren are not expected to increase as a result of operating the proposed EM railgun facility. Therefore, there would be no significant impacts to SIAs from the generation of noise by the proposed EM railgun facility.

The SIAs are well beyond the 80-ft buffer for magnetic field levels and beyond distances where any change in the magnetic field would be noticeable; therefore, there is no potential for adverse impacts to SIAs from electromagnetic hazards.

4.10 Cumulative Impacts

Cumulative impacts have been defined by the CEQ in 40 CFR 1508.7 as:

> *Impacts on the environment which result from the incremental impact of the action when added to other past, present and reasonably foreseeable future actions regardless of what agency (federal or non-federal) or person undertakes such other actions.*

The CEQ regulations further require that NEPA environmental analyses address connected, cumulative, and similar actions in the same document (40 CFR 1508.25). This requirement prohibits segmentation of a project into smaller components to avoid required environmental analysis.

4.10.1 Existing and Expanded EMLF

The proposed action would construct structures to accommodate an EM railgun system consisting of an up to 64-MJ launcher, associated PFN modules, a control and instrumentation building, a projectile range control structure, and a tactical catch chamber. These structures would allow the Navy to develop a full-scale launcher that could be capable of generating projectile kinetic energy up to 64-MJ of muzzle energy.

This proposed action is part of the Navy's Electromagnetic Launcher Program, and as such represents a large step towards developing a full-scale railgun that eventually, after having been tested at a facility with a larger range than Dahlgren's, will be deployed on the next generation of Navy ships, such as the DDG 1000. The existing EMLF with a 32-MJ railgun (but a current muzzle energy of only 16-MJ because of the limitations of the PFN) and a smaller terminal range represented an earlier step in this rapidly progressing RDT&E program.

By building the proposed 64-MJ railgun facility adjacent to the existing EMLF, the Navy is maximizing the operational efficiency of the facility. For example, the two railguns can share the electrical PFN and the overhead crane. Keeping the two facilities together also would minimize the construction footprint and the impact on Dahlgren's resources. Combined, the two facilities require clearing 1.4 ac of forest with associated wildlife habitat (1 ac for this proposed action and 0.4 ac for the original, existing EMLF). Together, they require filling 0.09 ac of wetland (all for the original, existing EMLF). These cumulative impacts on natural resources are minor. Additionally, the existing and new facilities would share utility service lines, avoiding the need to build an entirely new utility system. Building the proposed 64-MJ launcher facility as an addition to an existing building, the cost and impacts of operating it would be less than if two separate buildings were built.

The two railguns would not be firing at the same time, so there would not be synchronous, cumulative noise or EM energy impacts, with two shots being fired at once. The EM energy released during each firing would not be cumulative; for either railgun, it would be limited to an area close to the launcher (for the 64-MJ railgun, an area no more than 80 ft from the launcher). The number of times railgun firing takes place in a month or over the course of a year might increase because there would now be two railguns; however, both railguns would share some of the PFN system, which limits the number of times each could be fired. The capacitors require time to recharge before they can produce a pulse after a railgun is fired. Nonetheless, there might be more additional firings and, therefore, some cumulative noise impacts, not with respect to the intensity of the noise, but with respect to the frequency of the noise events.

More intensive use of the Shock Tube Road corridor (which is used for other RDT&E activities) would require maintenance of the shrub-grass-herbaceous vegetation found along the roads leading to the EMLF and the proposed facilities in order to clearly see the barricades across the roads in place during operations to stop noninvolved personnel from entering the area. Approximately 15 acres of non-forest vegetation would be affected. These areas are cut with a bush hog every few years to keep the vegetation low enough to see over it down the roads, but the proposed action would cause this range vegetation maintenance to occur more frequently. No forests would be affected. Wildlife that uses the shrubby areas would be affected because the taller vegetation provides more varied food and shelter than closely-cropped vegetation.

4.10.2 Other RDT&E Activities

With respect to other "past, present and reasonably foreseeable future actions," Dahlgren has historically provided, and continues to provide important contributions to support the Fleet and

US troops. The testing of guns, ordnance and electromagnetic devices is an important portion of Dahlgren’s ongoing RDT&E work.

Large-caliber guns, including 8”, 5”, 155-mm, and 76-mm, are fired routinely at Dahlgren’s PRTR. This routine RDT&E activity has been taking place for over 80 years. The primary environmental impact of on-going large caliber gun firing is noise, sometimes exceeding 130 dBP at locations down and around the PRTR. Other principal sources of noise at Dahlgren include small caliber (guns under 30 mm) firing, explosive detonations, test aircraft including fixed wing and helicopters, and surface craft on the river.

Operation of the new railgun would add a new source of noise to Dahlgren. As explained in Section 4.5.2, because the railgun is a new type of weapon still undergoing RDT&E, there is no specific noise model available for predicting projectile launch noise, as opposed to conventional large weapons, for which DoD’s BNOISE2 model can be used. More testing and subsequent noise measurements are needed to establish a more conclusive picture of potential noise impacts from the higher muzzle energy levels and Dahlgren is currently collecting more noise data from the 32-MJ launcher and will continue to collect noise data as it scales up to a 64-MJ launcher.

At the present time, therefore, there is not sufficient data to quantitatively evaluate the increase in overall noise that would result from the operation of the proposed new EM railgun facility in combination with the noise from past, present, and foreseeable future operations. However, based on the noise levels expected to be generated by the new railgun, the frequency of railgun firing relative to other noise generating activities, the containment of most of the noise produced by the railgun, and the ongoing mitigation of noise effects at Dahlgren, cumulative noise impacts are not expected to be significant or to cause significant impacts to the environment or human health and safety.

With regard to the cumulative magnetic field impacts that could arise from the operation of the proposed EM railgun system in combination with other EM RDT&E activities at Dahlgren (which include RDT&E for radars and other sensors, lasers, communications, and electromagnetic weapons such as electromagnetic pulse generators), it must be noted that the lifetime of the magnetic field that would be generated by the proposed EM railgun system operations is calculated in milliseconds; additionally, as explained in Section 4.8.2, no magnetic field above the established exposure limits is expected to exist outside of the EMLF. Therefore, there is no potential for cumulative impacts.

4.11 Summary of Environmental Impacts

Implementing the proposed action is not expected to result in significant impacts, and the preparation of an EIS is not required. Table 4-3 presents a summary of the environmental impacts of the No Action and Proposed Action Alternatives.

Table 4-3
Summary of Environmental Impacts

Resource	No Action Alternative	Preferred Alternative
Land Use & Coastal Zone	No impacts	Consistent to the maximum extent practicable with the enforceable policies of the state's coastal management program. Consistent with Dahlgren's Area Development Plan and with existing land uses.
Socioeconomics	No impacts	Construction would provide positive economic benefits. Not expected to have significant adverse impacts that could disproportionately affect minorities, low-income persons, or children.
Transportation	No impacts.	During operations, roads going through site would be closed and barriers erected and manned on roads leading to the site except for emergency vehicles, causing installation traffic to detour around this area. Gates would be open when railgun not operating. Detours typical of other range operations and impacts minor.
Air Quality	No impacts	Area in attainment. No new stationary source (boilers to produce heat) required. No significant long-term impacts to air quality. Short-term impacts from clearing land for construction, which would be minimized by preparation and implementation of soil erosion control measures.
Noise	No impacts	Measurement of 32-MJ railgun noise when firing at 16 MJ indicates that maximum peak noise for off-installation receptors and on-installation housing would be below 130 peak decibels (dBP), the level above which there is a high risk of complaints. So far, no clear relationship established between increasing muzzle energy levels and peak noise levels. Given the greater peak noise generated from large-gun firing and explosive detonations, future peak noise levels are expected to be dominated by ordnance operations. Large caliber (5" or larger) gun firings in recent years have averaged about 800 per year. The railgun is projected to fire approximately 400 rounds per year. Unlike conventional gun firings that generate noise both at the muzzle and downrange (nearer to the public), the railgun produces noise only at the muzzle (on base) and noise quickly dissipates to much lower levels in the public areas. As muzzle energy increases up to 64 MJ, Dahlgren will take noise measurements under varying weather conditions to: (1) develop a mathematical noise prediction model able to forecast peak noise from higher muzzle energies; (2) ensure that potential high risk of generating noise complaints (i.e., greater than 130 dBP at noise sensitive receptors) are minimized and/or mitigated in the future; and (3) ensure that noise impacts to the public and Dahlgren's personnel are minor.
Infrastructure	No impacts	Utility services for the new building would come from existing EMLF service connections. The existing utility grid would support the operation of the 64-MJ railgun. At maximum muzzle energy, the number of firings per day and the time to recharge capacitors may be limited by the capacity of the grid. However, all EMLF program test objectives can be met.
Cultural Resources	No impacts	VDHR responded to a request to review historic status of the Cold War conical shock tube foundation that lies along Shock Tube Road by indicating that no further identification efforts are warranted and the project has no impact on cultural resources.
Health & Safety	No impacts	Use of range standard operating procedures (SOPs) and development and implementation of risk hazard assessments (RHAs) would mitigate risks of railgun operations. Area around the EMLF would be cleared and gates and road barriers erected to keep people away during operations. EMLF personnel would be located 80 ft from the EMLF during operations, a distance at which the magnetic and electrical field intensities generated by the railgun would be many times below the maximum permissible exposure limits. No explosives would be used for operating the railgun, and the railgun projectiles would be shot along a guideway into a heavily-reinforced tactical catch structure.
Natural Resources	No impacts	Construction of the railgun facilities would require disturbance of several acres of soil, clearing of about 1 acre of forest, and the creation of 1.44 acres of

Resource	No Action Alternative	Preferred Alternative
		impervious surface Soil erosion and sediment control and stormwater management plans would be implemented to minimize soil erosion. Strict adherence to erosion and sediment control measures would protect wetlands adjacent to the site; these wetlands would not be directly disturbed. No rare, threatened or endangered species are known to occur on or frequent the site, which is largely developed and disturbed. Wildlife affected would be those typical of forest edges. No ecologically-important special interest areas would be affected.
Cumulative	No impacts	By building the 64-MJ adjacent to the existing 32-MJ railgun in the EMLF, operational efficiency would be maximized and land impacts minimized. Minor cumulative impacts to vegetation, soils, wildlife, and stormwater would be added to EMLF impacts. The proposed 64-MJ railgun would not operate at the same time as the 32-MJ railgun and so there would be no cumulative noise or EM energy impacts. More intensive use of Shock Tube Road would require more frequent mowing of vegetation, which would affect its value to wildlife. Cumulative noise impacts when combined with large-gun noise are not expected to be significant. No potential for cumulative electromagnetic impacts with other electromagnetic sources at Dahlgren because there would be no magnetic field above established exposure limits beyond the EMLF.

5 MITIGATION MEASURES

Mitigation measures designed to minimize environmental impacts would be implemented during construction and operation of the proposed EM railgun facility. These measures include the following:

- Soil erosion and sediment control plans and stormwater pollution prevention plans will be developed and implemented, and BMPs will be maintained to minimize soil erosion and manage stormwater runoff both during construction and during operation of the proposed facilities.

- Operational restrictions on activities occurring in the proposed EM railgun structures would be implemented when any live ordnance is present in Building 1180.

- The 80-ft buffer zone around the EM launcher would be enforced during firing to prevent exposure of personnel to magnetic field levels above guidelines for the most sensitive population (people with pacemakers and AIMD).

- As discussed in Section 4.5.2, during railgun RDT&E activities, scientists and engineers would carefully monitor noise levels and gather data. Testing would gradually scale up to 64-MJ, so that that measures needed to reduce noise could be implemented prior to the 64-MJ testing. Mitigation measures will be implemented to ensure installation and non-installation personnel are not exposed to hazardous noise levels. Potential mitigation measures include erecting noise barriers or a noise muffling system, testing when weather conditions result in lower noise levels, etc.

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7 LIST OF PREPARERS AND REVIEWERS

This Environmental Assessment was prepared by:

EARTH TECH | AECOM

675 North Washington Street, Suite 300
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DTI Sector of Kratos Defense & Security Solutions		
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Naval Facilities Engineering Command Washington		
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APPENDIX A

CATEGORICAL EXCLUSIONS AND SUPPLEMENTS

8 Feb 05

MEMORANDUM

From: XDC8

Subj: RECORD OF CATEGORICAL EXCLUSION FOR THE SPECIAL PROJECT C06-03; RAILGUN FACILITY CONSTRUCTION PROJECT

Ref: (a) OPNAVINST 5090.1B
(b) SECNAVINST 5090.6A
(c) DD Form 1391 of 23 Dec 03
(d) Area Development Plan, Jun 01
(e) NSWCDD ltr 11019 ser XDW21/016 of 16 Jul 03
(f) NOSSA ltr 8020 ser N71/3482 of 15 Aug 03

1. INTRODUCTION

a. This record of Categorical Exclusion documents the impact that the construction of the Special Project C06-03, Railgun Facility construction project will have on the environment at the Naval Surface Warfare Center, Dahlgren Laboratory, a tenant of the Naval District Washington, West Area, Dahlgren, hereafter referred to as Dahlgren.

b. This record of Categorical Exclusion was prepared in accordance with references (a) and (b).

2. BACKGROUND

This proposed action is in response to the Navy's requirement for developing a long-range precision strike weapon supporting missions that are beyond the range of existing naval guns. Electromagnetic (EM) Launch Technology or Railgun is a technology that could meet the Navy's long-term requirement. The proposed action is to construct a facility to house and operate a refurbished 8MJ railgun from the "Green Farm" project. This will allow the Navy to begin the proof of concept development of railgun technology to the 64MJ level scale and performance.

3. PROPOSED ACTION

a. This proposed action, construction of the EM Launch Technology Development (Railgun) facility, reference (c), is for the erection of a one-story, 6,400 square foot pre-engineered high-bay steel frame building. The facility will provide a large gun housing room with two gun foundation pits and a bathroom. The building will have no windows, but will have roll-up doors to bring in equipment and to be used as gun bay doors.

b. This project will include site utility development, fire protection with alarms, heating, ventilation, and air conditioning for the gun bays, communications, electrical power distribution, lighting, intrusion detection and public announcement systems. Site improvements will include stormwater management, parking and paving and anti-terrorism force protection.

c. The proposed action supports the Dahlgren's mission requirements for the proof of concept for electromagnetic launch capabilities at scale and performance that can be further developed into tactical and strategic capabilities for future weapons systems.

d. This project is in accordance with reference (d) and will be located on the existing 2000 Meter Test Range.

4. PROPOSED ACTION ALTERNATIVES

a. No Action.

The No Action alternative is rejected because the proposed Special Project would not be constructed and RDT&E capability of the Railgun technology would not be developed. Currently, there are no systems of the scope and scale required to fully develop EM launch capabilities within the United States. Existing facilities within the United States are sub scale and are limited in their growth capabilities.

b. Renovation and Modernization.

The Renovation and Modernization alternative is rejected because there are no other permanent facilities available at Dahlgren large enough to support this mission.

c. Leasing.

The Leasing alternative is rejected because there is no existing facility of this size available for leasing within the required area. In addition, construction requirements for this project are not typical of commercials based space.

5. EXISTING ENVIRONMENT

The existing environment for the proposed action on Mainside, Dahlgren is an area already listed as an operational range (2000 meter land range) for research, development, testing and evaluation of weapons systems development under references (c) and (d). Utilities are available in the general area to support the current level of operational activities but will need to be upgraded to accommodate the proposed action.

6. ENVIRONMENTAL CONSEQUENCES

a. Air Pollution

Dahlgren is located in an area that is in compliance with the National Ambient Air Quality Standards for all air pollutants defined in the Clean Air Act Amendment of 1990. Therefore, this action does not need to be evaluated according to the guidelines in the Clean Air Act General Conformity Rule.

Any construction equipment used for the execution of this project will emit de minimus quantities of NOX and VOCs, and will therefore have minimal impact to the environment.

b. Ordnance

The immediate proposed project area should not be contaminated with ordnance; however, normal precautions for unexploded ordnance encountered during construction would be observed and ordnance sweeps will be performed prior to any ground intrusion.

Since the proposed project is in the close proximity to the Inhabited Building Distance arc generated from the Radiography Facility (Building 1180), a site approval request, reference (e) was forwarded to the Naval Ordnance Safety & Security Activity. Reference (f) granted both explosives safety site and final safety approvals for this project providing that no concurrent operations take place in the Railgun Facility when ordnance is present in building 1180.

c. Cultural Resources

The proposed area of construction is in an area that has undergone a cultural resources survey and found to be free of archaeological and historical restrictions. This project area is not located in a historic district or contains any known sites eligible for nomination to the National Register of Historic Places. If there are archaeological artifacts discovered during the course of construction, Dahlgren's Cultural Resources Office will be notified.

d. Natural Resources

Wetlands: The proposed construction area does not contain any known wetlands.

Endangered Species: Per reference (c), the proposed facility location is within an area already disturbed by previous construction and ordnance operational activities. There are no known endangered species that would be threatened or harmed by this proposed action.

Habitat Loss: The proposed action location is within an existing pine tree stand of approximately 0.4 acres and would have to be cleared to accommodate the facility and parking lot. The loss of approximately 0.4 acres of forest will not be significant given the predominately-forested nature of Dahlgren.

e. Stormwater Management and Erosion Control

Erosion and sedimentation control measures will be in place during the construction project. Plans and specifications will require the use of protective perimeter measures and site stabilization upon completion. Stormwater impact will be minimized and covered by State regulations and Navy guidelines.

f. Noise

Impacts on noise levels during construction activities would include noise form construction equipment operating on the site and from other associative equipment such as generators and power tools and would be temporary in nature. Furthermore, the proposed action site is located on an existing range, which already experiences high levels of operational noise.

g. Hazards of Electromagnetic Radiation to Ordnance (HERO)

Reference (e) enclosure (1) addresses the potential for adverse effects from the generation of electromagnetic energy (EME) within the Electromagnetic Launcher facility. Reference (e) concluded that the predicted electromagnetic field levels are below the respective Hazards of Electromagnetic Radiation to Ordnance (HERO), Hazards of Electromagnetic Radiation to Personnel (HERP) and Electromagnetic Interference (EMI) limits established by either military or commercial standards. To further address HERO, HERP and EMI levels, field measurements will be conducted during operations to confirm the energy levels predicted in reference (e).

Subj: RECORD OF CATEGORICAL EXCLUSION FOR THE SPECIAL PROJECT C06-03; RAILGUN FACILITY CONSTRUCTION PROJECT

h. Land Use

Upon completion of the proposed action, the overall land use will be consistent with reference (c).

7. CONCLUSION

The proposed action is the only action that is an economically cost-effective alternative to allow for the expansion of the mission at Dahlgren. The proposed action meets the requirements of reference (b), enclosure (1), paragraphs 5.f.(17), 5.f.(34) and 5.f.(44).

On the basis of the available information, this proposed action has insignificant impact of the environment and is considered Categorically Excluded from the requirements to prepare either an Environmental Assessment or an Environmental Impact Statement.

8. ADDITIONAL INFORMATION

For more information, please contact Ms. Ann Swope at (540) 653-8695.

Prepared by W. E. Goss, Jr.

2-8-05
Date

Ann G. Swope
Safety & Environmental Office
NSWCDL, Code XDC8

2/8/05
Date

Distribution:
XDC8 (Swope, Goss, File)

30 Mar 06

MEMORANDUM

From: XDC8

Subj: SUPPLEMENT TO CATEGORICAL EXCLUSION FOR SPECIAL PROJECT C06-03, RAILGUN FACILITY CONSTRUCTION PROJECT

Ref: (a) RECORD OF CATEGORICAL EXCLUSION FOR THE SPECIAL PROJECT C06-03; RAILGUN FACILITY CONSTRUCTION PROJECT, 8 Feb 05
(b) SECNAVINST 5090.6A

Encl: (1) VDEQ letter of 13 Feb 06

1. The purpose of this supplement is to document a proposed modification to Railgun Facility plans as described in the original Categorical Exclusion, reference (a).

2. The modification adds (a) a 32' x 100' concrete pad with embedded steel rails immediately adjacent to the southeast side of Building 1410, (b) a 40' x 40' concrete pad on the northwest side of Frontage Road opposite Building 1410, and (c) gravel access roads to the pads.

3. The proposed modification was described to the Commonwealth of Virginia Department of Environmental Quality in a Joint Permit Application dated 22 Dec 05. Enclosure (1) is the VDEQ's authorization to proceed with the proposed project modification. The VDEQ authorization further states that no additional authorization from the Corps of Engineers is required. The modification, mapped on page 2, includes a total impact of 0.09 acres of wetland. The modification presents minimal environmental impact and meets the original CATEX category requirements; paragraphs 5.f.(17), 5.f.(34), and 5.f.(44) of reference (b).

4. For more information, contact Ann Swope at (540) 653-8695.

RDNeil

Prepared by Richard D. Neil

3/30/06
Date

Ann G. Swope

Ann G. Swope
Safety & Environmental Office
NSWCDL Code XDC8

3/30/06
Date

Distribution:
XDC8 (Swope, Goss, File)
NSASP (Wray)

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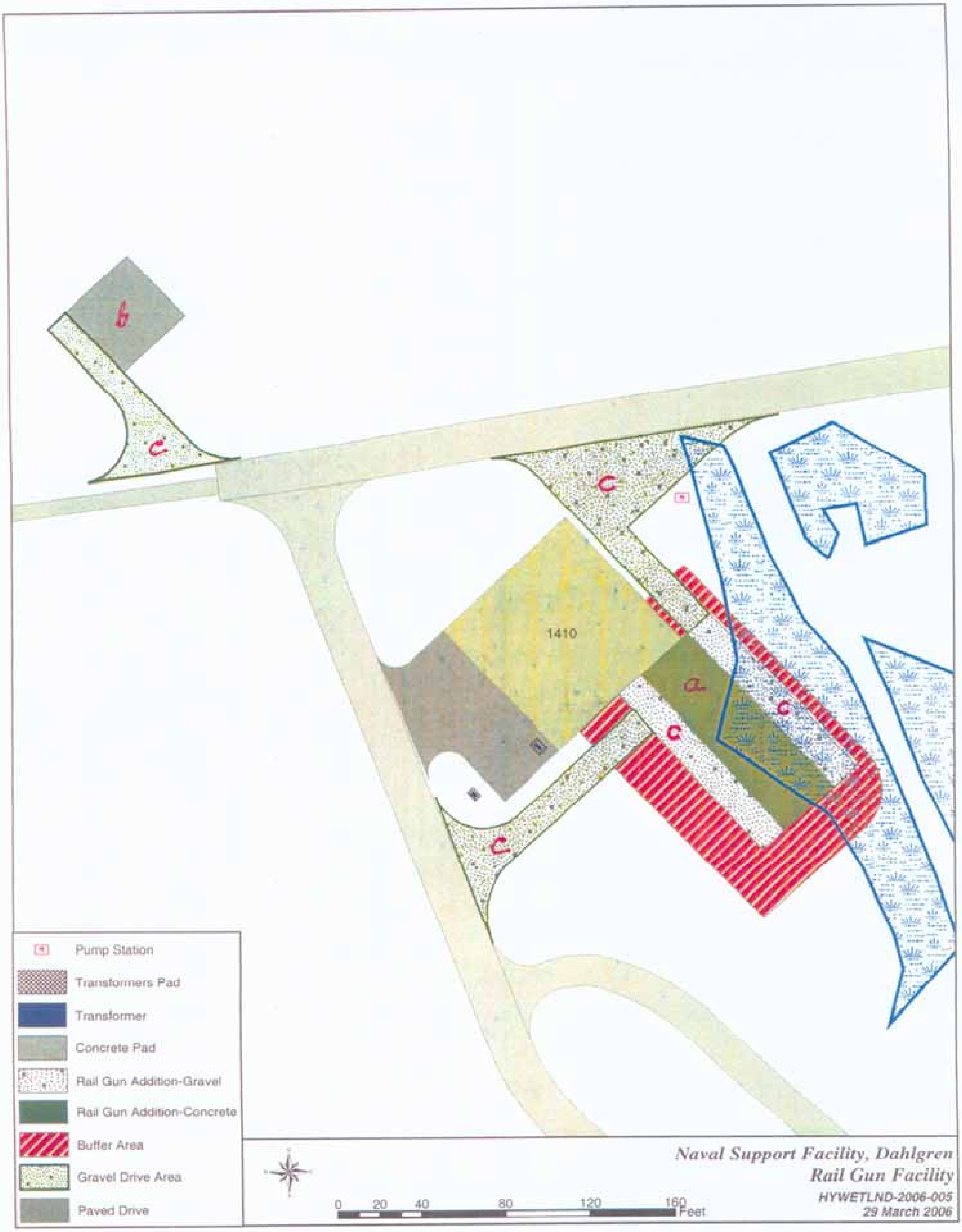

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Naval Support Facility, Dahlgren
Rail Gun Facility
HYWETLND-2006-005
29 March 2006

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COMMONWEALTH of VIRGINIA

DEPARTMENT OF ENVIRONMENTAL QUALITY

Northern Virginia Regional Office
13901 Crown Court
Woodbridge, VA 22193-1453
(703) 583-3800 *fax* (703) 583-3801
www.deq.virginia.gov

February 13, 2006

Mr. Jeffrey Bossart
NSF Dahlgren
4271 Potomac Drive, Building 189
Dahlgren, Virginia 22448-5100

RE: Virginia Water Protection (VWP) General Permit Authorization No. WP4-05-3018,
EM Launcher Building Upgrade, King George County, Virginia
Notice of Authorization to Proceed with Project Permanently Impacting up to 0.10 acre of Surface Waters

Dear Mr. Bossart:

The Department of Environmental Quality (DEQ) received your Joint Permit Application, dated December 22, 2005, on January 3, 2006 to construct "EM Launcher Building Upgrade," an addition to an existing research facility and an access drive, on a 9.5 acres acre parcel in King George County, Virginia. The proposed activities will result in the total impact of 0.09 acre of palustrine forested wetland. Based on DEQ's technical review, the application was complete as of January 3, 2006. The proposed project referenced above qualifies for coverage under VWP General Permit Number WP4 in accordance with 9 VAC 25-690-10 et seq. Please note that you are responsible for complying with the attached Part I and Part III conditions that are applicable to your project. Should the project surface water impacts exceed 0.10 acre, the permittee shall be responsible for contacting DEQ to revise the authorization, including provisions for compensatory mitigation for all permanent surface water impacts.

The work authorized by this permit also satisfies the terms and conditions contained in the Norfolk District, Corps of Engineers' State Program General Permit (SPGP-01) and no additional authorization from the Corps is required. The permittee is responsible for following all special conditions contained within the SPGP-01 that are pertinent to the project. The SPGP-01 can be downloaded from http://www.nao.usace.army.mil/Regulatory/spgp/SPGP2003.htm or obtained from any Corps office.

This letter shall serve as DEQ's authorization to proceed with the project as proposed. Please contact Byron Shumate at (703) 583-3802 or bcshumate@deq.virginia.gov with questions concerning the above information.

Sincerely,

JCrowther

Joan C. Crowther
Water Resources Development Supervisor

Attachments: Part I – Special Conditions, Part III - Conditions Applicable to All VWP Permits

cc: Ms. Regena Bronson, U.S. Army Corps of Engineers, Potomac Field Office

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XDC8
2 Oct 07

MEMORANDUM

From: XDC8

Subj: CATEGORICAL EXCLUSION FOR SPECIAL PROJECT C06-03, RAILGUN FACILITY CONSTRUCTION PROJECT, SUPPLEMENT 2

Ref: (a) RECORD OF CATEGORICAL EXCLUSION FOR THE SPECIAL PROJECT C06-03; RAILGUN FACILITY CONSTRUCTION PROJECT, 8 FEB 05
(b) SUPPLEMENT TO CATEGORICAL EXCLUSION FOR SPECIAL PROJECT C06-03, RAILGUN FACILITY CONSTRUCTION PROJECT, 30 MAR 06

Encl: (1) NSASP letter of 20 Aug 07
(2) VDEQ letter of 6 Sep 07

1. The purpose of this supplement is to document a proposed modification to Railgun Facility plans as described in the original Categorical Exclusion, reference (a); and as supplemented in reference (b).

2. This modification adds a 30′ extension to the entire northeast side of the existing 80′ x 80′ steel frame building for the purpose of housing additional capacitor banks for the railgun program. The extension slightly increases the wetland impact, however, the total wetland impact still falls within the 0.10 acre limit established with Commonwealth of Virginia Department of Environmental Quality (DEQ) in ref (b).

3. The proposed modification presents minimal environmental impact and meets the original reference (a) categorical exclusions 17, 34, and 44. The modification was described to the DEQ in enclosure (1). DEQ approved the modification in their response, enclosure (2).

4. This supplement was prepared by Richard D. Neil of the NSWCDD Safety & Environmental Office. For more information, contact Ann Swope at (540) 653-8695.

Ann G. Swope
Safety & Environmental Office
NSWCDD Code XDC8

10/2/07
Date

Distribution:
XDC8 (Neil, Goss, File)
NSASP (Pinto, Albert, Wray)

DEPARTMENT OF THE NAVY
NAVAL SUPPORT ACTIVITY
SOUTH POTOMAC
4271 POTOMAC DRIVE
DAHLGREN, VIRGINIA 22448-5106

IN REPLY REFER TO

5090
Ser HN2WTW/071
August 20, 2007

Ms. Melissa Kauskie
Department of Environmental Quality
13901 Crown Court
Woodbridge, Virginia 22193

Dear Ms. Kauskie:

Naval Support Facility, Dahlgren, Virginia was issued a permit (VMRC #05-3018) in 2006 to impact 0.09 acres of plaustrine forested wetland in association with the EM Launcher Building Upgrade (Building 1410). A required 30' x 80' addition to the east side of Building 1410 will result in an additional impact of 0.005 acres of wetland. We request a modification to our existing permit for the proposed action.

Every effort was made to reduce the size of the building footprint. A site map identifying the wetland impact and a general location map are enclosed.

Please direct all correspondence to Mr. James Pinto, Code HN2WJP, 17483 Dahlgren Road, Suite 104, Dahlgren, Virginia 22448-5119. For more information, please contact Dr. Thomas Wray II, Code HN2WTW at (540) 653-4186.

Sincerely,

JAMES PINTO
By direction

Enclosures: 1. Building 1410 Addition Site Map
2. General Location Map

Enclosure (1)

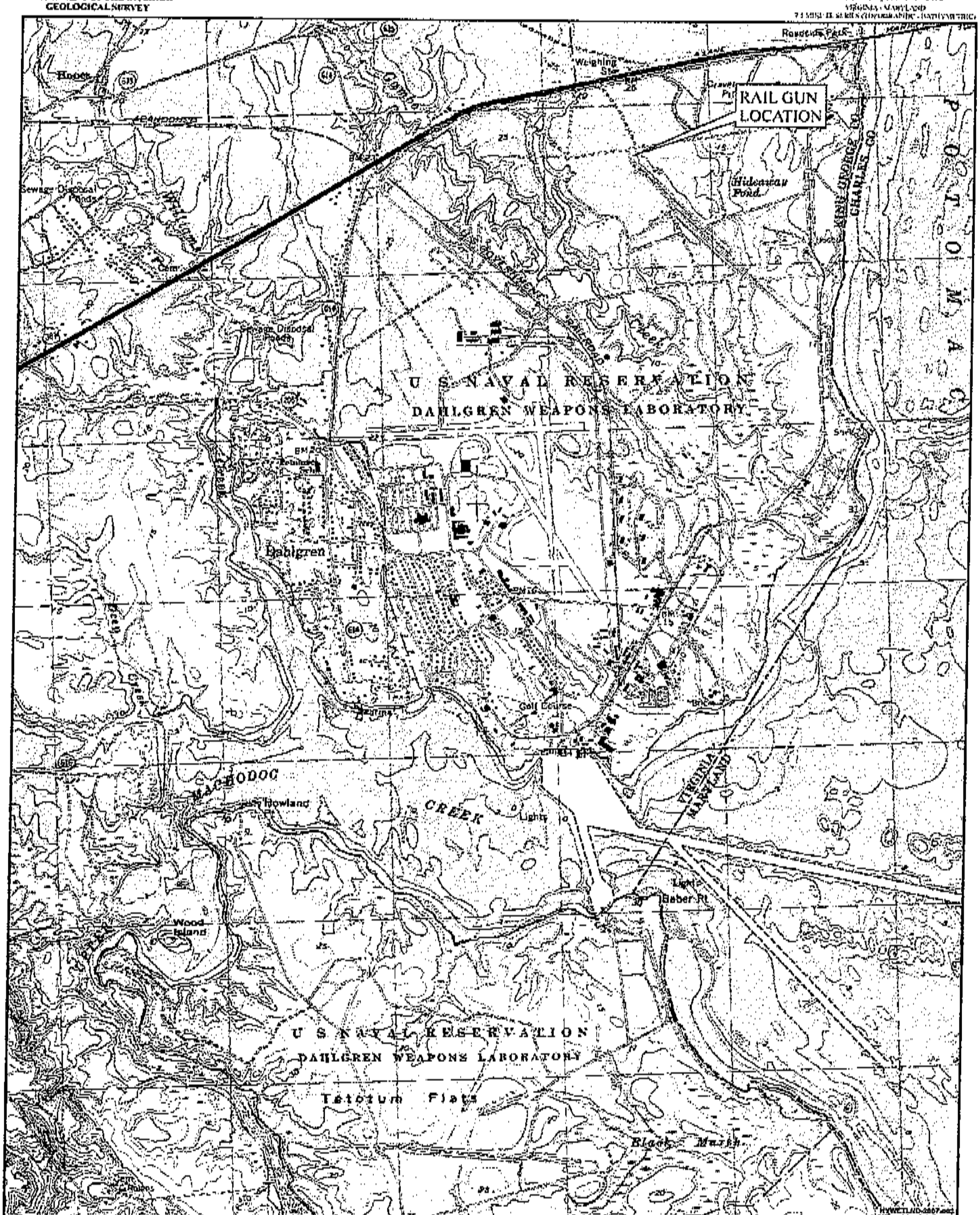
5090
Ser HN2WTW/071

Blind copy to:
Reading File
HN2WTW
XDC8 (Neil)
PWC (Shifflette)

FRONTAGE ROAD
0.005
1410
SHOCK TUBE ROAD
HIDEAWAY LANE
Wetland
Wetland Impact
Pump Station
Existing Rail Gun
Addition
Gravel Drive
0 10 20 40 60 80
Feet
Naval Support Facility
30 Foot X 80 Foot Addition
to Building 1410
HYWETLND-2007-002
19 July 2007

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

DAHLGREN QUADRANGLE
VIRGINIA - MARYLAND



DAHLGREN, VA - MD
1968
Photo Revised 1983
Bathymetry Added 1987

ENCLOSURE (2)

COMMONWEALTH *of* VIRGINIA

DEPARTMENT OF ENVIRONMENTAL QUALITY

Northern Virginia Regional Office
13901 Crown Court
Woodbridge, VA 22193-1453
(703) 583-3800 *fax* (703) 583-3801
www.deq.virginia.gov

September 6, 2007

NSF Dahlgren
Attn: Mr. James Pinto
Code HN2WJP
17483 Dahlgren Road, Suite 104
Dahlgren, Virginia 22448

CERTIFIED MAIL
RETURN RECEIPT REQUESTED

Re: VWP General Permit Authorization Number WP4-05-3018
EM Launcher Building Upgrade, King George County, Virginia
Notice of Planned Change Approval Letter

Dear Mr. Pinto:

The Virginia Department of Environmental Quality (DEQ) has received your Notice of Planned Change request for the Virginia Water Protection (VWP) General Permit Authorization Number WP4-05-3018. The authorization was issued on February 13, 2006 for the impact of 0.09 acre of palustrine forested wetlands. Compensation was not required as the project fell within Reporting Only General Permit thresholds.

In the request letter dated August 20, 2007 and received August 27, 2007, you indicated the need to construct a 30' x 80' addition to the east side of Building 1410, which will result in an additional 0.005 acre of impact to palustrine forested wetlands. Compensation for the additional impacts will not be required, as the project still falls within reporting-only thresholds.

In accordance with your request and pursuant to the VWP General Permit Regulation 9 VAC 25-690-80, DEQ approves the additional impacts for coverage under this authorization

Please note that this letter is an official component of the authorization and should be attached to the authorization in your files. If you have any questions, do not hesitate to contact Melissa Andersen Kuskie at (703) 583-3892 or makuskie@deq.virginia.gov.

Respectfully,

Trisha Beasley

Trisha M. Beasley
VWPP Program Manager

cc: Regena Bronson, U.S. Army Corps of Engineers, King George Field Office – VIA EMAIL

Enclosure (2)

PART I – SPECIAL CONDITIONS

A. Authorized activities

1. This permit authorizes impacts of up to two acres of nontidal surface waters including up to 500 linear feet of perennial stream channel and up to 1,500 linear feet of nonperennial stream channel according to the information provided in the approved application.

2. Any changes to the authorized permanent impacts to surface waters associated with this project shall require either a notice of planned change in accordance with 9VAC25-690-80, or another VWP permit application.

3. Any changes to the authorized temporary impacts to surface waters associated with this project shall require written notification to DEQ and restoration to pre-existing conditions in accordance with the conditions of this permit authorization.

4. Modification to compensation requirements may be approved at the request of the permittee when a decrease in the amount of authorized surface waters impacts occurs, provided that the adjusted compensation meets the initial authorization compensation goals.

5. The activities authorized for coverage under this VWP general permit must commence and be completed within five years of the date of this authorization.

B. Continuation of Coverage

Reapplication for continuation of coverage under this VWP general permit or a new VWP permit may be necessary if any portion of the authorized activities or any VWP permit requirement (including compensation) has not been completed within five years of the date of authorization. Notwithstanding any other provision, a request for continuation of coverage under a VWP general permit in order to complete monitoring requirements shall not be considered a new application, and no application fee will be charged. The request for continuation of coverage must be made no less than 60 days prior to the expiration date of this VWP general permit authorization, at which time the board will determine if continuation of the VWP general permit authorization is necessary.

C. Overall Project Conditions

1. The activities authorized by this VWP general permit shall be executed in a manner so as to minimize any adverse impact on instream beneficial uses as defined in §62.1-10 (b) of the Code of Virginia.

2. No activity may substantially disrupt the movement of aquatic life indigenous to the water body, including those species which normally migrate through the area, unless the primary purpose of the activity is to impound water. Culverts placed in streams must be installed to maintain low flow conditions. The requirement to countersink does not apply to extensions or maintenance of existing culverts that are not countersunk, to floodplain culverts being placed above ordinary high water, to culverts being placed on bedrock, or to culverts required to be placed on slopes 5% or greater. No activity may cause more than minimal adverse effect on navigation. Furthermore the activity must not impede the passage of normal or expected high flows and the structure or discharge must withstand expected high flows.

3. Wet or uncured concrete shall be prohibited from entry into flowing surface waters. Excess or waste concrete shall not be disposed of in flowing surface waters or washed into flowing surface waters.

4. All fill material shall be clean and free of contaminants in toxic concentrations or amounts in accordance with all applicable laws and regulations.

5. Erosion and sedimentation controls shall be designed in accordance with the Virginia Erosion and Sediment Control Handbook, Third Edition, 1992, or for mining activities covered by this general permit, the standards issued by the Virginia Department of Mines, Minerals and Energy that are as effective as those in the Virginia Erosion and Sediment Control Handbook, Third Edition, 1992. These controls shall be placed prior to clearing and grading and maintained in good working order to minimize impacts to state waters. These controls shall remain in place until the area is stabilized and shall then be removed.

6. Any exposed slopes and streambanks shall be stabilized immediately upon completion of work in each permitted impact area. All denuded areas shall be properly stabilized in accordance with the Virginia Erosion and Sediment Control Handbook, Third Edition, 1992.

7. All construction, construction access (e.g., cofferdams, sheetpiling, and causeways) and demolition activities associated with this project shall be accomplished in a manner that minimizes construction or waste materials from entering surface waters to the maximum extent practicable, unless authorized by this VWP general permit.

8. No machinery may enter flowing waters, unless authorized by this VWP general permit.

9. Heavy equipment in temporarily-impacted wetland areas shall be placed on mats, geotextile fabric, or other suitable material to minimize soil disturbance to the maximum extent practicable. Equipment and materials shall be removed immediately upon completion of work.

10. All nonimpacted surface waters within 50 feet of any permitted activities and within the project or right-of-way limits shall be clearly flagged or marked for the life of the construction activity at that location to preclude any unauthorized disturbances to these surface waters during construction. The permittee shall notify all contractors that these marked areas are surface waters where no activities are to occur.

11. Temporary disturbances to surface waters during construction shall be avoided and minimized to the maximum extent practicable. All temporarily disturbed wetland areas shall be restored to preconstruction conditions within 30 days of completing work, which shall include re-establishing pre-construction contours, and planting or seeding with appropriate wetland vegetation according to cover type (emergent, scrub/shrub, or forested). The permittee shall take all appropriate measures to promote and maintain revegetation of temporarily disturbed wetland areas with wetland vegetation through the second year post-disturbance. All temporarily impacted streams and streambanks shall be restored to their original contours within 30 days following the construction at that stream segment, and the banks seeded or planted with the same vegetation cover type originally present along the streambanks, including supplemental erosion control grasses if necessary, except for invasive species identified on DCR's Invasive Alien Plant Species of Virginia list.

12. All materials (including fill, construction debris, and excavated and woody materials) temporarily stockpiled in wetlands shall be placed on mats or geotextile fabric, immediately stabilized to prevent entry into state waters, managed such that leachate does not enter state waters, and completely removed within 30 days following completion of that construction activity. Disturbed areas shall be returned to original contours, restored within 30 days following removal of the stockpile, and restored with the same vegetation cover type originally present, including supplemental erosion control grasses if necessary, except for invasive species identified on DCR's Invasive Alien Plant Species of Virginia list.

13. Continuous flow of perennial springs shall be maintained by the installation of spring boxes, french drains, or other similar structures.

14. The permittee shall employ measures to prevent spills of fuels or lubricants into state waters.

15. The permittee shall conduct activities in accordance with any time-of-year restrictions recommended by the Department of Game and Inland Fisheries or the Virginia Marine Resources Commission, and shall ensure that all contractors are aware of any time-of-year restrictions imposed.

16. Water quality standards shall not be violated as a result of the construction activities, unless allowed by this permit authorization.

17. Untreated stormwater runoff shall be prohibited from directly discharging into any surface waters, unless allowed by this permit authorization. Appropriate best management practices shall be deemed suitable treatment prior to discharge into state waters.

18. If stream channelization or relocation is required, all work in surface waters shall be done in the dry, unless authorized by this VWP general permit, and all flows shall be diverted around the channelization or relocation area until the new channel is stabilized. This work shall be accomplished by leaving a plug at the inlet and outlet ends of the new channel during excavation. Once the new channel has been stabilized, flow shall be routed into the new channel by first removing the downstream plug and then the upstream plug. The rerouted stream flow must be fully established before construction activities in the old stream channel can begin.

D. <u>Road Crossings</u>

1. Access roads and associated bridges or culverts shall be constructed to minimize the adverse effects on surface waters to the maximum extent practicable. Access roads constructed above preconstruction contours and elevations in surface waters must be bridged or culverted to maintain surface flows.

2. Installation of road crossings shall occur in the dry via the implementation of cofferdams, sheetpiling, stream diversions, or similar structures.

E. <u>Utility Lines</u>

1. All utility line work in surface waters shall be performed in a manner that minimizes disturbance, and the area must be returned to its original contours and restored within 30 days of completing work in the area, unless otherwise authorized by this VWP general permit. Restoration shall be the

seeding or planting of the same vegetation cover type originally present, including supplemental erosion control grasses if necessary, except for invasive species identified on DCR's Invasive Alien Plant Species of Virginia list.

2. Material resulting from trench excavation may be temporarily sidecast into wetlands not to exceed a total of 90 days, provided the material is not placed in a manner such that it is dispersed by currents or other forces.

3. The trench for a utility line cannot be constructed in a manner that drains wetlands (e.g., backfilling with extensive gravel layers creating a french drain effect.). For example, utility lines may be backfilled with clay blocks to ensure that the trench does not drain surface waters through which the utility line is installed.

F. Stream Modification and Stream Bank Protection

1. Riprap bank stabilization shall be of an appropriate size and design in accordance with the Virginia Erosion and Sediment Control Handbook, Third Edition, 1992.

2. Riprap apron for all outfalls shall be designed in accordance with the Virginia Erosion and Sediment Control Handbook, Third Edition, 1992.

3. For stream bank protection activities, the structure and backfill shall be placed as close to the stream bank as practicable. No material shall be placed in excess of the minimum necessary for erosion protection.

4. All stream bank protection structures shall be located to eliminate or minimize impacts to vegetated wetlands to the maximum extent practicable.

5. Asphalt and materials containing asphalt or other toxic substances shall not be used in the construction of submerged sills or breakwaters.

6. Redistribution of existing stream substrate for the purpose of erosion control is prohibited.

7. No material removed from the stream bottom shall be disposed of in surface waters, unless authorized by this permit.

G. Dredging

1. Dredging depths shall be determined and authorized according to the proposed use and controlling depths outside the area to be dredged.

2. Dredging shall be accomplished in a manner that minimizes disturbance of the bottom and minimizes turbidity levels in the water column.

3. If evidence of impaired water quality, such as a fish kill, is observed during the dredging, dredging operations shall cease and the DEQ shall be notified immediately.

4. Barges used for the transportation of dredge material shall be filled in such a manner to prevent any overflow of dredged materials.

5. Double handling of dredged material in state waters shall not be permitted.

6. For navigation channels the following shall apply:

    a. A buffer of four times the depth of the dredge cut shall be maintained between the bottom edge of the design channel and the channelward limit of wetlands or mean low water, or a buffer of 15 feet shall be maintained from the dredged cut and the channelward edge of wetlands or mean low water, whichever is greater. This landward limit of buffer shall be flagged and inspected prior to construction.

    b. Side slope cuts of the dredging area shall not exceed a two-horizontal-to-one-vertical slope to prevent slumping of material into the dredged area.

7. A dredged material management plan for the designated upland disposal site shall be submitted and approved 30 days prior to initial dredging activity.

8. Pipeline outfalls and spillways shall be located at opposite ends of the dewatering area to allow for maximum retention and settling time. Filter fabric shall be used to line the dewatering area and to cover the outfall pipe to further reduce sedimentation to state waters.

9. The dredge material dewatering area shall be of adequate size to contain the dredge material and to allow for adequate dewatering and settling out of sediment prior to discharge back into state waters.

10. The dredge material dewatering area shall utilize an earthen berm or straw bales covered with filter fabric along the edge of the area to contain the dredged material, and shall be properly stabilized prior to placing the dredged material within the containment area.

11. Overtopping of the dredge material containment berms with dredge materials shall be strictly prohibited.

H. <u>Stormwater Management Facilities</u>

1. Stormwater management facilities shall be installed in accordance with best management practices and watershed protection techniques (i.e., vegetated buffers, siting considerations to minimize adverse effects to aquatic resources, bioengineering methods incorporated into the facility design to benefit water quality and minimize adverse effects to aquatic resources) that provide for long-term aquatic resources protection and enhancement, to the maximum extent practicable.

2. Compensation for unavoidable impacts shall not be allowed within maintenance areas of stormwater management facilities.

3. Maintenance activities within stormwater management facilities shall not require additional permit authorization or compensation, provided that the maintenance activities do not exceed the original contours of the facility, as approved and constructed, and is accomplished in designated maintenance areas as indicated in the facility maintenance or design plan.

PART III – CONDITIONS APPLICABLE TO ALL VWP GENERAL PERMITS

A. Duty to Comply

The permittee shall comply with all conditions of the VWP general permit. Nothing in this VWP general permit shall be construed to relieve the permittee of the duty to comply with all applicable federal and state statutes, regulations, and toxic standards and prohibitions. Any VWP general permit noncompliance is a violation of the Clean Water Act and State Water Control Law, and is grounds for enforcement action, VWP general permit authorization termination for cause, VWP general permit authorization revocation, or denial of a continuation of coverage request.

B. Duty to Mitigate

The permittee shall take all reasonable steps to minimize or prevent any impacts in violation of the VWP general permit which may have a reasonable likelihood of adversely affecting human health or the environment.

C. Reopener

This VWP general permit authorization may be reopened to modify its conditions when the circumstances on which the previous VWP general permit authorization was based have materially and substantially changed, or special studies conducted by the board or the permittee show material and substantial change since the time the VWP general permit authorization was issued and thereby constitute cause for VWP general permit authorization revocation and reissuance.

D. Compliance with State and Federal Law

Compliance with this VWP general permit constitutes compliance with the VWP permit requirements of the State Water Control Law. Nothing in this VWP general permit shall be construed to preclude the institution of any legal action under or relieve the permittee from any responsibilities, liabilities, or other penalties established pursuant to any other state law or regulation or under the authority preserved by §510 of the Clean Water Act.

E. Property Rights

The issuance of this VWP general permit does not convey any property rights in either real or personal property, or any exclusive privileges, nor does it authorize any injury to private property or any invasion of personal property rights, nor any infringement of federal, state or local laws or regulations.

F. Severability

The provisions of this VWP general permit authorization are severable.

G. Right of Entry

The permittee shall allow the board or its agents, upon the presentation of credentials, at reasonable times and under reasonable circumstances:

1. To enter the permittee's property, public or private, and have access to, inspect and copy any

records that must be kept as part of the VWP general permit conditions;

2. To inspect any facilities, operations or practices (including monitoring and control equipment) regulated or required under the VWP general permit;

3. To sample or monitor any substance, parameter or activity for the purpose of assuring compliance with the conditions of the VWP general permit or as otherwise authorized by law.

For the purpose of this section, the time for inspection shall be deemed reasonable during regular business hours. Nothing contained herein shall make an inspection time unreasonable during an emergency.

H. Transferability of VWP general permit authorization

This VWP general permit authorization may be transferred to another person by a permittee if:

1. The current permittee notifies the board of the transfer of the title to the facility or property;

2. The notice to the board includes a written agreement between the existing and new permittee containing a specific date of transfer of VWP general permit authorization responsibility, coverage and liability to the new permittee, or that the existing permittee will retain such responsibility, coverage or liability, including liability for compliance with the requirements of any enforcement activities related to the permitted activity; and

3. The board does not notify the existing and new permittee of its intent to modify or revoke and reissue the VWP general permit authorization within 15 days.

On the date of the VWP general permit authorization transfer, the transferred VWP general permit authorization shall be as fully effective as if it had been issued directly to the new permittee.

I. Notice of Planned Change

Authorization under the VWP general permit may be modified subsequent to issuance if: (i) the permittee determines that additional permanent wetland or stream impacts are necessary, provided that the cumulative increase in acreage of wetland impacts is not greater than 1/4 acre and the cumulative increase in stream impacts is not greater than 50 linear feet, and provided that the additional impacts are fully compensated; (ii) the project results in less wetland or stream impacts, in which case, compensation requirements may be modified in relation to the adjusted impacts at the request of the permittee, provided that the adjusted compensation meets the initial authorization compensation goals; (iii) there is a change in the project plans that does not result in a change in project impacts; (iv) there is a change in the mitigation bank at which credits are purchased or used, provided that the same amount of credits are purchased or used and all criteria for use are met, as detailed in 9 VAC 25-210-115; or (v) typographical errors need to be corrected. A notice of planned change is not required if the project results in additional temporary impacts to surface waters, provided that DEQ is notified in writing, the additional temporary impacts are restored to pre-existing conditions in accordance with Part I C 11 of this general permit, and the additional temporary impacts do not exceed the general permit threshold for use. The permittee shall notify the board in advance of the planned change, and the planned change request will be reviewed according to all provisions of this regulation.

J. VWP General Permit Authorization Termination for Cause

This VWP general permit authorization is subject to termination for cause by the board after public notice and opportunity for a hearing. Reasons for termination for cause are as follows:

1. Noncompliance by the permittee with any condition of the VWP general permit authorization;

2. The permittee's failure in the application or during the VWP general permit authorization issuance process to disclose fully all relevant facts or the permittee's misrepresentation of any relevant facts at any time;

3. The permittee's violation of a special or judicial order; and

4. A determination that the permitted activity endangers human health or the environment and can be regulated to acceptable levels by a VWP general permit authorization planned change or termination for cause.

K. VWP General Permit Authorization Termination by Consent

This VWP general permit authorization may be terminated by consent when all permitted activities requiring notification under 9VAC25-690-50 A 1 have been completed, when the authorized impacts will not occur, or when a planned change occurs that involves substituting a specified, approved mitigation bank(s) with another specified, approved mitigation bank. The permittee shall submit a request for termination by consent within 30 days of project completion or project cancellation. The director may accept this termination of authorization on behalf of the board. The request for termination by consent shall contain the following information:

1. Name, mailing address and telephone number of the permittee;

2. Name and location of the activity;

3. The VWP permit authorization number; and

4. One of the following certifications:

   a. For project completion:

   "I certify under penalty of law that all activities authorized by a VWP general permit have been completed. I understand that by submitting this notice of termination, that I am no longer authorized to perform activities in surface waters in accordance with the VWP general permit, and that performing activities in surface waters is unlawful where the activity is not authorized by a VWP permit. I also understand that the submittal of this notice does not release me from liability for any violations of this VWP general permit authorization."

   b. For project cancellation:

   "I certify under penalty of law that the activities authorized by this VWP general permit will not occur. I understand that by submitting this notice of termination, that I am no longer authorized to perform activities in surface waters in accordance with the VWP general permit, and that performing activities in surface waters is unlawful where the activity is not authorized

by a VWP permit. I also understand that the submittal of this notice does not release me from liability for any violations of this VWP general permit authorization, nor does it allow me to resume the permitted activities without reapplication and reauthorization."

c. For Events Beyond Permittee Control, the Permittee shall provide a detailed explanation of the events, to be approved by DEQ, and the following certification statement:

"I certify under penalty of law that all activities authorized by a VWP general permit have changed as the result of events beyond my control (see attached). I understand that by submitting this notice of termination I am no longer authorized to perform activities in surface waters in accordance with the VWP general permit, and that performing activities in surface waters is unlawful where the activity is not authorized by a VWP permit. I also understand that the submittal of this notice does not release me from liability for any violations of this VWP general permit authorization, nor does it allow me to resume the permitted activities without reapplication and reauthorization."

L. Civil and Criminal Liability

Nothing in this VWP general permit shall be construed to relieve the permittee from civil and criminal penalties for noncompliance.

M. Oil and Hazardous Substance Liability

Nothing in this VWP general permit shall be construed to preclude the institution of legal action or relieve the permittee from any responsibilities, liabilities, or penalties to which the permittee is or may be subject under §311 of the Clean Water Act or §§62.1-44.34:14 through 62.1-44.34:23 of the State Water Control Law.

N. Duty to Cease or Confine Activity

It shall not be a defense for a permittee in an enforcement action that it would have been necessary to halt or reduce the activity for which a VWP permit has been granted in order to maintain compliance with the conditions of the VWP permit.

O. Duty to Provide Information

1. The permittee shall furnish to the board any information which the board may request to determine whether cause exists for modifying, revoking, reissuing and terminating the VWP permit, or to determine compliance with the VWP permit. The permittee shall also furnish to the board, upon request, copies of records required to be kept by the permittee.

2. Plans, maps, conceptual reports and other relevant information shall be submitted as required by the board prior to commencing construction.

P. Monitoring and Records Requirements

1. Monitoring of parameters, other than pollutants, shall be conducted according to approved analytical methods as specified in the VWP permit. Analysis of pollutants will be conducted according to 40 CFR Part 136 (2000), Guidelines Establishing Test Procedures for the Analysis of Pollutants.

2. Samples and measurements taken for the purpose of monitoring shall be representative of the monitored activity.

3. The permittee shall retain records of all monitoring information, including all calibration and maintenance records and all original strip chart or electronic recordings for continuous monitoring instrumentation, copies of all reports required by the VWP permit, and records of all data used to complete the application for the VWP permit, for a period of at least three years from the date of the expiration of a granted VWP permit. This period may be extended by request of the board at any time.

4. Records of monitoring information shall include, as appropriate:

   a. The date, exact place and time of sampling or measurements;

   b. The name of the individuals who performed the sampling or measurements;

   c. The date and time the analyses were performed;

   d. The name of the individuals who performed the analyses;

   e. The analytical techniques or methods supporting the information such as observations, readings, calculations and bench data used;

   f. The results of such analyses; and

   g. Chain of custody documentation.

Q. <u>Unauthorized Discharge of Pollutants</u>

Except in compliance with this VWP general permit, it shall be unlawful for the permittee to:

1. Discharge into state waters sewage, industrial wastes, other wastes, or any noxious or deleterious substances;

2. Excavate in a wetland;

3. Otherwise alter the physical, chemical, or biological properties of state waters and make them detrimental to the public health, to animal or aquatic life, to the uses of such waters for domestic or industrial consumption, for recreation, or for other uses; or

4. On and after October 1, 2001, conduct the following activities in a wetland:

   a. New activities to cause draining that significantly alters or degrades existing wetland acreage or functions;

   b. Filling or dumping;

   c. Permanent flooding or impounding; or

   d. New activities that cause significant alteration or degradation of existing wetland acreage or functions.

APPENDIX B

NAVAL ORDNANCE SAFETY AND SECURITY ACTIVITY SITE APPROVAL

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DEPARTMENT OF DEFENSE EXPLOSIVES SAFETY BOARD
2461 EISENHOWER AVENUE
ALEXANDRIA, VIRGINIA 22331-0600

JUL 23 2008

DDESB-PE

MEMORANDUM FOR COMMANDING OFFICER, NAVAL ORDNANCE SAFETY AND SECURITY ACTIVITY (ATTENTION: CODE N54)

SUBJECT: DDESB Final Approval of Expedited Safety Site Approval for Building 1180 and Project NF 102-08 MILCON Project P-306, addition to Electromagnetic Launch Facility 1410, Control Building and Terminal Effects Range at Naval Support Facility, Dahlgren VA [N61151/MILCON P-306/CNF102-08//WEBSAR 1071/ WW-132]

References: (a) NOSSA Letter 8020 Ser N54-JE/9304 of 27 June 2008, 2nd End on NAVSUPPAC South Potomac PWD Dahlgren ltr PRSP/020 of 18 April 08, Subject: Request for Expedited Explosives Safety Site Approval for Project NF 102-08 Military Construction Project P-306, Addition to Electromagnetic Launch Facility 1410, Control Building and Terminal Effects Range for Naval Surface Warfare Center, Dahlgren Division, at Naval Support Facility, Dahlgren [N61151/MILCON P-306/CNF102-08/WEBSAR 1071/WW-132]

(b) DoD 6055.09-STD, DoD Ammunition and Explosives Safety Standards, 29 February 2008

The subject site plan approval request, reference (a), has been reviewed with respect to the explosives safety requirements of reference (b). Based on the information provided, final site plan approval is granted for Building 1180, used for non-destructive testing of ordnance, and MILCON Project P-306 for building an addition to Building 1410, a new Control Building , and a Terminal Effects Range for Naval Surface Warfare Center, Dahlgren, VA. This approval is based on the following:

a. Building 1410 including the proposed addition, the Control Building, and the Terminal Effects Range will not contain explosives. The addition to Building 1410 will not contain windows.

b. The approved explosives limits for Building 1180 are 1,500 pounds (lbs) net explosive weight for quantity distance (NEWQD) of HD 1.1; 3,000 lbs NEWQD of HD 1.2.1 with a maximum credible event (MCE) less than or equal to 186 lbs; 20,000 lbs of HD 1.2.2; 20,000 lbs NEWQD of HD 1.3, and mission essential quantities of HD 1.4. The hazardous fragment distance is 900 feet, based on the requirements of paragraph C9.4.1.2.1.1.4. for sparsely populated locations. If the number of personnel increases to more than 25 people in any sector from Building 1180, the explosives limits above are no longer valid and a new site plan for Building 1180 must be submitted.

c. Mixing quantities of HD 1.1, 1.2.x, and 1.3 will comply with the requirements of paragraph C9.2.2 of reference (b).

d. No ordnance will be present in Building 1180 during the firing at the launch facility. This restriction will be included in the standard operation procedures at Building 1180 and for firing at the launch facility. Access to Shock Tube Road, Tisdale Road, and the Tactical Round Catch will be restricted when ordnance is present in Building 1180.

e. The Commander, Dahlgren Division, Naval Surface Warfare Center accepts the risk of damage to the addition to Building 1140 in the event of an explosive incident at Radiography Building 1180.

A copy of the complete site plan package and this approval letter must be maintained as a permanent record at the installation of origin. Master planning documents and installation drawings must be updated to reflect this site plan.

Point of contact is Ms. Stephanie Christie, DSN: 221-1356; Commercial: 703-325-1356; and E-mail: Stephanie.Christie@ddesb.osd.mil.

E. [illegible] for
CURTIS M. BOWLING
Chairman
DDESB

DEPARTMENT OF THE NAVY
NAVAL ORDNANCE SAFETY AND SECURITY ACTIVITY
FARRAGUT HALL
3817 STRAUSS AVENUE, SUITE 108
INDIAN HEAD, MD 20640-5151

8020
Ser N54-JE/9334
13 Aug 08

From: Commanding Officer, Naval Ordnance Safety and Security Activity
To: Commanding Officer, Naval Facilities Engineering Command, Washington (PRSPI12JW)

Subj: REQUEST FOR EXPEDITED EXPLOSIVES SAFETY SITE APPROVAL FOR PROJECT NF 102-08 MILITARY CONSTRUCTION PROJECT P-306, ADDITION TO ELECTROMAGNETIC LAUNCH FACILITY 1410, CONTROL BUILDING AND TERMINAL EFFECTS RANGE FOR NAVAL SURFACE WARFARE CENTER, DAHLGREN DIVISION, NAVAL SUPPORT FACILITY, DAHLGREN [N61151/MILCON P-306/CNF102-08/WEBSAR 1071/ WW-132F]

Ref: (a) NOSSA ltr 8020 Ser N54-JE/9304 dtd 27 Jun 08
(b) NAVSEA OP 5, Volume 1, Seventh Revision

Encl: (1) DDESB memo DDESB-PE of 23 Jul 08

1. Enclosure (1) provides both site and final safety approvals to construct an extension to the Naval Electromagnetic Launch Facility (Building 1410), Control Building, and Terminal Effects Range, for Naval Surface Warfare Center, Dahlgren Division (NAVSURFWARCENDIV Dahlgren), at Naval Support Facility (NAVSUPPFAC), Dahlgren, and is forwarded for continuing action. This approval is based upon adherence to the conditions listed in both reference (a) and enclosure (1). The following are also conditions of this approval:

a. All incoming personnel for construction of this project must be indoctrinated on explosives safety and Hazards of Electromagnetic Radiation to Ordnance (HERO) concerns at the installation. This should include regulations governing cell phone use and smoking.

b. Occupants of any construction trailers near the job site must be directly involved with the project construction. Administrative personnel must be located outside of all installation inhabited building distance (IBD) arcs.

2. Updates to the installation's master planning documents must be made, in accordance with reference (b), Sections 4-4.2.9 and 7-4.4.1.2. Copies of this approval, to include maps and documents contained in the original submission, must be maintained in installation records, per reference (b), paragraph 8-1.2.6.

Subj: REQUEST FOR EXPEDITED EXPLOSIVES SAFETY SITE APPROVAL FOR PROJECT NF 102-08 MILITARY CONSTRUCTION PROJECT P-306, ADDITION TO ELECTROMAGNETIC LAUNCH FACILITY 1410, CONTROL BUILDING AND TERMINAL EFFECTS RANGE FOR NAVAL SURFACE WARFARE CENTER, DAHLGREN DIVISION, NAVAL SUPPORT FACILITY, DAHLGREN [N61151/MILCON P-306/CNF102-08/WEBSAR 1071/ WW-132F]

3. The Naval Ordnance Safety and Security Activity (NOSSA) point-of-contact for questions related to this project is Mr. James Elligson, N546, at DSN: 354-4966; Commercial: (301) 744-4966; or E-Mail: jim.elligson@navy.mil.

Gary A. Hogue

GARY A. HOGUE
By direction

Copy to:
NAVSUPPFAC Dahlgren (ESO)
NAVSURFWARCENDIV Dahlgren (ESO)
NAVFAC Washington PWD South Potomac, Dahlgren (PWO)
NOSSA ESSOLANT (N5L; N5L8)

DEPARTMENT OF DEFENSE EXPLOSIVES SAFETY BOARD
2461 EISENHOWER AVENUE
ALEXANDRIA, VIRGINIA 22331-0600

JUL 23 2008

DDESB-PE

MEMORANDUM FOR COMMANDING OFFICER, NAVAL ORDNANCE SAFETY AND SECURITY ACTIVITY (ATTENTION: CODE N54)

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a. Building 1410 including the proposed addition, the Control Building, and the Terminal Effects Range will not contain explosives. The addition to Building 1410 will not contain windows.

b. The approved explosives limits for Building 1180 are 1,500 pounds (lbs) net explosive weight for quantity distance (NEWQD) of HD 1.1; 3,000 lbs NEWQD of HD 1.2.1 with a maximum credible event (MCE) less than or equal to 186 lbs; 20,000 lbs of HD 1.2.2; 20,000 lbs NEWQD of HD 1.3, and mission essential quantities of HD 1.4. The hazardous fragment distance is 900 feet, based on the requirements of paragraph C9.4.1.2.1.1.4. for sparsely populated locations. If the number of personnel increases to more than 25 people in any sector

Encl (1)

from Building 1180, the explosives limits above are no longer valid and a new site plan for Building 1180 must be submitted.

c. Mixing quantities of HD 1.1, 1.2.x, and 1.3 will comply with the requirements of paragraph C9.2.2 of reference (b).

d. No ordnance will be present in Building 1180 during the firing at the launch facility. This restriction will be included in the standard operation procedures at Building 1180 and for firing at the launch facility. Access to Shock Tube Road, Tisdale Road, and the Tactical Round Catch will be restricted when ordnance is present in Building 1180.

e. The Commander, Dahlgren Division, Naval Surface Warfare Center accepts the risk of damage to the addition to Building 1410 in the event of an explosive incident at Radiography Building 1180.

A copy of the complete site plan package and this approval letter must be maintained as a permanent record at the installation of origin. Master planning documents and installation drawings must be updated to reflect this site plan.

Point of contact is Ms. Stephanie Christie, DSN: 221-1356; Commercial: 703-325-1356; and E-mail: Stephanie.Christie@ddesb.osd.mil.

E Alch D/for

CURTIS M. BOWLING
Chairman
DDESB

APPENDIX C

FEDERAL COASTAL CONSISTENCY DETERMINATION

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DEPARTMENT OF THE NAVY
NAVAL SUPPORT ACTIVITY
SOUTH POTOMAC
6509 SAMPSON ROAD SUITE 216
DAHLGREN, VIRGINIA 22448-5106

IN REPLY REFER TO

5090
Ser PRDH42TW/100
December 8, 2008

Ms. Ellie Irons
Office of Environmental Impact Review
Virginia Department of Environmental Quality
629 East Main Street, Room 631
Richmond, Virginia 23219

RE: Federal Consistency Determination for the Construction and Operation of the Railgun at Naval District Washington - West, Dahlgren, Virginia (DEQ 05-044F)

Dear Ms. Irons:

The Commonwealth of Virginia completed its review of the above referenced Federal Consistency Determination (FCD) on April 21, 2005. Since that determination was completed, there has been a change in the scope of the project; the construction of the railgun facility and projectile recovery structures have been moved to the southwest thereby eliminating direct impacts to approximately 0.63 acres of non-tidal palustrine wetlands. Enclosed figures show the original FCD impacted wetlands and the new railgun construction location without impacts to wetlands.

We request your review of this change in scope to ensure that the original FCD is still valid.

Please direct all correspondence to:

ATTN: Director, Environmental Division
Department of Navy
NAVFAC Washington, PWD South Potomac
18329 Thompson Road, Suite 226
Dahlgren, Virginia 22448-5110

5090
Ser PRDH42TW/100
December 8, 2008

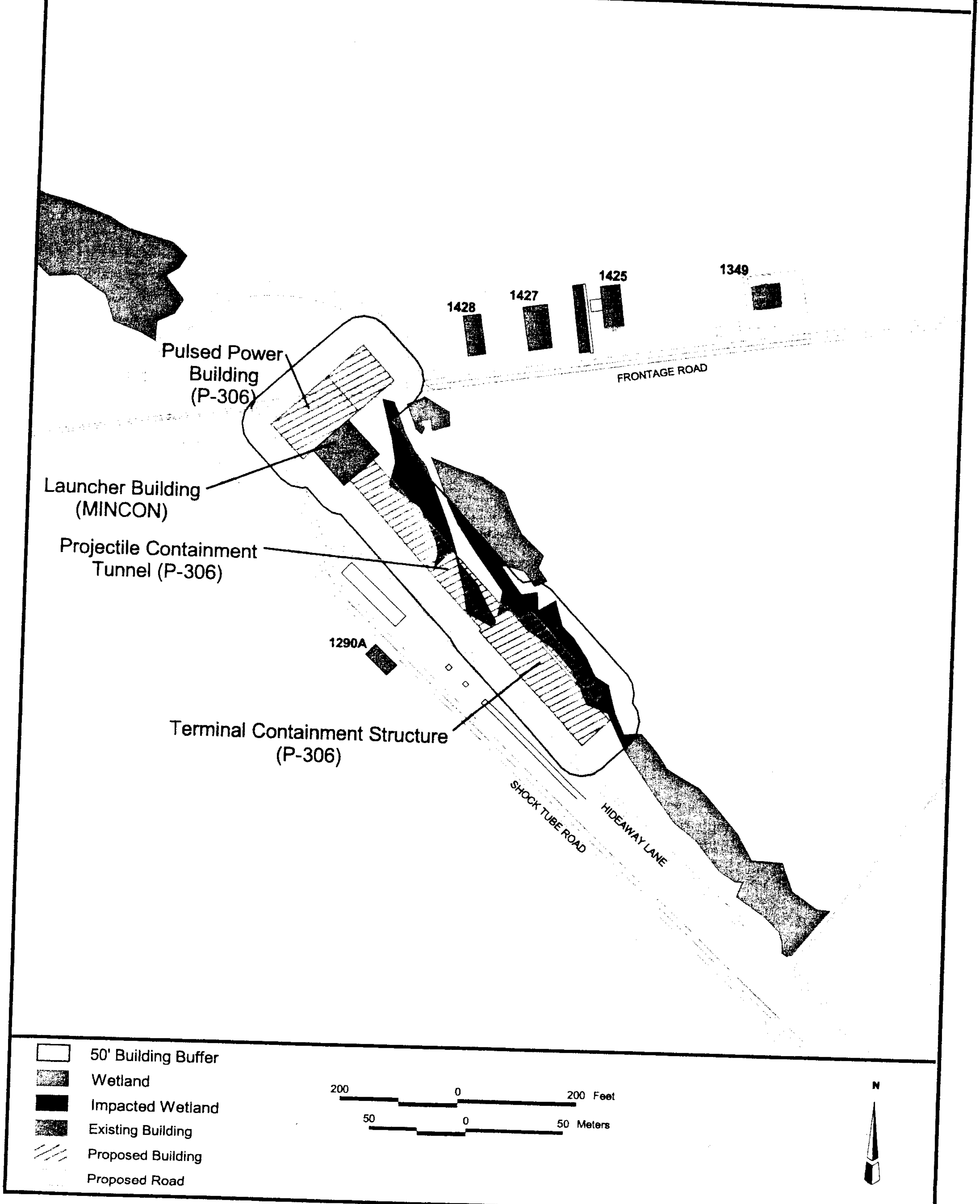
For further information, please contact Dr. Thomas Wray II, Code PRDH42TW, at (540) 653-4186.

Sincerely,

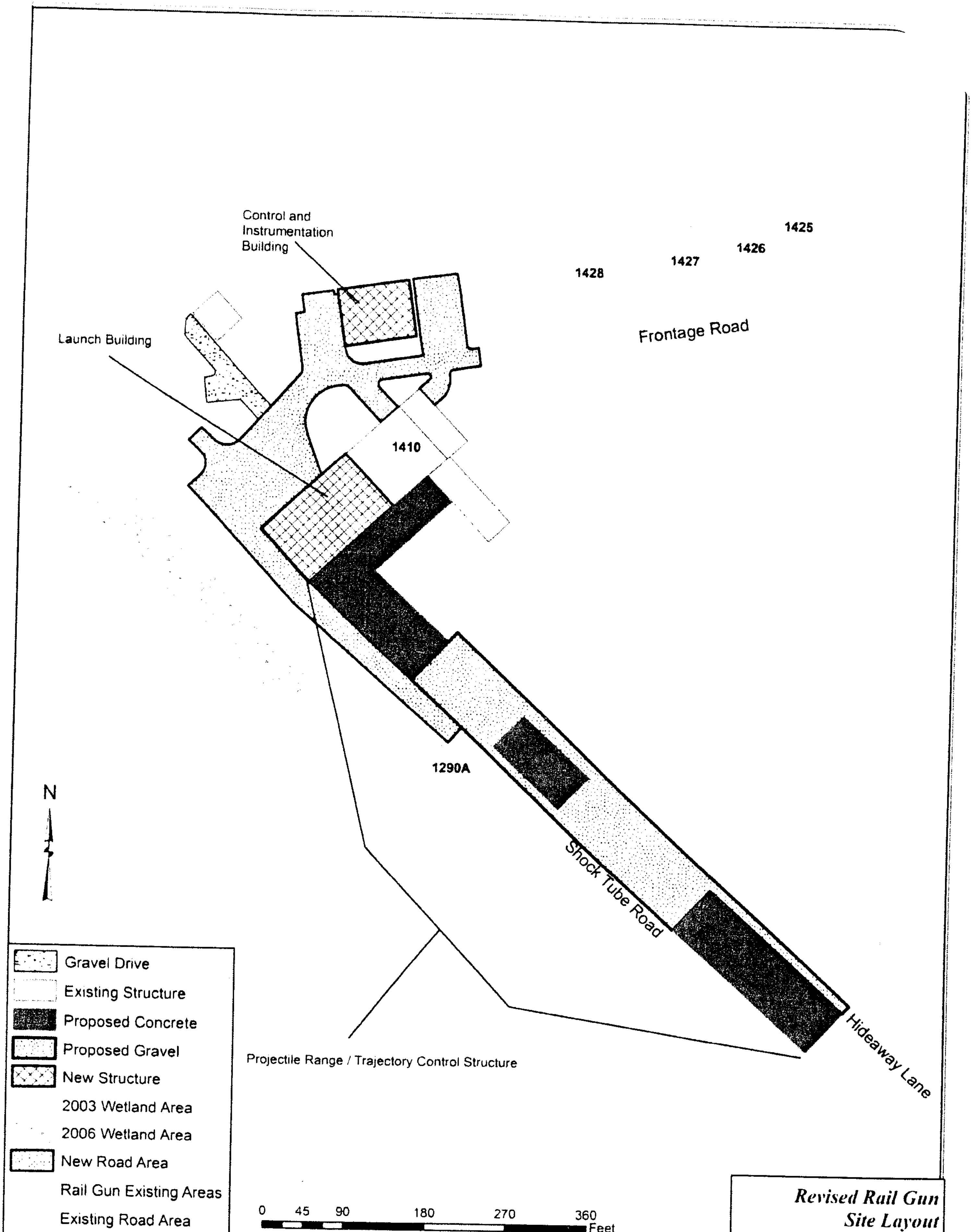
JEFFREY C. BOSSART
By direction

Enclosures: 1. Original FCD Wetlands Impact
2. New Railgun Construction Location

Impacted Wetlands at the Railgun Site



ENCLOSURE(1)



Revised Rail Gun Site Layout

BGGENEXS-2008-037

ENCLOSURE(2)

-isher,John

From: Dooley,Amy
Sent: Friday, December 19, 2008 9:59 AM
To: Fisher,John
Cc: Beasley,Trisha
Subject: RE: Navy Railgun Project Amendment

Good Morning John,

I have searched our databases and cannot find any indication that a JPA was submitted for the railgun project. Upon review of the information you attached, it does not appear that a permit will be required from VWP due to the relocation of the project outside of surface waters; therefore, eliminating the originally proposed wetland impacts. Please let me know if you have any other questions.

Thank you and have a wonderful holiday!
Amy Dooley

Department of Environmental Quality
Northern Virginia Regional Office
Virginia Water Protection Permit Program
13901 Crown Court
Woodbridge, VA 22193

Phone: 703-583-3905
Fax: 703-583-3821

From: Fisher,John
Sent: Friday, December 19, 2008 9:17 AM
To: Dooley,Amy
Subject: Navy Railgun Project Amendment

Amy:

As discussed, please review the amendment to the proposal with respect to impacts to the VWPP program.

Thanks,
John

John E. Fisher
Virginia Department of Environmental Quality
Division of Environmental Enhancement
Office of Environmental Impact Review
629 East Main Street, #633
Richmond, Virginia 23219
(804) 698-4339
(804) 698-4319 fax
efisher@deq.virginia.gov
www.deq.virginia.gov

COMMONWEALTH of VIRGINIA

DEPARTMENT OF ENVIRONMENTAL QUALITY
Street address: 629 East Main Street, Richmond, Virginia 23219
Mailing address: P.O. Box 1105, Richmond, Virginia 23218
TDD (804) 698-4021
www.deq.virginia.gov

L. Preston Bryant, Jr.
Secretary of Natural Resources

David K. Paylor
Director

(804) 698-4000
1-800-592-5482

January 5, 2009

ATTN: Director, Environmental Division
Department of the Navy
NAVFAC Washington, PWD South Potomac
18329 Thompson Road, Suite 226
Dahlgren, Virginia 22448-5110

RE: Amendment to the proposal submitted by the Navy in a 2005 Federal Consistency Determination for the Construction and Operation of the Railgun at Naval District Washington-West, Dahlgren, Virginia (DEQ #05-044F)

Dear Director:

The Department of Environmental Quality-Office of Environmental Impact Review (DEQ-OEIR) has received your December 8, 2008 letter (attached) requesting the review of the change in scope of the above-mentioned proposal. In accordance with *15CFR, 930, Subpart C, § 930.46*, for a proposed activity that was previously determined by the Commonwealth to be consistent with the enforceable policies of the Virginia Coastal Resources Management Program (VCP) (also called the Virginia Coastal Zone Management Program), but which has not yet begun, the Navy shall further coordinate with DEQ and prepare a supplemental consistency determination if there are substantial changes in the proposed activity that will affect any state coastal use or resource substantially different than originally described.

PROJECT DESCRIPTION

Original Proposal

As originally proposed, the Navy would construct a facility for the operational development and subsequent testing of an electronic railgun at the naval District Washington, West Area, Dahlgren. The facility would consist of a pulsed power building; a control and instrument building; a projectile containment tunnel; and a terminal containment structure. Identified project impacts included construction impacts to approximately 0.63 acres of non-tidal palustrine wetlands on site.

received
1/7/09

Amended Proposal

According to your December 8 letter, the locations of the railgun facility and projectile recovery structures have been moved approximately 50 feet to the southwest of the original location, thereby eliminating direct impacts to the wetlands.

FEDERAL CONSISTENCY UNDER THE COASTAL ZONE MANAGEMENT ACT

Pursuant to the Coastal Zone Management Act of 1972, as amended, federal activities must be consistent with the VCP. The VCP consists of a network of policies administered by several agencies. DEQ, as the lead agency for the VCP, coordinates the review of federal consistency determinations with agencies administering the enforceable policies of the VCP.

2005 Review

In the Commonwealth's April 21, 2005 response to the original proposal, DEQ concurred that the proposed activity is consistent with the VCP, provided that the Navy complies with all requirements of applicable permits and other authorizations that may be required. The DEQ response included the requirement that the Navy obtain a Virginia Water Protection (VWP) permit for impacts to the wetlands.

Amendment Review

DEQ-OEIR provided the amended proposal to the Virginia Water Protection Permit (VWPP) program staff at the DEQ Tidewater Regional Office (TRO) for its review. Based on the information provided, DEQ-TRO determined (attached) that the relocation of the project outside of wetlands eliminates the originally proposed wetland impacts. Therefore, it appears that a VWP permit will not be required for the amended proposal.

Based on our review of the 2005 consistency certification, the amendment to the proposed railgun facility and the comments submitted by DEQ-TRO, DEQ concurs that this amended proposal is consistent with the VCP. While DEQ concurs that the construction and operation of the railgun is consistent with the VCP, project activities must also be carried out in strict accordance with all other applicable state, federal, and local laws and regulations.

Thank you for submitting the amendment for our review. If you have any questions, please call me at (804) 698-4325, or John Fisher at (804) 698 4339.

Sincerely,

Ellie

Ellie L. Irons, Manager
Office of Environmental Impact Review

Director, Environmental Division
Department of the Navy

Attachments

cc: David Hartshorn, DEQ-NRO
Trisha Beasley, DEQ-NRO

DEPARTMENT OF THE NAVY
NAVAL DISTRICT WASHINGTON
1014 N STREET SE SUITE 200
WASHINGTON NAVY YARD DC 20374-5001

5090
Ser HN2TW/014
4 Feb 05

Ms. Ellie Irons
Office of Environmental Impact Review
Virginia Department of Environmental Quality
629 East Main Street, Room 631
Richmond, Virginia 23219

Dear Ms. Irons:

In accordance with Section 307 (c) (1) of the Federal Coastal Zone Management Act of 1972 as amended, enclosed is the Federal Coastal Consistency Determination for the construction of the required facilities for the subsequent operational development and testing of an electric railgun at Naval District Washington, West Area, Dahlgren in King George County, Virginia.

The Department of the Navy has determined that the proposed action is consistent, to the maximum extent practicable, with the enforceable policies of the Virginia Coastal Resource Management Program.

For further information, please contact Dr. Thomas Wray II, Code HN2TW, at (540) 653-4186.

Sincerely,

Jeffrey C Bossart

JEFFREY C. BOSSART
Site Environmental Program Director
By direction of the
Commandant

Enclosure: 1. Coastal Consistency Determination

Copy to:
Ms. Carolyn Woods
Engineering Field Activity Chesapeake
1314 Harwood Street, S.E.
Washington Navy Yard, DC 20374-5001

FEDERAL COASTAL CONSISTENCY DETERMINATION FOR CONSTRUCTION AND OPERATION OF THE RAILGUN AT NAVAL DISTRICT WASHINGTON - WEST, DAHLGREN, VIRGINIA

FEDERAL AGENCY ACTION

The Department of the Navy proposes to construct a facility for the operational development and subsequent testing of an electric railgun at the Naval District Washington, West Area (NDW-West, Dahlgren), Dahlgren, Virginia. The sponsors of the electric railgun program, the Naval Sea Systems Command (NAVSEA) Program Manager PMS-500 and the Office of Naval Research (ONR), are responsible for the development of the proof of concept (POC) for the electric railgun. The project sponsors have selected the Naval Surface Warfare Center Dahlgren Laboratory (NSWCDL) at NDW-West, Dahlgren to develop the POC, as it is known as the center for excellence for combat and weapons systems development. NSWCDL is the principal Navy research, development, testing, and evaluation (RDT&E) center for surface warfare analysis, surface ship combat systems, strategic systems, mines, mine countermeasures, amphibious warfare and special warfare systems, and diving.

Currently, NDW-West, Dahlgren does not have the specialized facilities required to perform this operation. Thus, facilities must be built to accommodate the operational personnel as well as the testing facilities themselves. The proposed action entails the construction of the required facilities for the operational development and testing of the railgun.

The proposed railgun facilities would feature the following components:

- **Pulsed Power Building** - a 9,600-sq-ft (892-sq-m) high-bay building that would house a capacitor needed to supply the launcher with pulsed power.
- **Control and Instrumentation Building** - a 4,000-sq-ft (372-sq-m) building that would provide a site operations area, a staging area, a test observation area, test and analysis laboratories, instrumentation housing, and restrooms.
- **Projectile Containment Tunnel** - a 328-ft- (100-m-) long

tunnel that would contain the projectiles and would extend from the launcher building to the terminal containment structure.

- **Terminal Containment Structure** – a 246-ft (75-m) preformed concrete structure with gravel in-fill. It would be modular and reusable, and would safely terminate projectile flights. Lethality assessments would occur at the terminal containment structure.

PURPOSE

There have been numerous studies that indicate the need for long-range, time-critical strike capability weapons in our nation's defense inventory. "Hypervelocity weapons" for attacking time-critical targets, the ability to defeat "bunkers and hardened targets," and low-cost "volume fires" are repeatedly cited as being critical to achieving transformational war fighting capability.

Guns from World War II Naval battleships could fire over 20 miles (mi) (32 kilometers [km]) in support of amphibious and shore bombardment operations. Since its battleships were decommissioned after the Cold War, the Navy has been criticized for failing to provide a substitute capability in the form of long-range artillery aboard surface combatants. The 5" guns available today, which fire projectiles that can hit targets up to 13 mi (21 km) away, do not satisfy the requirements of either the Marine Corps or the Navy. The Marine Corps requires long-range artillery (gun) support from the sea, and the modern Navy needs to operate farther from hostile shores than just two decades ago because of exposure to longer-range enemy anti-ship weapons.

The only weapon in the Fleet today that can reach extended distances from a ship is the Tomahawk missile; however, the Navy and the Marines would prefer to have rapid-fire, inexpensive, long-range artillery. Although the Tomahawk is a powerful and precise weapon, it is expensive, each costing more than $500,000. With the potential to deliver lethal, hypersonic projectiles, Naval railguns offer a transformational solution for volume fires and time-critical strikes. Railguns provide a means for sustained offensive power projection, complementary to missiles and tactical aircraft.

The comparatively small projectiles of a railgun offer distinct logistics advantages over propellant-based guns. Thousands of railgun projectiles fit into the same magazine volume that accommodates only hundreds of projectiles with associated propellant charges. Because railgun rounds have no propellant-based charges, explosive hazards are virtually eliminated; the absence of explosive propellants would obviate the need for the stringent explosives safety procedures currently required for conventional ammunition during manufacturing, transportation, handling, and storage. Hazards of electromagnetic radiation to ordnance (HERO) and electro-static discharge (ESD) would essentially become non-issues with respect to railguns. The result would be vastly improved safety for sailors and reduced logistics costs.

Several recent studies have concluded that railgun technologies are sufficiently mature to proceed to a full-scale POC demonstration. The objectives of such a demonstration would be to validate key performance aspects of both the electromagnetic (EM) launcher and the hypersonic guided projectile. The POC demonstration would require specialized facilities to develop and test hypersonic weapon capability. In order to advance the development of a Naval railgun, it is first necessary to proceed to a full-scale POC demonstration. The POC demonstration would require specialized facilities for operational development and testing. The NSWCDL at NDW-West, Dahlgren does not currently have such specialized facilities. Implementation of the proposed action would facilitate the POC demonstration for an electric railgun.

ANALYSIS

The Commonwealth of Virginia has developed and implemented a federally approved Coastal Resources Management Program (CRMP) describing current coastal legislation and nine enforceable policies. Following are the nine enforceable policies issued by Virginia for the coastal area:

- Fisheries management.
- Subaqueous lands management.
- Wetlands management.
- Dunes management.
- Non-point source pollution control.
- Point source pollution control.
- Shoreline sanitation.

- Air pollution control.
- Coastal lands management.

An analysis of the proposed railgun facility construction and operation with respect to each of the enforceable policies follows.

Fisheries Management

Construction of the proposed railgun facility at NDW-West, Dahlgren is not in proximity to any waterbodies and consequently will not adversely impact the conservation and enhancement of finfish and shellfish resources or the promotion of commercial or recreational fisheries.

Subaqueous Lands Management

Construction of the proposed railgun facility at NDW-West, Dahlgren will not encroach on state-owned subaqueous lands.

Wetlands Management

The proposed railgun facility construction will result in approximately 0.63 ac (0.25 ha) of unavoidable non-tidal palustrine wetland impacts at NDW-West, Dahlgren. Anticipated impacts will require submission of a Joint Permit Application (JPA) to the Virginia Marine Resources Commission (VMRC). VMRC, acting as the clearinghouse for the JPA, will forward the application to the other pertinent regulatory agencies.

In connection with the alternatives analysis, the *Memorandum of Agreement Between the Environmental Protection Agency and the Department of the Army Concerning the Determination of Mitigation under the Clean Water Act Section 404 (b)(1) Guidelines* emphasizes:

- **Avoidance** - avoid potential impacts to the maximum extent practicable;

- **Minimization** - take appropriate and practicable steps to minimize the adverse impacts (e.g., limit the anticipated impact to an area of the wetland with lesser value than other areas, or reduce the actual size of the impacted area); and

- **Compensatory Mitigation** - take appropriate and practicable compensatory mitigation action for unavoidable adverse impacts which remain after all appropriate and practicable minimization has been required (create a new wetland area, restore existing degraded wetland, or enhance low value wetland into improved wetland).

With respect to alternatives, the Navy first considered locations other than NDW-West, Dahlgren for the proposed railgun site. It was determined that given the unmatched resources at NDW-West, Dahlgren, it is the only realistic location for construction of the proposed railgun facility. The NSWCDL at NDW-West, Dahlgren is the center for excellence for combat and weapons systems development, and has maintained and improved its expertise over the decades. PMS-500 and the ONR will rely on the knowledge of NSWCDL resident scientists and technicians, among the nation's foremost experts in combat and weapons systems, for development of the POC for the electric railgun.

Next, the Navy considered alternatives sites at NDW-West, Dahlgren to construct and operate the railgun facility. It was determined that no other site met the siting criteria. These criteria included: 1) a site with enough land to accommodate an up-to-4,900-foot (1500-m) projectile tunnel and containment structure, and 2) a site with enough land that was outside any Explosive Safety Quantity Distance (ESQD) arcs such that some proposed railgun operations could occur concurrently with other NSWCDL activities.

The specific project footprint was configured to avoid wetlands to the maximum extent practicable (see Figure 1). As part of the permit process, the Navy will be working with the regulatory agencies to identify appropriate and practicable compensatory mitigation measures to offset wetland impacts resulting from the construction of the proposed railgun facility at NDW-West, Dahlgren.

Dunes Management

Construction of the proposed railgun facility at NDW-West, Dahlgren will not adversely affect any sand dunes.

Non-Point Source Pollution Control

Construction of the various components of the proposed railgun facility will result in an increase of about 22,000 sq ft (2,040 sq m) of new impervious surface.NDW-West Dahlgren's General Permit for Stormwater Discharges from Construction Sites will require the preparation and implementation of a Stormwater Pollution Prevention Plan as required under the Virginia Pollution Discharge Elimination System permit program. This document, in addition to an erosion and sediment control plan and stormwater management plan as required by Virginia's Erosion and Sediment Control and Stormwater Management Laws and implementing regulations, will serve to limit the impacts of converting a pervious surface to an impervious one.

Point Source Pollution Control

The proposed railgun facility will not require an industrial discharge and the bathroom facilities will be connected to the existing sanitary sewage system at NDW-West Dahlgren. NDW-West Dahlgren received a Certificate to Construct from the Virginia Department of Environmental Quality (VDEQ) for the construction of a new sewage lift station that will service the railgun facility. Best management practices will be implemented during construction of the facility.

Shoreline Sanitation

Construction of the proposed railgun facility at NDW-West, Dahlgren will not include the demolition or installation of septic tanks. As such, this policy is not applicable.

Air Pollution Control

Construction of the proposed railgun facility will temporarily produce dust. It will also result in some increase in vehicle emissions in the vicinity of the proposed site as construction workers travel to and from the site and operate construction equipment. The production of dust and the increase in vehicle emissions will be temporary (i.e., only during the construction period). Operation of the railgun will require one 2500 KW generator. Installation of the generator will be coordinated with VDEQ under the guidance of NDW-West Dahlgren's Synthetic Minor State Operating Permit.

Coastal Lands Management

Since the proposed action is occurring on land under the exclusive control of the federal government, there is no development within designated state coastal zone resource protection areas or resource management areas.

CONCLUSION

Based upon the information provided here and the analyses within the draft Environmental Assessment, the Navy finds that the construction and operation of the railgun is consistent to the maximum extent practicable with the policies of the Virginia CRMP.

Impacted Wetlands at the Railgun Site

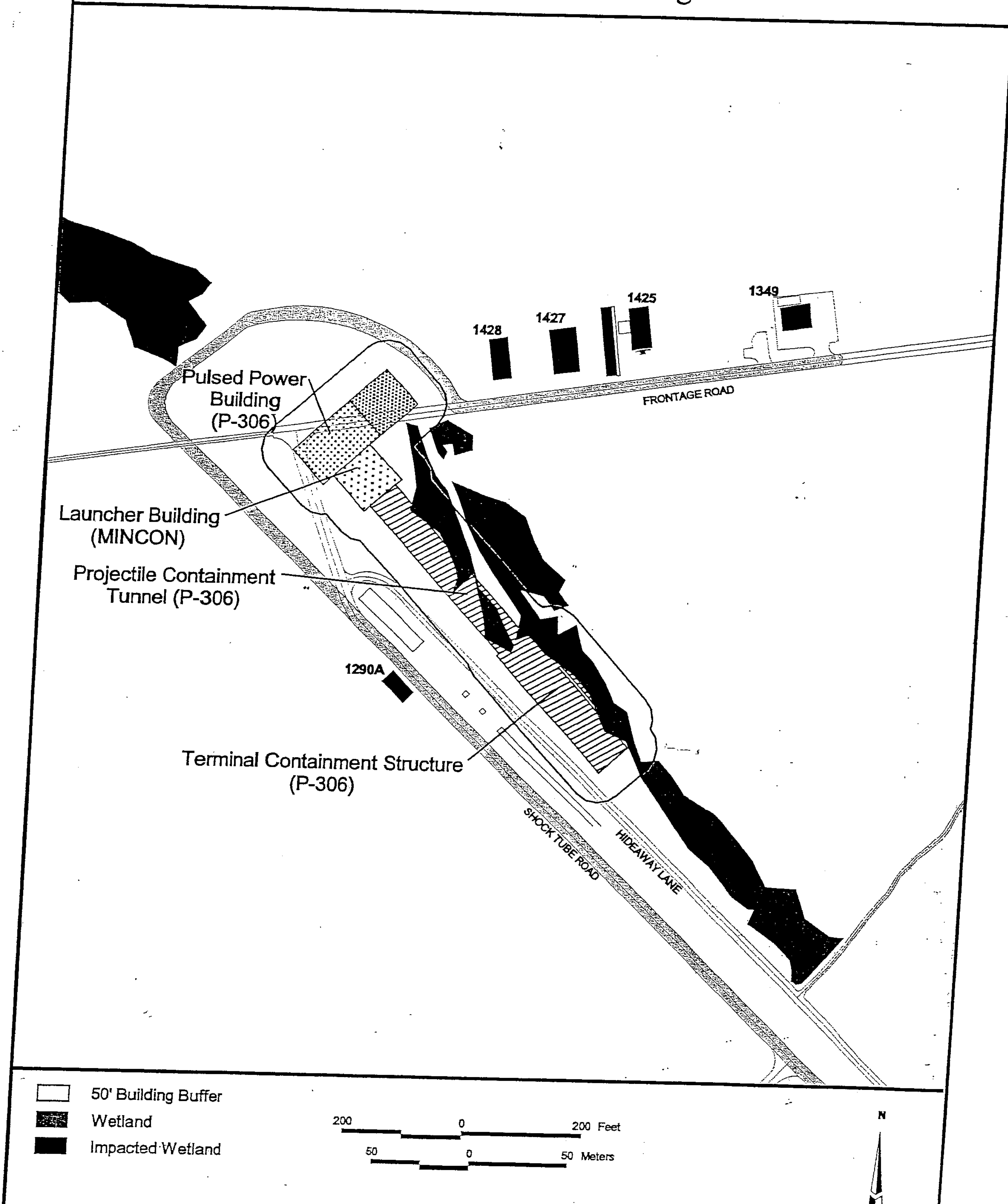


Figure 1

COMMONWEALTH of VIRGINIA

W. Tayloe Murphy, Jr.
Secretary of Natural Resources

DEPARTMENT OF ENVIRONMENTAL QUALITY
Street address: 629 East Main Street, Richmond, Virginia 23219
Mailing address: P. O. Box 10009, Richmond, Virginia 23240
Fax (804) 698-4500 TDD (804) 698-4021
www.deq.virginia.gov

Robert G. Burnley
Director

(804) 698-4000
1-800-592-5482

April 21, 2005

Mr. Jeffery C. Bossart
Site Environmental Program Director
By direction of the Commandant
Naval District Washington, West Area (NDW-West, Dahlgren)
Department of the Navy
1014 N Street, SE Suite 200
Washington Navy Yard, DC 20374-5001

RE: Federal Consistency Determination for the Construction and Operation of the Railgun at Naval District Washington – West, Dahlgren, Virginia (DEQ 05-044F).

Dear Mr. Bossart:

The Commonwealth of Virginia has completed its review of the above-referenced federal consistency determination. The Department of Environmental Quality (DEQ) is responsible for coordinating state reviews of federal consistency determinations submitted under the Coastal Zone Management Act. The following agencies and locality joined in this review:

Department of Environmental Quality
Department of Game and Inland Fisheries
Department of Conservation and Recreation
Department of Historic Resources
Marine Resources Commission
King George County

In addition, the RADCO Planning District Commission was invited to comment.

Project Description

The Department of the Navy has submitted a Federal Consistency Determination for the Construction and Operation of the Railgun at Naval District Washington – West, Dahlgren, Virginia. The Federal Consistency Determination refers to a draft Environmental Assessment (EA). The EA was not provided with the Federal Consistency Determination. The Department of the Navy proposes to construct a facility for the operational development and subsequent testing of an electronic railgun at the Naval District Washington, West Area (NDW-West, Dahlgren), Dahlgren, Virginia. The sponsors of the electric railgun program, the Naval Sea Systems Command (NAVSEA) Program Manager PMS-500 and the Office of Naval Research (ONR), are responsible for the proof of concept (POC) for the electric railgun. The project sponsors have selected the Naval Surface Warfare Center Dahlgren Laboratory (NSWCDL) at NDW-West, Dahlgren to develop the POC, as it is known as the center for excellence for combat and weapons systems development. NSWCDL is the principal Navy research, development, testing, and evaluation (RDT&E) center for surface warfare analysis, surface ship combat systems, strategic systems, mines, mine countermeasures, amphibious warfare and special warfare systems and diving.

Currently, NDW-West, Dahlgren does not have the specialized facilities required to perform this operation. Thus, facilities must be built to accommodate the operational personnel as well as the testing facilities themselves. The proposed action entails the construction of the required facilities for the operational development and testing of the railgun.

The proposed railgun facilities would feature the following components:

- **Pulsed Power Building** – a 9,600-sq-ft (829-sq-m) high-bay building that would house a capacitor needed to supply the launcher with pulsed power.
- **Control and Instrument Building** – a 4,000-sq-ft (372-sq-m) building that would provide a site operations area, a staging area, a test observation area, test and analysis laboratories, instrument housing and restrooms.
- **Projectile Containment Tunnel** – a 328-ft (100-m) long tunnel that would contain the projectiles and would extend from the launcher building to the terminal containment structure.
- **Terminal Containment Structure** – a 246-ft (75-m) preformed concrete structure with gravel in-fill. It would be modular and reusable, and would safely terminate projectile flights. Lethality assessments would occur at the terminal containment structure.

The Navy determined that, based on the information provided in the Federal Consistency Determination and the analysis within the draft Environmental Assessment, the construction and operation of the railgun is consistent to the maximum extent practicable with the policies of the Virginia Coastal Resource Management Program.

Federal Consistency under the Coastal Zone Management Act

Pursuant to the Coastal Zone Management Act of 1972, as amended, federal activities located inside or outside of Virginia's designated coastal management area that can have reasonably foreseeable effects on coastal resources or coastal uses must, to the maximum extent practicable, be implemented in a manner consistent with the Virginia Coastal Resources Management Program (VCP). The VCP consists of a network of programs administered by several agencies. The DEQ coordinates the review of federal consistency determinations with agencies administering the Enforceable and Advisory Policies of the VCP.

Based on the information provided in the Federal Consistency Determination, and the comments of reviewing agencies, we concur that the proposed activity is consistent with the Virginia Coastal Resources Management Program, provided that the Department of the Navy complies with all requirements of applicable permits and other authorizations that may be required.

Enforceable Policies

The following Enforceable Policies of the VCP apply to the proposed project:

1. Fisheries Management. The Federal Consistency Determination (page 5) reports that construction of the proposed railgun facility at NDW-West, Dahlgren is not in proximity to any waterbodies and consequently will not adversely impact the conservation and enhancement of finfish and shellfish resources or the promotion of commercial or recreational fisheries.

DGIF finds this project to be consistent with the Fisheries Section of the VCP. DGIF does not anticipate a significant adverse impact upon listed wildlife resources under DGIF jurisdiction to occur due to this project.

2. Subaqueous Land Management. Federal Consistency Determination (page 5) reports that construction of the proposed railgun facility at NDW-West, Dahlgren will not encroach on state-owned subaqueous lands.

The Virginia Marine Resources Commission (VMRC) did not indicate that the project would have any impacts to regulatory programs under its jurisdiction. Please be advised that the VMRC, pursuant to § 28.2-1204 of the Code of Virginia, has jurisdiction over any encroachments, in, on, or over any State-owned rivers, streams, or creeks in the Commonwealth. Accordingly, if any portion of the project involves any encroachments channelward of ordinary high water along natural rivers and streams, a permit may be required from VMRC. For additional information, contact Ben McGinnis, VMRC, at (757) 247-8028.

3. Wetlands Management. The Federal Consistency Determination (page 5) reports that the proposed railgun facility construction will result in approximately 0.63 ac (0.25 ha) of unavoidable non-tidal palustrine wetland impacts at NDW-West, Dahlgren. Anticipated impacts will require the submission of a Joint Permit Application (JPA) to the Virginia Marine Resources Commission (VMRC). VMRC, acting as the clearinghouse for the JPA, will forward the application to the other pertinent regulatory agencies.

The Navy alternatives analysis (FCD; pages 5, 6) was performed using *the Memorandum of Agreement Between the Environmental Protection Agency and the Department of the Army Concerning the Determination of Mitigation under the Clean Water Act Section 404 (b) (1) Guidelines*. The FCD (page 6) reports that, with respect to alternatives:

- It was determined that given the unmatched resources at NDW-West, Dahlgren, it is the only realistic location for construction of the proposed railgun facility (FCD; page 6).

- It was determined that no other site met the siting criteria. These criteria included: 1) a site with enough land to accommodate an up-to-4,900-foot (1500-m) projectile tunnel and containment structure, and 2) a site with enough land that was outside any Explosives Safety Quantity Distance (ESQD) arcs such that some proposed railgun operations could occur concurrently with other NSWCDL activities.

- The specific project footprint was configured to avoid wetlands to the maximum extent practicable (see Figure 1). As part of the permit process, the Navy will be working with the regulatory agencies to identify appropriate and practicable compensatory mitigation measures to offset wetland impacts resulting from the construction of the proposed railgun facility at NDW-West, Dahlgren.

DEQ found that the Consistency Determination indicates that impacts are proposed to 0.63 acre of palustrine forested wetlands. Impacts to streams are not proposed.

In accordance with 9 VAC 25-210-50 of the Virginia Water Protection (VWP) Permit Program regulations, a VWP permit from the Virginia Department of Environmental Quality (DEQ) will be required for these proposed impacts to wetlands. Upon receipt of a Joint Permit Application for the proposed wetland impacts, DEQ-VWP Permit staff will review the proposed impacts and compensation in accordance with the VWP permit program regulations and current VWP permit program guidance.

DEQ encourages the Navy to monitor activities to ensure that erosion and stormwater management practices are adequately preventing sediment and pollution migration into nearby surface waters. Erosion controls and Best Management Practices (BMPs) should be in place prior to construction.

4. Dunes Management. The Federal Consistency Determination (page 6) reports that construction of the proposed railgun facility at NDW-West, Dahlgren will not adversely affect any sand dunes.

5. Non-point Source Pollution Control. The Federal Consistency Determination (page 7) reports that construction of the various components of the proposed railgun facility will result in an increase of about 22,000 sq ft (2,040 sq m) of new impervious surface. NDW-West Dahlgren's General Permit for Stormwater Discharges from Construction Sites will require the preparation and implementation of a Stormwater Pollution Prevention Plan as required under the Virginia Pollution Discharge Elimination System permit program. This document, in addition to an erosion and sediment control plan and stormwater management plan as required by Virginia's

Erosion and Sediment Control and Stormwater Management Laws and implementing regulations, will serve to limit the impacts of converting the pervious surface to an impervious one.

According to the Department of Conservation and Recreation (DCR), Federal agencies and their authorized agents conducting regulated land-disturbing activities on private and public lands in the state must comply with the Virginia Erosion and Sediment Control Law and Regulations (VESCL&R), Virginia Stormwater Management Law and Regulations (VSWML&R), and other applicable federal nonpoint source pollution mandates (e.g. Clean Water Act Section 313, Federal Consistency under the Coastal Zone Management Act).

The Navy must comply with Virginia's Erosion and Sediment Control Law (Virginia Code 10.1-567) and regulations (4 VAC 50-30-30 et seq.) and Stormwater Management Law (Virginia Code 10.1-603.5) and regulations (4 VAC 3-20-210 et seq.). Clearing and grading activities, installation of staging areas, parking lots, roads, buildings, utilities, or other structures, soil/dredge spoil areas, or related land conversion activities that disturb 10,000 square feet or more (2,500 square feet or more in a Chesapeake Bay Preservation Area) would be regulated by VESCL&R and those that disturb one acre or greater would be covered by VSWML&R. Accordingly, the Navy should prepare and implement erosion and sediment control (ESC) and stormwater management (SWM) plans to ensure compliance with state law. The federal agency is ultimately responsible for achieving project compliance through oversight of on-site contractors, regular field inspection, prompt action against non-compliant sites, and/or other mechanisms, consistent with agency policy.

The Navy is encouraged to contact DCR's York-Rappahannock Watershed Office, (804) 443-6752, for assistance with developing or implementing E&S and/or Stormwater Management Plans to ensure project conformance during and after construction. For information pertaining to the VPDES stormwater general permit for construction activities, please contact Lee Hill at DCR's Central Office, (804) 786-3998.

6. Point Source Pollution Control. The Federal Consistency Determination reports that (Point Source Pollution Control; page 7) the proposed railgun facility will not require an industrial discharge and bathroom facilities will be connected to the existing sanitary sewage system at NDW-West Dahlgren. NDW-West Dahlgren received a Certificate to Construct from the Virginia Department of Environmental Quality (VDEQ) for the construction of a new sewage lift station that will service the railgun facility. Best management practices will be implemented during the construction of the facility.

7. Shoreline Sanitation. The Federal Consistency Determination (page 7) reports that construction of the proposed railgun facility at NDW-West, Dahlgren will not include the demolition or installation of septic tanks.

8. Air Pollution Control. The Federal Consistency Determination (page 7) reports that construction of the proposed railgun facility will temporarily produce dust. It will also result in some increase in vehicle emissions in the vicinity of the proposed site as construction workers travel to and from the site and operation construction equipment. The production of dust and the increase in vehicle emissions will be temporary (i.e., only during the construction period). Operation of the railgun will require one 2500 KW generator. Installation of the generator will be coordinated with VDEQ under guidance of NDW-West Dahlgren's Synthetic Minor State Operating Permit.

DEQ found that the FCD clearly states that the permitting requirements of the Air Regulations will be complied with for the emergency power requirements for the facility. All other Air Regulation requirements are covered by the FCD. DEQ recommends that during construction, fugitive dust must be kept to a minimum by using control methods outlined in 9 VAC 5-50-60 *et seq.* of the Regulations for the Control and Abatement of Air Pollution. These precautions include, but are not limited to, the following:

- Use, where possible, of water or chemicals for dust control;
- Installation and use of hoods, fans, and fabric filters to enclose and vent the handling of dusty materials;
- Covering of open equipment for conveying materials; and
- Prompt removal of spilled or tracked dirt or other materials from paved streets and removal of dried sediments resulting from soil erosion.

If project activities include the burning of construction material, this activity must meet the requirements under 9 VAC 5-40-5600 *et seq.* of the Regulations for open burning, and it may require a permit. The Regulations provide for, but do not require, the local adoption of a model ordinance concerning open burning. For more information, please contact John Bowden, DEQ Northern Regional Office, (703) 583-3880. For more information pertaining to local requirements (e.g., open burning, etc.), please contact Dennis Kerns, King George County Administrator, (540) 775-9181.

9. Coastal Lands Management/Chesapeake Bay Preservation Act. The Federal Consistency Determination (page 8) reports that, since the proposed action is occurring on land under the exclusive control of the federal government, there is no development within designated state coastal zone resource protection areas or resource management areas.

According to DCR's Division of Chesapeake Bay Local Assistance (DCBLA), although Chesapeake Bay Preservation Areas (CBPAs) are not locally designated on federal lands, this does not relieve the Department of the Navy of its responsibilities to be consistent with the provisions of the *Chesapeake Bay Preservation Area Designation and Management Regulations,* (Regulations) as one of the enforceable policies of Virginia's Coastal Resources Management Program (VCP). Federal actions on installations located within Tidewater Virginia are required to be consistent with the performance criteria of the Regulations on lands analogous to locally designated Chesapeake Bay Preservation Areas.

In King George County, the areas protected by the Bay Act, as locally implemented requiring stringent performance criteria, include: tidal wetlands, non-tidal wetlands connected by surface flow and contiguous to tidal wetlands or tributary streams, tidal shores and a 100-foot vegetated buffer area located adjacent to and landward of the aforementioned features (Resource Protection

Areas – RPA). Less stringent performance criteria apply jurisdiction-wide for the remainder of the county (Resource Management Areas – RMA).

According to DCR-DCBLA, the proposed railgun facility appears to be outside of those areas requiring the more stringent performance criteria (RPAs), however the project is subject to the less stringent general performance criteria (RMAs). These criteria include minimizing the amount of land disturbed, preserving indigenous vegetation and minimizing impervious cover. In addition, all development exceeding 2,500 square feet, shall comply with requirements of the *Virginia Erosion and Sediment Control Handbook*, Third Edition, 1992. Also, stormwater management criteria consistent with the water quality protection provisions (§ 4 VAC 3-20-71 et seq.) of the Virginia Stormwater Management Law and Regulations (§ 4 VAC 3-20) shall be satisfied.

Furthermore, the 1998 Federal Agencies' Chesapeake Ecosystem Unified Plan requires the signatories, including the Department of the Navy, to fully cooperate with local and state governments in carrying out voluntary and mandatory actions to comply with the management of stormwater. The agencies also committed to encouraging construction design that a) minimizes natural area loss on new and rehabilitated federal facilities; b) adopts low impact development and best management technologies for storm water, sediment and erosion control, and reduces impervious surfaces; and c) considers the Conservation Landscaping and Bay-Scapes Guide for Federal Land Managers. In addition, the Chesapeake 2000 Agreement committed the government agencies to a number of sound land use and stormwater quality controls. The signatories additionally committed the agencies to lead by example with respect to controlling nutrient, sediment and chemical contaminant runoff from government properties. In December 2001, the Executive Council of the Chesapeake Bay Program issued Directive No. 01-1, Managing Storm Water on State, Federal and District-owned Lands and Facilities, which includes specific commitments for agencies to lead by example with respect to stormwater control.

To ensure that this project complies with the General Performance Criteria under §9 VAC 10-20-110 of the Bay Act Regulations, the Navy must coordinate project activities with DCR-CBLA. For additional information and coordination, contact Alice Baird, DCR-CBLA at (804) 225-2307.

Advisory Policies of the VCP and Other Environmental Issues

DEQ encourages the Navy to consider the advisory policies of the VCP. Also, there are other environmental laws and policies that may apply to this project.

1. Natural Heritage Resources. The Federal Consistency Determination does not identify impacts to Natural Heritage Resources, resulting from the proposed project.

The Department of Conservation and Recreation's Division of Natural Heritage (DCR) has searched its Biotics Data System for occurrences of natural heritage resources from the area outlined on the submitted map. Natural heritage resources are defined as the habitat of rare, threatened, or endangered plant and animal species, unique or exemplary natural communities, and significant geologic formations.

Biotics documents the presence of natural heritage resources in the project area. However, due to the scope of the activity and the distance to the resources, DCR does not anticipate that this project will adversely impact these natural heritage resources. In addition, DCR files do not indicate the presence of any State Natural Area Preserves under DCR's jurisdiction in the project vicinity.

Under a Memorandum of Agreement established between the Virginia Department of Agriculture and Consumer Services (VDACS) and the Virginia Department of Conservation and Recreation (DCR), DCR represents VDACS in comments regarding potential impacts on state-listed threatened and endangered plant and insect species. The current activity will not affect any documented state-listed plants or insects.

New and updated information is continually added to Biotics. Department of the Navy should coordinate this activity with DCR-DNH. Please contact René Hypes, DCR-DNH at (804) 786-7951 for further information.

2. *Wildlife Resources.* The Federal Consistency Determination does not address potential impact to wildlife, including state or federally listed endangered or threatened species. Under Section 7 of the endangered Species Act of 1973 (as amended) if any protected species, to include state or federally listed species, or their critical habitats are sighted or would be impacted by the proposed project, the Navy is required to notify the U.S. Fish and Wildlife Service (USFWS) and Virginia Department of Game and Inland Fisheries (DGIF) and suspend the project until the Section 7 consultation process has been completed.

The Department of Game and Inland Fisheries, as the Commonwealth's wildlife and freshwater fish management agency, exercises enforcement and regulatory jurisdiction over wildlife and freshwater fish, including state or federally listed endangered or threatened species, but excluding listed insects (*Virginia Code* Title 29.1). DGIF is a consulting agency under the U.S. Fish and Wildlife Coordination Act (16 U.S.C. sections 661 et seq.), and provides environmental analysis of projects or permit applications coordinated through DEQ and several other state and federal agencies. DGIF determines likely impacts upon fish and wildlife resources and habitat, and recommends appropriate measures to avoid, reduce, or compensate for those impacts.

DGIF note that the Federal Consistency Determination (page 5) identifies impacts resulting from the construction of this facility for the operational development and testing of an electric railgun at NDW-West, Dahlgren will include the loss of 0.63 acre of non-tidal palustrine wetland habitat. Impacts to wetland habitat resulting from this project are discussed in Enforceable Policies: Section 3 *Wetlands Management.* For additional guidance, please see Section 3 *Wetlands Management.*

DGIF recommends providing compensatory mitigation for unavoidable impacts to forested wetlands at a minimum ratio of 2:1, scrub/shrub wetlands at a minimum ratio of 1.5:1, emergent wetlands at a minimum ratio of 1:1, and streams at a minimum ratio of 1:1 per lf in a functionally similar stream. For more information, see the DGIF website at www.dgif.state.va.us or contact Ray Fernald at (804) 367-6913.

3. Historic Structures and Archaeological Resources. The Federal Consistency Determination does not address potential impact to any known archaeological or architectural resource listed in or eligible for listing in the National Register of Historic Places or Virginia Landmarks Register.

Section 106 of the National Historic and Preservation Act of 1966, as amended, requires that federal agencies must consider effects of its activities on properties that are listed or eligible for listing on the National Register of Historic Places. The Department of Historic Resources (DHR) conducts reviews of projects to determine their effect on historic structures or cultural resources. DHR requests that the Department of the Navy consult with DHR directly. For additional information, contact Marc Holma, DHR at (804) 367-2323. In the event that archaeological resources are encountered during project activities, immediately contact Ms. Ethel Eaton, DHR at (804) 367-2323.

4. Solid and Hazardous Wastes and Hazardous Materials. The Federal Consistency Determination does not identify impacts to a solid waste management unit (SWMU), resulting from the proposed project. The Federal Consistency Determination does not identify hazardous waste or solid waste storage or dumping in the area.

During construction, there is the potential for a short-term increase in hazardous substances to be introduced to the ground surface from construction equipment operation. In the event of a spill, the Navy should excavate and dispose of contaminated soil in accordance with state and federal regulations. The following website may help the Navy locate additional information pertaining to NDW-West, Dahlgren: http://www.epa.gov/enviro/html/rcris/rcris_query_java.html.

Some of the applicable state laws and regulations are: Virginia Waste management Act, Code of Virginia Section 10.1-1400 *et seq.*; Virginia Hazardous Waste Management Regulations (VHWMR) (9VAC 20-60); Virginia Solid Waste Management Regulations (VSWMR) (9VAC 20-80); Virginia Regulations for the Transportation of Hazardous Materials (9VAC 20-110). Some of the applicable Federal laws and regulations are: the Resource Conservation and Recovery Act (RCRA), 42 U.S.C. Section 6901 *et seq.*, and the applicable regulations contained in Title 40 of the Code of Federal Regulations; and the U.S. Department of Transportation Rules for Transportation of Hazardous materials, 49 CFR Parts 107.

Please note that DEQ encourages all construction projects and facilities to implement pollution prevention principles, including the reduction, reuse, and recycling of all solid wastes generated. All solid waste, hazardous waste, and hazardous materials must be managed in accordance with all applicable federal, state, and local environmental regulations. Contact John Bowden, DEQ Northern Regional Office, (703) 583-3880, for additional information concerning location and availability of suitable waste management facilities in the project area or if free product, discolored soils, or other evidence of contaminated soils are encountered.

5. Pesticides and Herbicides. The use of herbicides or pesticides for landscape maintenance should be in accordance with the principles of integrated pest management. The least toxic pesticides that are effective in controlling the target species should be used. Also, we recommend that the use of pesticides or herbicides containing volatile organic compounds as their active ingredient be avoided to the maximum extent practicable in order to protect air quality. Please contact the Department of Agriculture and Consumer Services at (804) 786-3501 for more information.

6. Pollution Prevention. DEQ advocates that principles of pollution prevention be used in all construction projects as well as in facility operations. Effective siting, planning, and on-site Best Management Practices (BMPs) will help to ensure that environmental impacts are minimized. However, pollution prevention techniques also include decisions related to construction materials, design, and operational procedures that will facilitate the reduction of wastes at the source. We have several pollution prevention recommendations that may be helpful in constructing or operating this project:

- Consider environmental attributes when purchasing materials. For example, the extent of recycled material content, toxicity level, and amount of packaging should be considered and can be specified in purchasing contracts.
- Consider contractors' commitment to the environment when choosing contractors. Specifications regarding raw materials and construction practices can be included in contract documents and requests for proposals.
- Choose sustainable materials and practices for infrastructure and building construction and design. These could include asphalt and concrete containing recycled materials, and integrated pest management in landscaping, among other things.

DEQ's Office of Pollution Prevention provides free information and technical assistance relating to pollution prevention techniques. For more information, contact DEQ's Office of Pollution Prevention, Mr. Tom Griffin at (804) 698-4545.

Thank you for the opportunity to review this project. If you need clarification of these comments, please contact me at (804) 698-4325 or Ernst Aschenbach at (804) 698-4326.

Sincerely,

Ellie L. Irons
Program Manager
Office of Environmental Impact Review

Enclosures

cc: Catherine Harold, DEQ-OWPS
Kotur S. Narasimhan, DEQ-ADA
Allen Brockman, DEQ-ORP
John Bowden, DEQ-NRO
Tony Watkinson, VMRC

Gerald P. Wilkes, DMME
Ray Fernald, DGIF
Allan Weber, VDH
John Davy, DCR
Keith R. Tignor, VDACS
Ethel Eaton, DHR
Alice Baird, DCR-CBLA
Michael Foreman, DOF
Dennis W. Kerns, King George County
Stephen H. Manster, RADCO PDC

Bowden,John

From: Bowden,John
Sent: Wednesday, March 16, 2005 12:43 PM
To: Ellis,Charles
Subject: Consistency Determination #05-044F

RECEIVED

MAR 21 2005

DEQ-Office of Environmental Impact Review

NVRO comments regarding the Consistency Determination for the Construction and Operation of the Railgun at Naval District Washington sponsored by DOD/Department of the Navy are as follows:

1. Wetlands-The Department of the Navy proposes to construct a facility for the operational development and subsequent testing of an electric rail gun at the Naval District Washington, West Area, Dahlgren, Virginia. The Consistency Determination indicates that impacts are proposed to 0.63 acre of palustrine forested wetlands. Impacts to streams are not proposed.

In accordance with 9 VAC 25-210-50 of the Virginia Water Protection (VWP) Permit Program regulations, a VWP permit from the Virginia Department of Environmental Quality (DEQ) will be required for these proposed impacts to wetlands. Upon receipt of a Joint Permit Application for the proposed wetland impacts, DEQ-VWP Permit staff will review the proposed impacts and compensation in accordance with the VWP permit program regulations and current VWP permit program guidance.

2. Air Permitting-The EA clearly states that the permitting requirements of the Air Regs will be complied with for the emergency power requirements for the facility. All other Air Reg requirements are covered by the EA.

John D. Bowden
Deputy Regional Director
Department of Environmental Quality
Northern Virginia Regional Office
(703) 583-3880
jdbowden@deq.virginia.gov

If you cannot meet the deadline, please notify CHARLIE ELLIS at 804/698-4488 prior to the date given. Arrangements will be made to extend the date for your review if possible. An agency will not be considered to have reviewed a document if no comments are received (or contact is made) within the period specified.

REVIEW INSTRUCTIONS:

A. Please review the document carefully. If the proposal has been reviewed earlier (i.e. if the document is a federal Final EIS or a state supplement), please consider whether your earlier comments have been adequately addressed.

B. Prepare your agency's comments in a form which would be acceptable for responding directly to a project proponent agency.

C. Use your agency stationery or the space below for your comments. **IF YOU USE THE SPACE BELOW, THE FORM MUST BE SIGNED AND DATED.**

Please return your comments to:

MR. CHARLES H. ELLIS III
DEPARTMENT OF ENVIRONMENTAL QUALITY
OFFICE OF ENVIRONMENTAL IMPACT REVIEW
629 EAST MAIN STREET, SIXTH FLOOR
RICHMOND, VA 23219
FAX #804/698-4319

Charles H. Ellis III

CHARLES H. ELLIS III
ENVIRONMENTAL PROGRAM PLANNER

COMMENTS

This will acknowledge receipt of your transmittal letter with enclosures requesting Commission review of the above-referenced project.

Please be advised that the Marine Resources Commission, pursuant to Section 28.2-1204 of the Code of Virginia, has jurisdiction over any encroachments in, on, or over any State-owned rivers, streams, or creeks in the Commonwealth. Accordingly, if any portion of the subject projects involves any encroachments channelward of ordinary high water along natural rivers and streams, a permit may be required from our agency.

(signed) ______ McGinnis (date) 03/07/05

(title) Environmental Engineer

(agency) VMRC

PROJECT # 05-044F

Ellis,Charles

From: Andrew Zadnik [Andrew.Zadnik@dgif.virginia.gov]
Sent: Friday, March 25, 2005 4:43 PM
To: Ellis,Charles
Cc: ProjectReview.Richmond_PO.DGIF@dgif.virginia.gov
Subject: 05-044F_ESSLOG 20261_Railgun at Naval District Washington

This project involves construction of a facility for the operational development and testing of an electric railgun at NDW-West, Dahlgren. Impacts will include the loss of 0.63 ac of non-tidal palustrine wetland.

We find this project to be consistent with the Fisheries Section of the VA Coastal Resources Management Program. We do not anticipate a significant adverse impact upon listed wildlife resources under our jurisdiction to occur due to this project.

We recommend providing compensatory mitigation for unavoidable impacts to forested wetlands at a minimum ratio of 2:1, scrub/shrub wetlands at a minimum ratio of 1.5:1, emergent wetlands at a minimum ratio of 1:1, and streams at a minimum mitigation ratio of 1:1 per lf in a functionally similar stream.

Thank you,

Andrew K. Zadnik
Environmental Services Section Biologist
Department of Game and Inland Fisheries
4010 West Broad Street
Richmond, VA 23230

(804) 367-2733
(804) 367-2427 (fax)

W. Tayloe Murphy, Jr.
Secretary of Natural Resources

Joseph H. Maroon
Director

COMMONWEALTH of VIRGINIA

DEPARTMENT OF CONSERVATION AND RECREATION

217 Governor Street
Richmond, Virginia 23219-2010
Telephone (804) 786-7951 FAX (804) 371-2674 TDD (804) 786-2121

MEMORANDUM

DATE: March 22, 2005

TO: Synthia Waymack, DCR-DPRR

FROM: René Hypes, DCR-DNH

SUBJECT: Due March 24, 2005
DEQ #05-044F, Construction & Operation of the Railgun at Naval District Washington

The Department of Conservation and Recreation's Division of Natural Heritage (DCR) has searched its Biotics Data System for occurrences of natural heritage resources from the area outlined on the submitted map. Natural heritage resources are defined as the habitat of rare, threatened, or endangered plant and animal species, unique or exemplary natural communities, and significant geologic formations.

Biotics documents the presence of natural heritage resources in the project area. However, due to the scope of the activity and the distance to the resources, we do not anticipate that this project will adversely impact these natural heritage resources.

In addition, our files do not indicate the presence of any State Natural Area Preserves under DCR's jurisdiction in the project vicinity.

Under a Memorandum of Agreement established between the Virginia Department of Agriculture and Consumer Services (VDACS) and the Virginia Department of Conservation and Recreation (DCR), DCR represents VDACS in comments regarding potential impacts on state-listed threatened and endangered plant and insect species. The current activity will not affect any documented state-listed plants or insects.

New and updated information is continually added to Biotics. Please contact DCR for an update on this natural heritage information if a significant amount of time passes before it is utilized.

The Virginia Department of Game and Inland Fisheries maintains a database of wildlife locations, including threatened and endangered species, trout streams, and anadromous fish waters, which may contain information not documented in this letter. Their database may be accessed from www.dgif.virginia.gov/wildlife/info_map/index.html, or contact Shirl Dressler at (804) 367-6913.

Should you have any questions or concerns, feel free to contact me at 804-371-2708. Thank you for the opportunity to comment on this project.

W. Tayloe Murphy, Jr.
Secretary of Natural
Resources

Joseph H. Maroon
Director

COMMONWEALTH of VIRGINIA

DEPARTMENT OF CONSERVATION AND RECREATION

101 N. 14th Street, 17th Floor
Richmond, Virginia 23219-3684
PHONE: (804) 225-3440 FAX: (804) 225-3447

March 28, 2005

RECEIVED
MAR 31 2005
DEQ-Div. of Environmental Enhancement

Mr. Ernie Aschenbach
Department of Environmental Quality
Office of Environmental Impact Review
629 East Main Street, Sixth Fl
Richmond, Virginia 23219

Re: Construction and Operation of the Railgun at Naval District Washington
DCR-DCBLA Project # FSPR-NAVY-02-05

Dear Mr. Aschenbach,

We have reviewed the consistency determination for the Construction and Operation of the Railgun at Naval District Washington as requested.

While Chesapeake Bay Preservation Areas are not locally designated on federal lands, this does not relieve the Department of the Navy of its responsibilities to be consistent with the provisions of the ***Chesapeake Bay Preservation Area Designation and Management Regulations***, (Regulations) as one of the enforceable programs of Virginia's Coastal Resources Management Program (VCRMP). Federal actions on installations located within Tidewater Virginia are required to be consistent with the performance criteria of the Regulations on lands analogous to locally designated Chesapeake Bay Preservation Areas.

In King George County, the areas protected by the Chesapeake Bay Act, as locally implemented requiring stringent performance criteria, include: tidal wetlands, non-tidal wetlands connected by surface flow and contiguous to tidal wetlands or tributary streams, tidal shores and a 100-foot vegetated buffer area located adjacent to and landward of the aforementioned features. Less stringent performance criteria apply jurisdiction-wide for the remainder of the county.

The proposed railgun facility appears to be outside of those areas requiring the more stringent performance criteria, however the project is subject to the less stringent general performance criteria. These criteria include minimizing the amount of land disturbed, preserving indigenous vegetation and minimizing impervious cover. In addition, all development exceeding 2,500 square feet shall comply with requirements of the *Virginia Erosion & Sediment Control Handbook*, Third Edition, 1992. Also, stormwater management criteria consistent with the water quality protection provisions (§ 4 VAC 3-20-71 et seq.) of the Virginia Stormwater Management Regulations (§ 4 VAC 3-20) shall be satisfied.

The 1998 Federal Agencies' Chesapeake Ecosystem Unified Plan requires the signatories, including the Department of the Navy, to fully cooperate with local and state governments in carrying out voluntary and mandatory actions to comply with the management of stormwater. The agencies also committed to encouraging construction design that a) minimizes natural area loss on new and rehabilitated federal facilities; b) adopts low impact development and best management technologies for storm water, sediment and erosion control, and reduces impervious surfaces; and c) considers the Conservation Landscaping and Bay-Scapes Guide for Federal Land Managers. In addition, the Chesapeake 2000 Agreement committed the government agencies to a number of sound land use and stormwater quality controls. The signatories additionally committed the agencies to lead by example with respect to controlling nutrient, sediment and chemical contaminant runoff from government properties. In December 2001, the Executive Council of the Chesapeake Bay Program issued Directive No. 01-1, Managing Storm Water on State, Federal and District-owned Lands and Facilities, which includes specific commitments for agencies to lead by example with respect to stormwater control.

We appreciate the opportunity to provide our comments on this project. Please do not hesitate to contact us at 1-800-CHESBAY should you have any questions.

Sincerely,

Alice R. T. Baird

Alice R. T. Baird, LA
Chesapeake Bay
Special Project Coordinator

Daniel Ben-Yisrael
Chesapeake Bay
Senior Planner

If you cannot meet the deadline, please notify CHARLIE ELLIS at 804/698-4488 prior to the date given. Arrangements will be made to extend the date for your review if possible. An agency will not be considered to have reviewed a document if no comments are received (or contact is made) within the period specified.

REVIEW INSTRUCTIONS:

A. Please review the document carefully. If the proposal has been reviewed earlier (i.e. if the document is a federal Final EIS or a state supplement), please consider whether your earlier comments have been adequately addressed.

B. Prepare your agency's comments in a form which would be acceptable for responding directly to a project proponent agency.

C. Use your agency stationery or the space below for your comments. **IF YOU USE THE SPACE BELOW, THE FORM MUST BE SIGNED AND DATED.**

Please return your comments to:

MR.CHARLES H. ELLIS III
DEPARTMENT OF ENVIRONMENTAL QUALITY
OFFICE OF ENVIRONMENTAL IMPACT REVIEW
629 EAST MAIN STREET, SIXTH FLOOR
RICHMOND, VA 23219
FAX #804/698-4319

Charles H Ellis III

CHARLES H. ELLIS III
ENVIRONMENTAL PROGRAM PLANNER

COMMENTS

This action is subject to review by DHR pursuant to Section 106 of the National Historic Preservation Act. Please remind the Dept of the Navy to consult with DHR directly.

(signed) [signature] (date) 17 MARCH 05

(title) Architectural Historian

(agency) DHR

PROJECT # 05-044F **8/98**

DHR # 2005-0295

If you cannot meet the deadline, please notify CHARLIE ELLIS at 804/698-4488 prior to the date given. Arrangements will be made to extend the date for your review if possible. An agency will not be considered to have reviewed a document if no comments are received (or contact is made) within the period specified.

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C. Use your agency stationery or the space below for your comments. **IF YOU USE THE SPACE BELOW, THE FORM MUST BE SIGNED AND DATED.**

Please return your comments to:

MR.CHARLES H. ELLIS III
DEPARTMENT OF ENVIRONMENTAL QUALITY
OFFICE OF ENVIRONMENTAL IMPACT REVIEW
629 EAST MAIN STREET, SIXTH FLOOR
RICHMOND, VA 23219
FAX #804/698-4319

RECEIVED

MAR 16 2005

DEQ-Office of Environmental Impact Review

Charles H. Ellis III

~~CHARLES~~ H. ELLIS III
ENVIRONMENTAL PROGRAM PLANNER

COMMENTS

No comments.

(signed) [signature] (date) 3-14-05

(title) County Administrator

(agency) King George County

PROJECT # 05-044F

APPENDIX D

VIRGINIA DEPARTMENT OF HISTORIC RESOURCES COORDINATION LETTERS

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COMMONWEALTH of VIRGINIA

L. Preston Bryant, Jr.
Secretary of Natural Resources

Department of Historic Resources
2801 Kensington Avenue, Richmond, Virginia 23221-0311

Kathleen S. Kilpatrick
Director

Tel: (804) 367-2323
Fax: (804) 367-2391
TDD: (804) 367-2386
www.dhr.virginia.gov

MEMORANDUM

DATE: 18 December 2008 **DHR File #** 2005-1263

TO: Mr. Jeffrey C. Bossart
Department of the Navy

FROM: Marc E. Holma, Architectural Historian (804) 367-2323, Ext. 114
Office of Review and Compliance

PROJECT: Construction of High-Energy Electromagnetic Launcher Facility
Naval Support Activity South Potomac, Dahlgren

___ This project will have an effect on historic resources. Based on the information provided, the effect will not be adverse.

___ This project will have an adverse effect on historic properties. Further consultation with DHR is needed under Section 106 of the NHPA.

___ Additional information is needed before we will be able to determine the effect of the project on historic resources. **Please see attached sheet.**

_X_ No further identification efforts are warranted. No historic properties will be affected by the project. Should unidentified historic properties be discovered during implementation of the project, please notify DHR.

___ We have previously reviewed this project. Attached is a copy of our correspondence.

___ Other (Please see comments below)

COMMENTS:

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DEPARTMENT OF THE NAVY
NAVAL SUPPORT ACTIVITY
SOUTH POTOMAC
6509 SAMPSON ROAD SUITE 216
DAHLGREN, VIRGINIA 22448-5106

IN REPLY REFER TO

5090
Ser PRDH42PA/097
December 8, 2008

CERTIFIED MAIL - RETURN RECEIPT REQUESTED

Ms. Ann Andrus
Commonwealth of Virginia
Department of Historic Resources
2801 Kensington Avenue
Richmond, Virginia 23221

Dear Ms. Andrus:

The Naval Support Activity South Potomac (NSASP) is providing oversight to the preparation of National Environmental Policy Act (NEPA) documentation to address the environmental effects of construction of a high-energy Electromagnetic (EM) Launcher Facility to demonstrate a 64 Megajoule (MJ) EM launcher and EM launcher scalability, barrel life, thermal management, and hypersonic weapon lethality. The facility would house the full-scale launcher, a high-energy pulse power system, and a terminal range for the Rail-gun project.

The EM Rail-gun program is a Research, Development, Test, and Evaluation (RDT&E) effort to incrementally develop a revolutionary ship weapon system capability that meets mid and far-term operational requirements. The Navy must be capable of providing sustainable offensive and defensive actions against all threats, either while conducting sea control, assured access, power projection, or naval presence missions. Electric weapons development such as the EM Rail-gun would enable the Navy to meet these requirements.

The EM Rail-gun project is currently under the P-306 MILCON at the Naval Support Facility (NSF), Dahlgren, Virginia for a tenant command, Naval Surface Warfare Center Dahlgren Laboratory (NSWCDL).

The proposed preferred site location is located in the center of the installation in an area where there are no historic districts or known archaeological sites.

The proposed action for the MILCON P-306 EM Rail-gun project also includes the demolition of the remains of the Conical Shock Tube concrete foundation, which lies directly in the footprint of the proposed project.

Enclosed are schematics and photos of the proposed project area, as well as documentation of the original construction of the Conical Shock Tube and its foundations.

In 1965, the Defense Atomic Support Agency contracted 2.38 million dollars for the construction of the Conical Shock Tube at Dahlgren, in response to the need for increased data on nuclear weapon air blast phenomena. Construction began in 1965 on this 2400' test facility (the world's largest nuclear blast simulator at that time) that could ensure testing in an enclosed environment without resorting to full-scale nuclear tests. It duplicated pressures and durations of nuclear air blasts up to 20 kilotons and was able to conduct testing that simulated altitudes up to 100,000 square feet. The facility could be used for testing structures, military equipment, re-entry vehicles and various other military devices for other Department of Defense agencies and private contractors. Construction was completed in August 1967 and released to the U.S. Navy in September 1967.

Telescopic in shape and weighing in at 1,775 tons, the metal components of the Conical Shock Tube had four 16" naval gun barrels coupled in tandem by means of metallic sleeves that comprised the firing chamber at the smallest end. The sleeves helped to prevent the escape of explosive gases. The detonation chamber was 180 feet long. The muzzle end of the telescopic structure measured approximately 24 feet across. A 3-stepped, concrete structure was poured behind the Conical Shock Tube to absorb the recoil thrust of the explosive testing, estimated to hit 2.5 million pounds at peak thrust. This structure was 25' wide, 130' long, used about 4 million pounds of concrete in construction, and is still in existence in the project area.

The Conical Shock Tube had three test stations (at the 10', 15', and 22' diameter points along the tube for mounting test models. Associative nearby test facilities included the computers for data acquisition and processing systems.

The Conical Shock Tube was dismantled in 1993 under a large, base-wide scrapping effort, as the structure was deemed obsolete for its original purpose. At that time, the structure was less than 30 years old, although constructed during the established Cold War period.

The proposed demolition of the concrete foundation would be to demolish these multiple foundations down to slightly below grade and then to provide a topping slab of 8" of concrete on top to form the new 200 meter Terminal Range of the EM Rail-gun. Given the extensive size and depth of the remaining Conical Shock Tube foundations, it would be more practical and less expensive to leave the underground portions in situ. Currently, some of the foundation pieces are covered in foot-deep mulch, remnants of a large tree cutting operation in the vicinity.

The Conical Shock Tube foundation and site was not included in the base's architectural survey of 1993, and thus was never identified as a historic structure or located within a historic district from 1994 Christopher Goodwin and Associates Report (on file at the Virginia Department of Historic Resources, VHDR). However, it may now meet the criteria of a Cold War asset as a stand alone structure. This qualification is currently being ascertained by our new installation architectural survey, whose updated recommendations will be sent to the VDHR for validation within the next several months. Any VDHR mitigation required for the demolition of the Conical Shock Tube foundation will be addressed as a condition within the NEPA documentation.

NSF Dahlgren seeks review of this project by your office to satisfy the regulatory requirements under the National Environmental Policy Act of 1969, as amended. The enclosed schematics are submitted for your review and comments. No response by the Virginia Department of Historic Resources with the thirty (30) day review cycle will be deemed concurrence. The Cultural Resources Program Office will provide appropriate documentation and informational copies to the Advisory Council on Historic Preservation in Washington, D.C.

5090
Ser PRDH42PA/097
December 8, 2008

Please direct all correspondence to:

ATTN: Environmental Division, PRIH40
Department of Navy
NAVFAC Washington, PWD South Potomac
18329 Thompson Road, Suite 226
Dahlgren, VA 22448-5110

For more information, please contact the Cultural Resources Program Office, Patricia Albert, at (540) 653-8584.

Sincerely,

JEFFREY C. BOSSART
By direction

Enclosure: 1. Maps and Proposed Schematics

Copy to: (w/o encl)
Mr. Don Klima
Advisory Council on Historic Preservation
Old Post Office Building
1100 Pennsylvania Avenue, N. W., #809
Washington, D. C. 20004

Enclosure (1)

Photos Taken During Construction
Of the Conical Shock Tube circa 1966

Completed Conical Shock Tube
Viewed from the South End 1967

Completed Conical Shock Tube
Viewed from the North End 1967

Conical Shock Tube Foundation
Element Numbers 1967 Photograph

North End of Foundation Elements
Aerial Photograph 2008
After Removal of Shock Tube
Key to Detailed Photographs
Taken 18 Nov 2008

South End of Foundation Elements
Aerial Photograph 2008
After Removal of Shock Tube
Key to Detailed Photographs
Taken 18 Nov 2008

Detailed Photographs of Shock Tube
Foundation Elements Taken 18 Nov 2008

Photos Taken During Construction Of the Conical Shock Tube circa 1966

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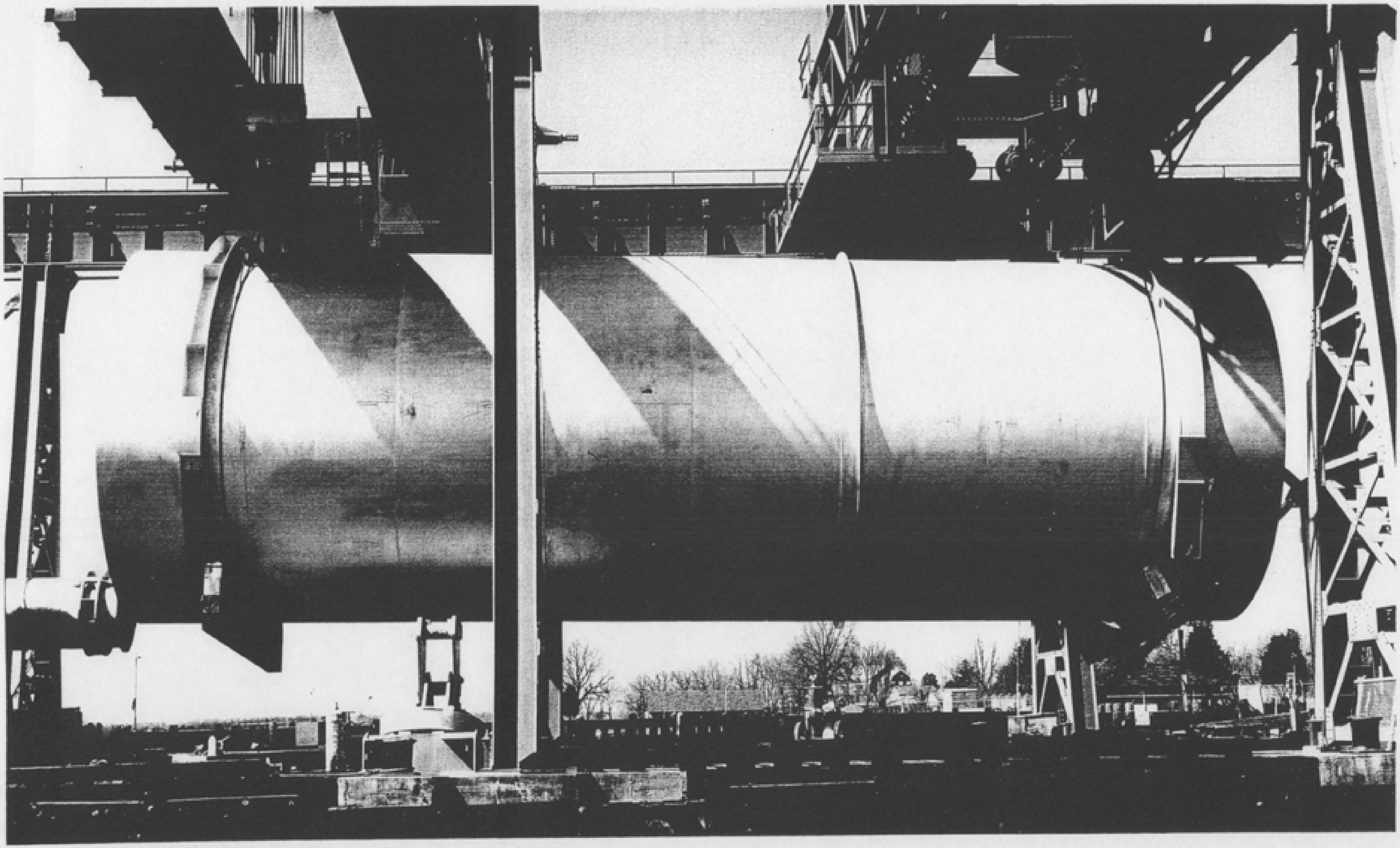
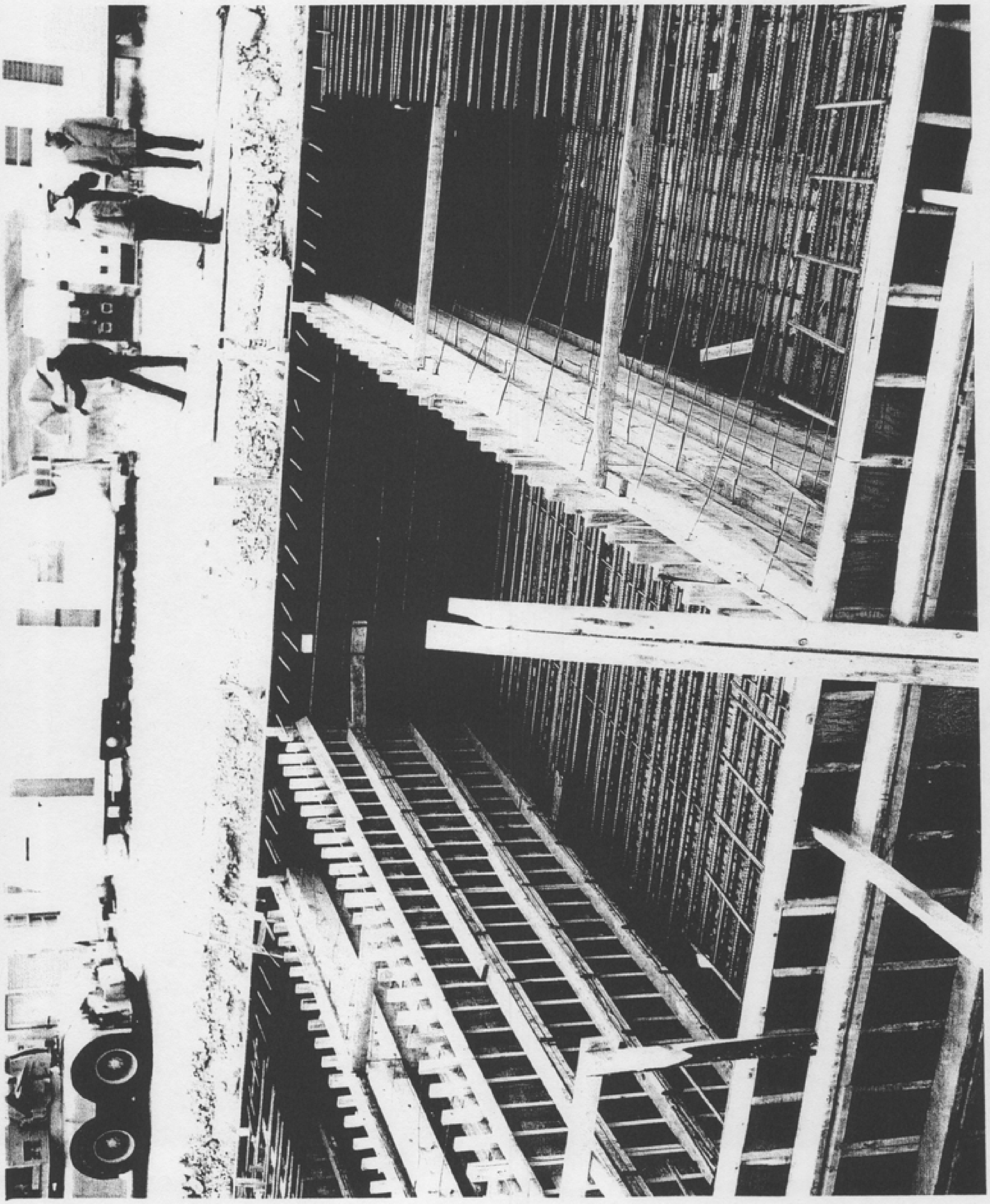
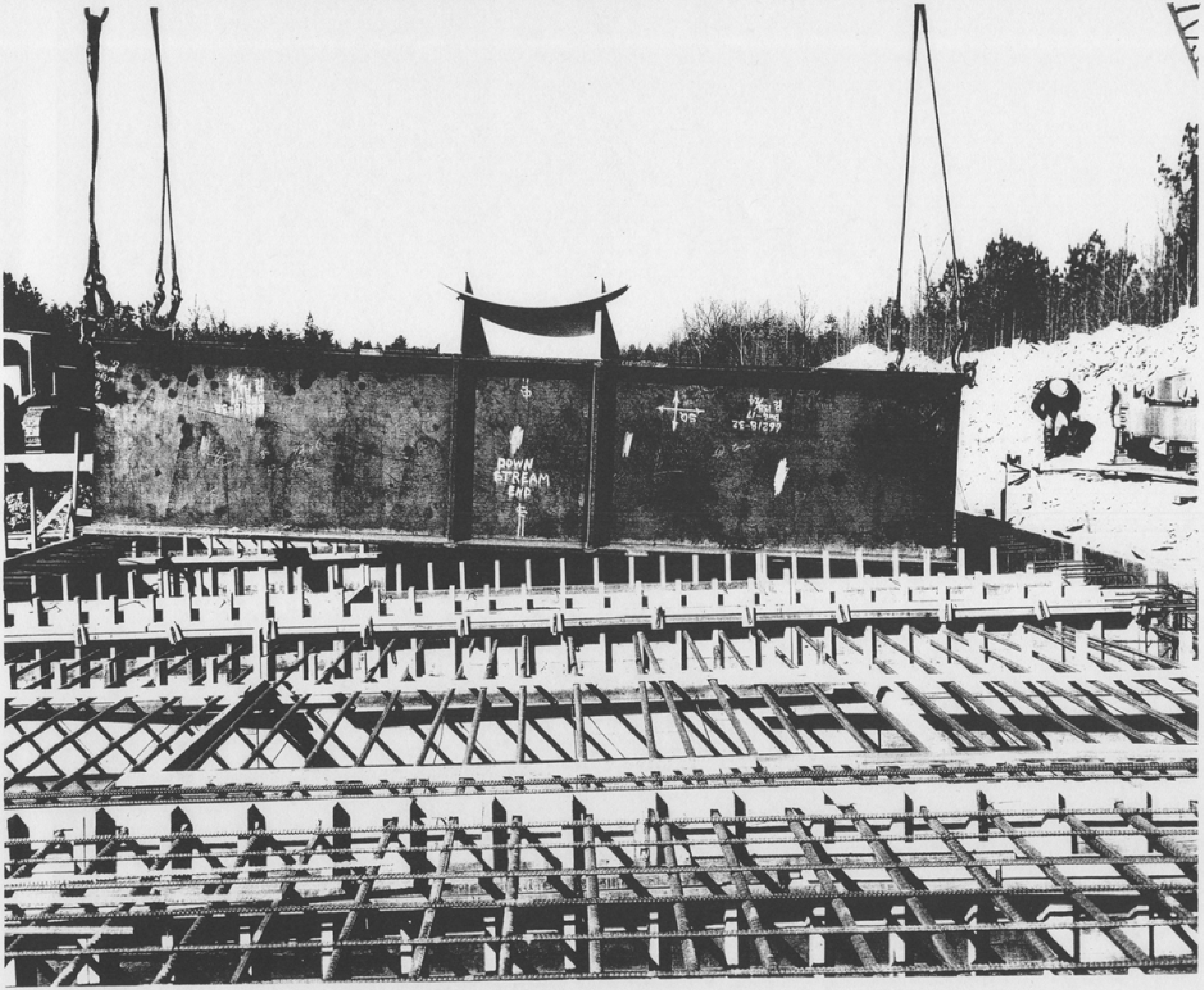


PHD-0538-4-66

28 March 1966

Contract NBy 53087 - Conical Shock Tube Facility, NWL, Dahlgren, Virginia.
Tube Section 27 being lifted from barge.

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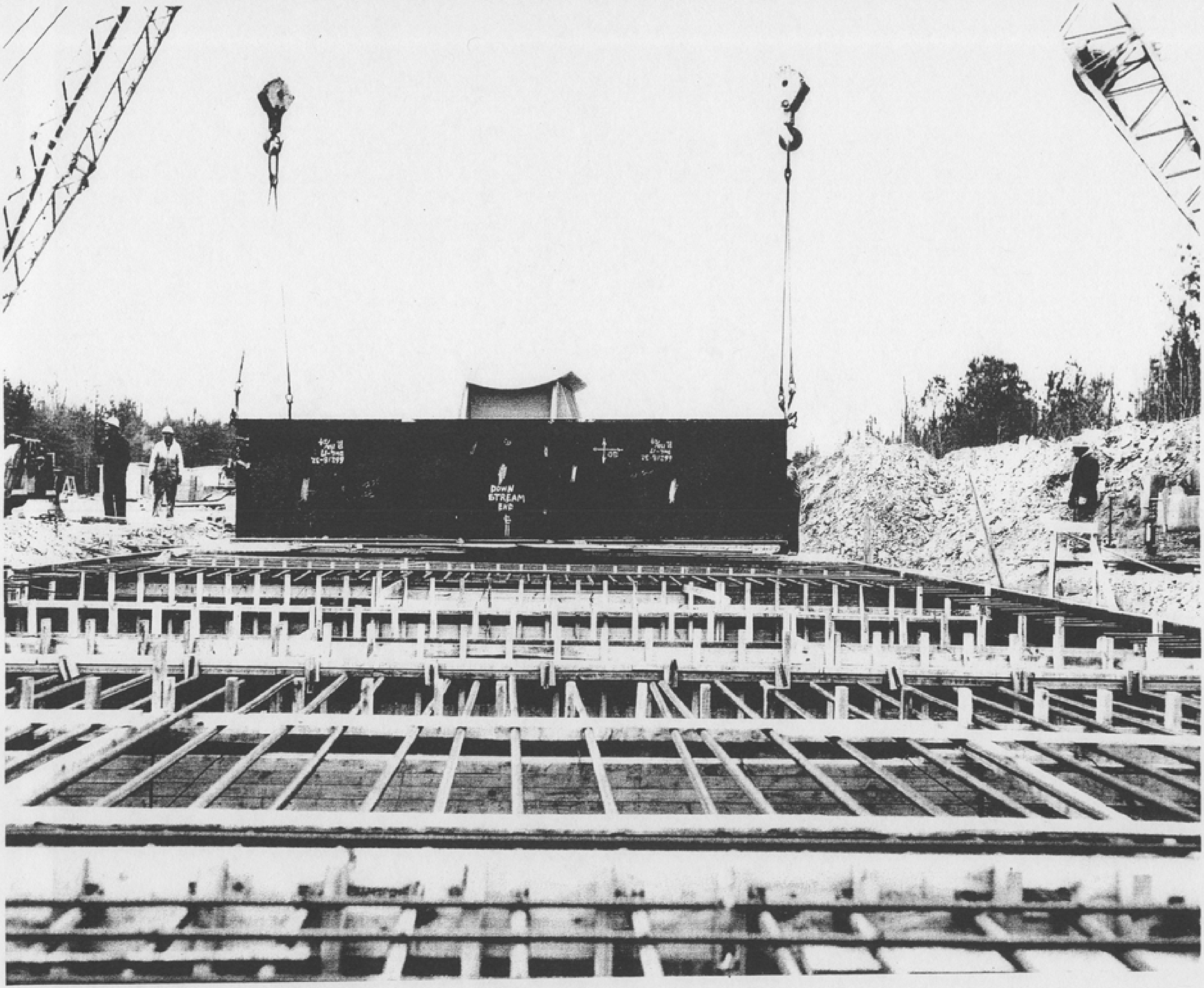
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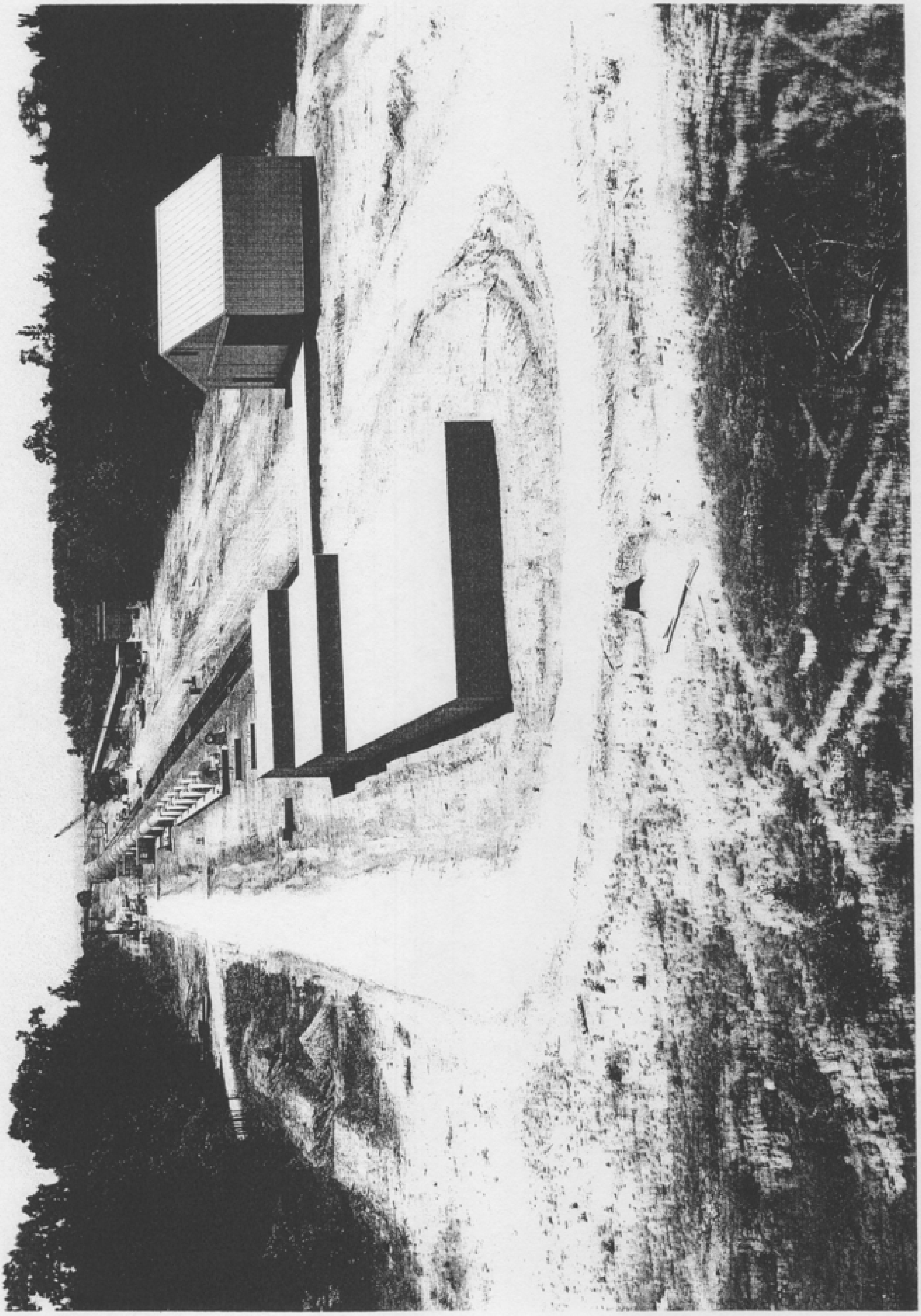

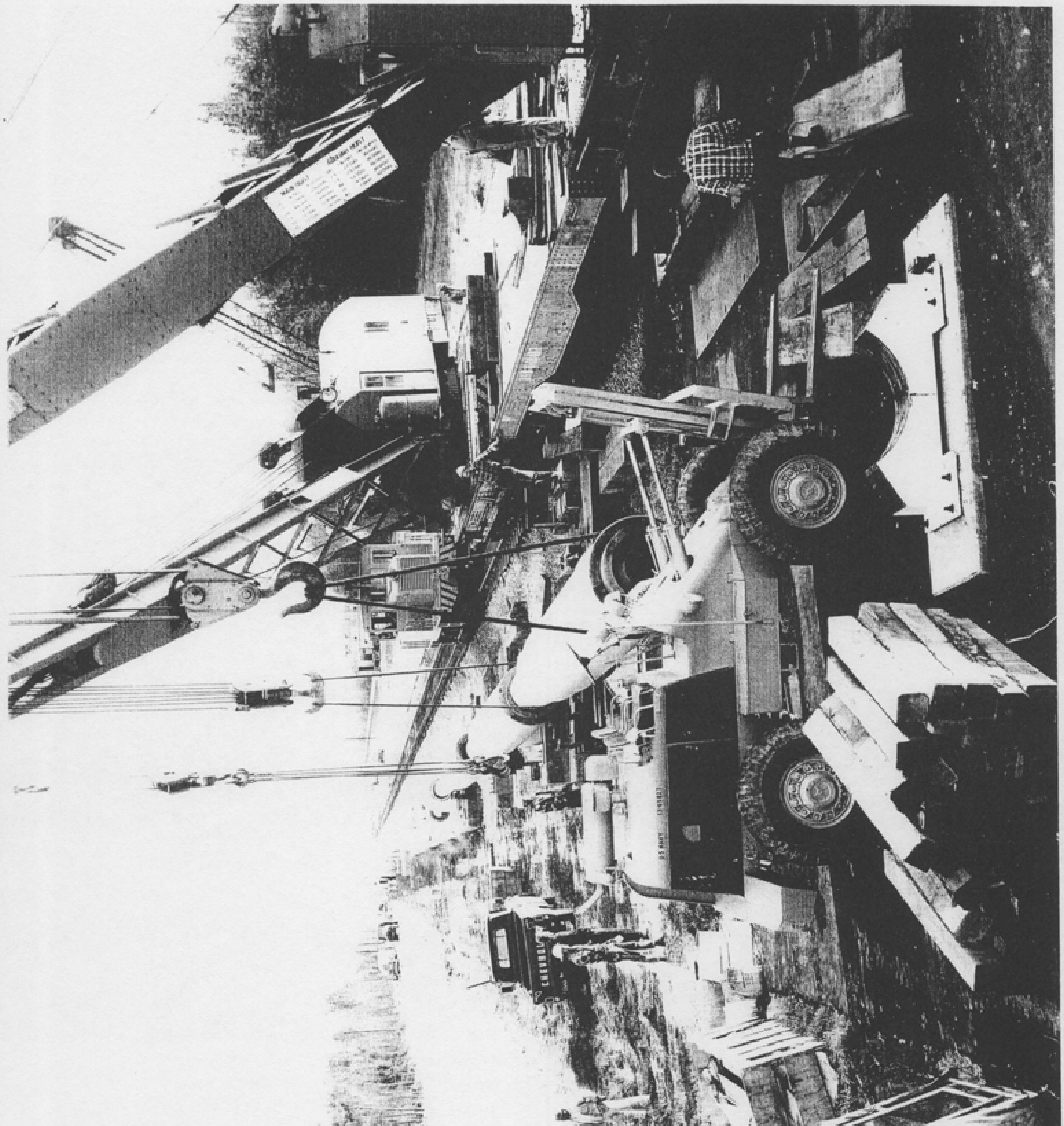

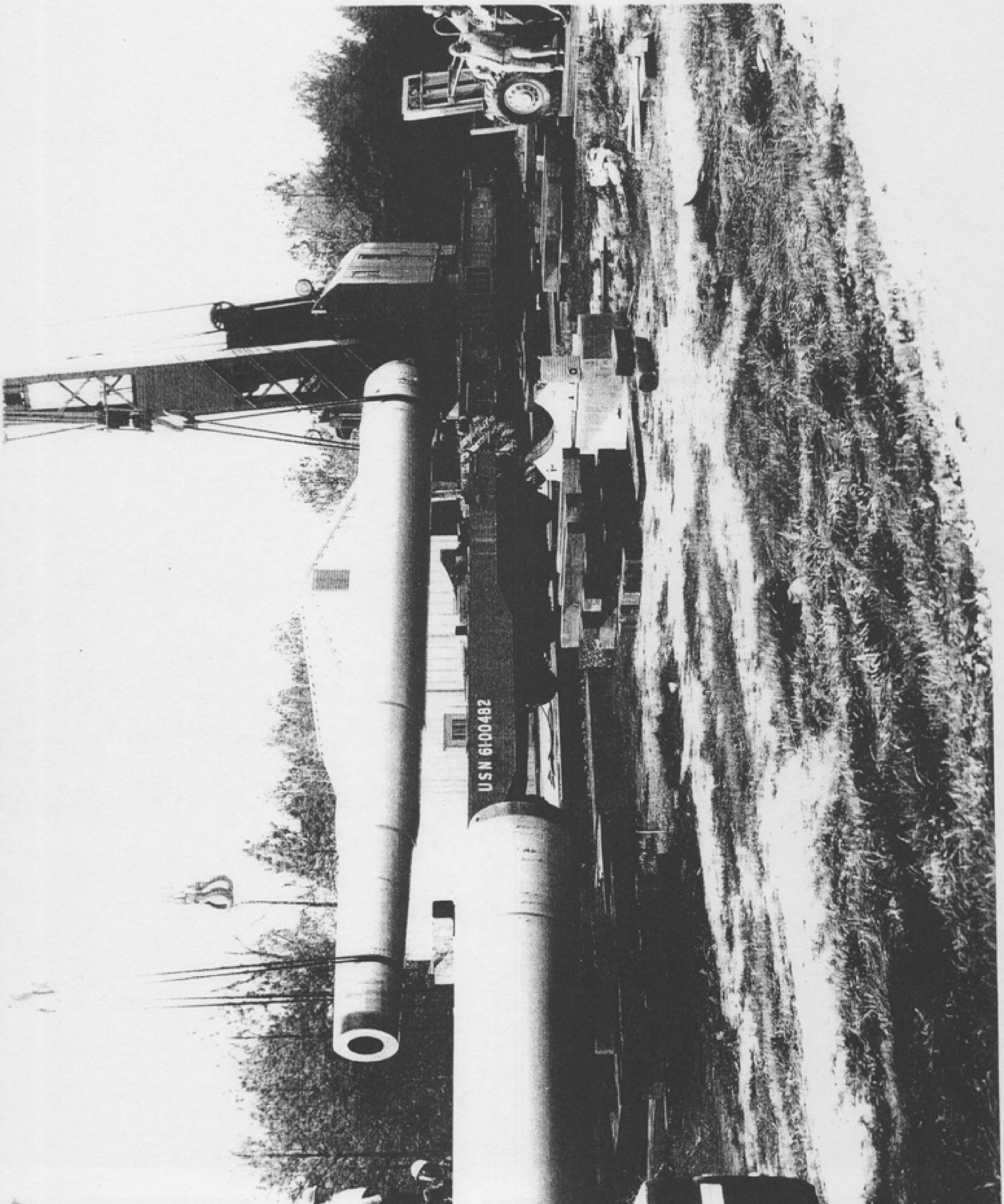
USN 61-00482

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Completed Conical Shock Tube
Viewed from the South End 1967

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Completed Conical Shock Tube Viewed From the South End 1967

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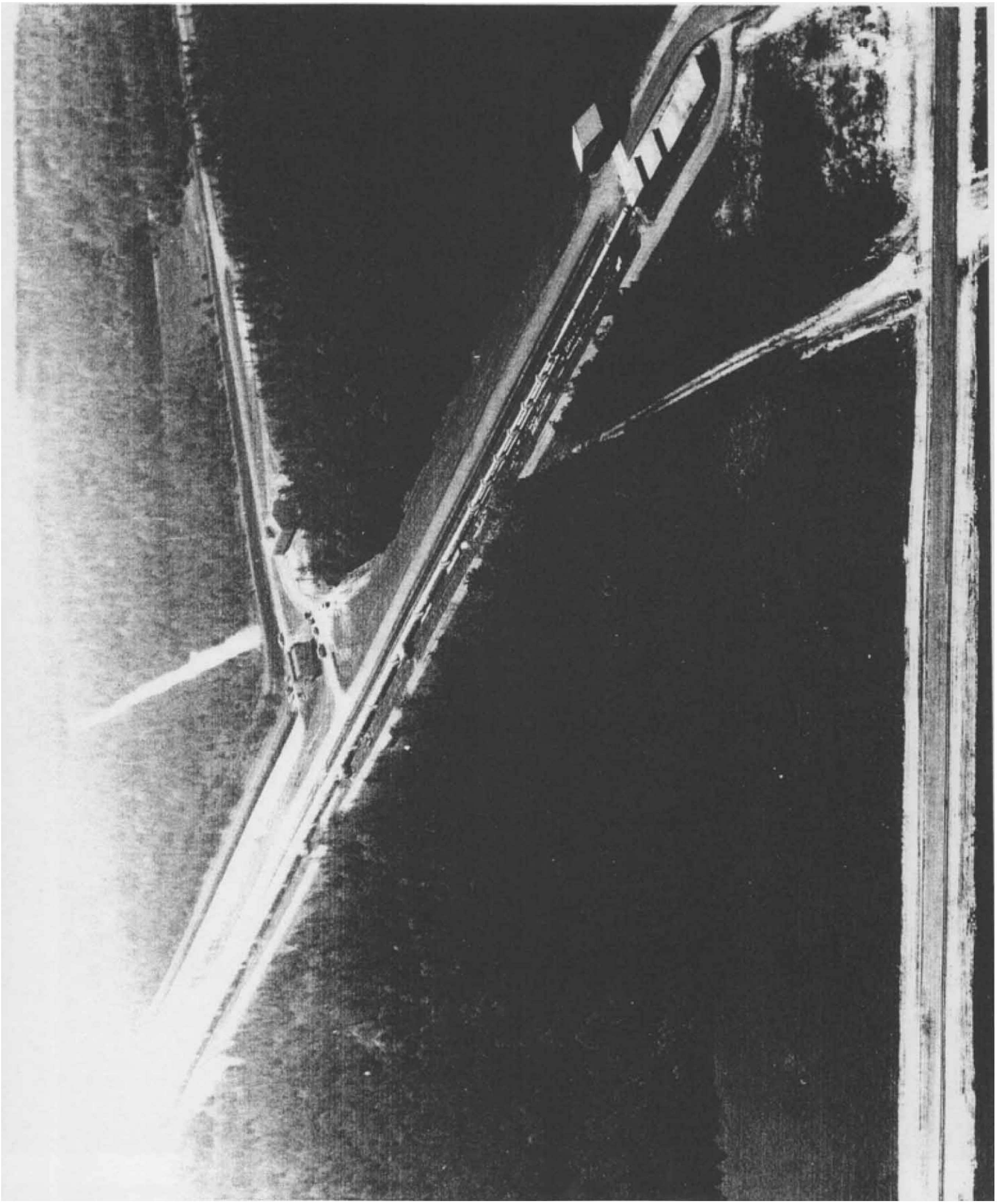
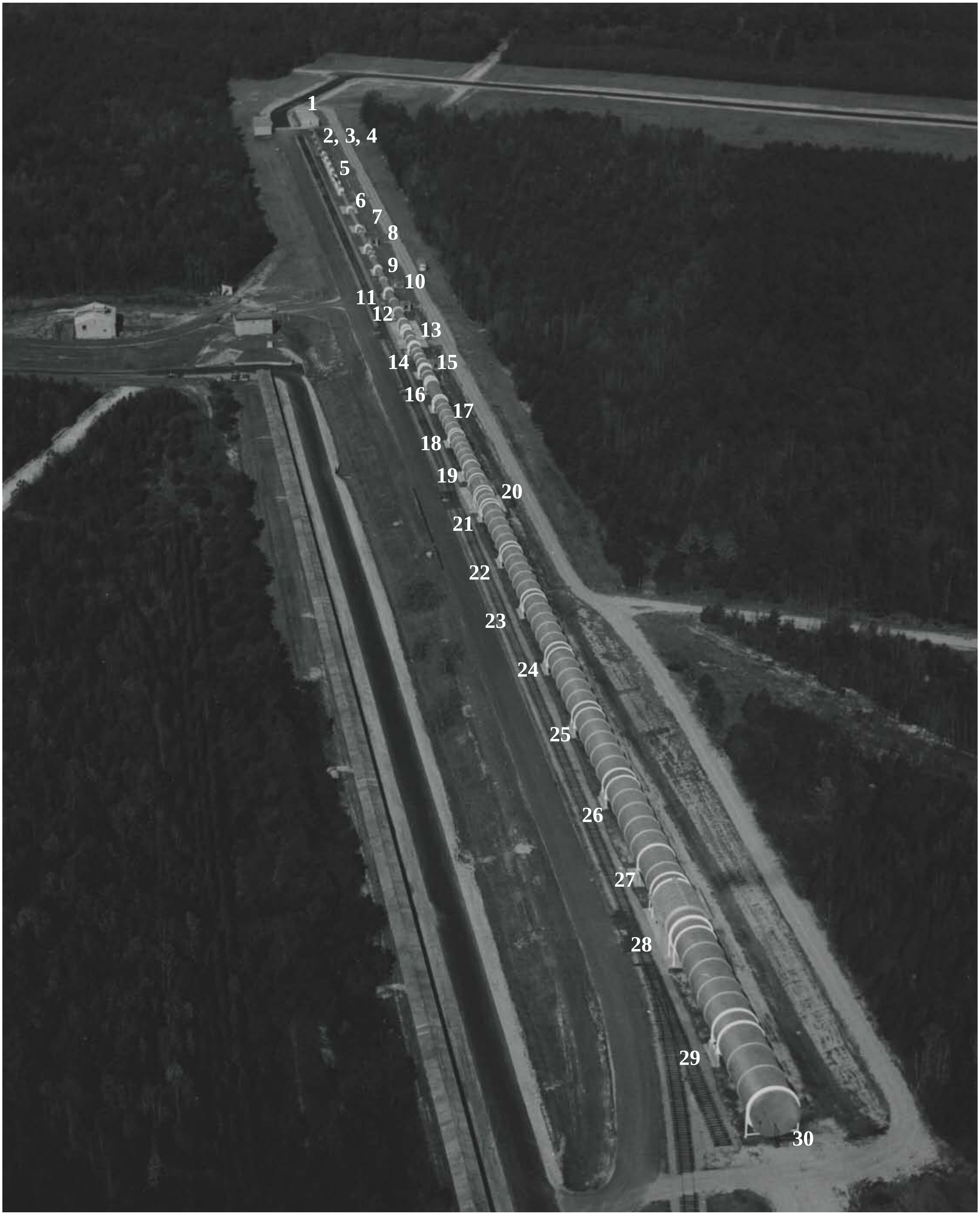
Completed Conical Shock Tube
Viewed from the North End 1967



Completed Conical Shock Tube Viewed From the North End 1967

Conical Shock Tube Foundation Element Numbers 1967 Photograph



Conical Shock Tube Viewed from the South End Photographed in November 1967

Numbers refer to items shown in detailed pictures taken 18 Nov 2008.

Items 12 and 14 were not photographed in 2008, they are apparently covered will fill.

No foundation elements were found in 2008 at the very end of the Shock Tube where an Item 30 may have supported the end.

North End of Foundation Elements
Aerial Photograph 2008
After Removal of Shock Tube
Key to Detailed Photographs
Taken 18 Nov 2008

Conical Shock Tube Foundations After Removal
Aerial Photography 2008 -- Overview of the North End, best viewed at 400%
Numbers refer to items shown in detailed pictures taken 18 Nov 2008.

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South End of Foundation Elements
Aerial Photograph 2008
After Removal of Shock Tube
Key to Detailed Photographs
Taken 18 Nov 2008

Conical Shock Tube Foundations After Removal

Aerial Photography 2008 -- Overview of the South End, best viewed at 400%.

Numbers refer to items shown in detailed pictures taken 18 Nov 2008.

Items 12 and 14 are not visible on the ground or in this photograph. They are visible in the 1967 photograph.

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Detailed Photographs of Shock Tube Foundation Elements Taken 18 Nov 2008

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Looking WNW at item 1. The green fence is not associated with the Shock Tube.


Item 1, Thrust plate, In Southeast end. Looking NNE.

Item 1 thrust plate, Looking north.

Item 2 First of three 3x9 items, looking NE. The Shock Tube foundation area is extensively covered with wood chips as a result of cutting and chipping of trees that had grown since the Shock Tube was in use. The wood chips are visible in nearly all pictures of the Shock Tube foundation.

Item 2, looking north.


Item 3 looking NE.


Item 3, looking north.

Item 4, looking NE.


Item 4, looking north.

Items 2, 3, and 4; looking north. Item 4 is near right. Green fence and large tan building with associated structures in the background are not part of the Shock Tube.

Looking SE at one of two storm water pipes in what may be the remains of a railroad crossing in the foreground. Item 5 is in the upper left, Shock Tube Road is near right. All white or gray upright structures on the upper right are not associated.

NW end of Item 5. Item 5 is approximately 10x230. One of two storm water pipes in what may be the remains of a railroad crossing in the right foreground.


Looking west at the NW end of Item 5.


Looking south at the location of item 6 buried in the wood chips, and the end of item 7 on the left.

Item 6 is a smallish concrete pad whose dimensions are difficult to determine under heavy cover of wood chips.

Looking west at the NW half of Item 5. Visible in the picture are non-associated structures: upright white equipment shelter, gray building 1290A, and green fence previously mentioned.

Looking south at the SE end of item 5. Stacked gray blocks on the left are not associated with the Shock Tube. These concrete barriers are placed to prevent fragments from damaging nearby equipment.

Looking west at the center of item 5. White equipment shelter is not associated with the Shock Tube.

Detail of one of several similar areas of item 5.

Item 5 looking west. Stacked gray blocks on the left and center are not associated with the Shock Tube. These concrete barriers are placed to prevent fragments from damaging nearby equipment. Visible in the background right of the picture are non-associated structures: upright white equipment shelter, gray building 1290A, and the green fence previously mentioned.

Item 5 looking north. Stacked gray blocks on the right and center are not associated with the Shock Tube. These concrete barriers are placed to prevent fragments from damaging nearby equipment. Visible in the background left of the picture are non-associated structures: upright white equipment shelter, gray building 1290A, and the green fence previously mentioned.


Item 6 detail.

Item 6, Item 5 looking west. Stacked gray blocks are not associated with the Shock Tube.


Item 7 detail.

Item 7 looking west. Stacked gray blocks and the stacked corrugated boxes are not associated with the Shock Tube.

Item 8 looking SW. White shipping container and upright concrete columns are not associated with the Shock Tube.


Item 8 detail.

Item 8 detail.

Item 8 looking west.

Looking northwest from item 8. Roof of building 1290A, green fence, and tan building 1410 are visible in the right background.


Item 9 looking WSW. Yellow-green dumpster, vertical concrete columns, and the corrugated boxes are not associated with the Shock Tube.

Item 10, mostly covered with wood chips. Item 11 is barely visible left of the pile of ties. Building 1180 in the background has a red roof. All the equipment on the other side of the road is not associated with the Shock Tube.


Looking NE at the north corner of Item 10 and unnamed lane in the background.

Item 11 looking NW.


Item 11 detail.


Looking west at an edge of Item 13 covered with soil.

Looking SE from atop item 13 along Shock Tube Road. Items 14 are not visible under the fill in the midview. An osprey nest on a pole and the Potomac River shore are in the background.

Looking WNW at a corner of buried item 13.

Looking west at a corner of buried item 13.


Looking west at a corner of buried item 13.

Looking NW at the corner of buried item(s) 15. All standing equipment and buildings in the background are not associated with the Shock Tube. Fill dirt with incipient grass may cover 3 items or sets of items. Items 12 and 14 are no longer visible, they are probably buried near the ends of Item 13.

Looking NW at items 15 in the foreground all standing equipment and buildings in the background are not associated with the Shock Tube. Slightly raised ground with incipient grass may cover 3 item or sets of items (12, 13, and 14).

Looking SE at Items 16, a 4x7 slab stepping down to partially buried 16x16 slab. An osprey nest pole and the Potomac River shore are in the background.

Looking west at items 16, a 4x7 slab stepping down to partially buried 16x16 slab. Shock Tube Road is in the background. The bottom of an equipment shelter is visible in the extreme upper left.

Item 17 detail.


Looking NW at items 17. Item 16 is seen just right of an equipment shelter. Other non-associated items are in the background.

Looking NW at items 18 and 18a. The shadow of the osprey nest pole is cast over the concrete pad.

Looking NW at items 18 and 18a. The shadow of the osprey nest pole is cast over the concrete pad.


Item 18a.


Looking NW at items 19 with the osprey nest pole in the background.


Looking west at item 20, osprey nest pole is in the background on the right.


Looking NW at item 20, osprey nest pole is in the background.


Item 20 detail.

Looking NW at items 21. Items 21 are very close to item 20. Items 19 and 18 can be seen in the background in alignment with items 21.


Looking NW at items 22.


Item 23 detail.


Item 23 has concrete beams tying the two separate 4x22 pads together.


Looking NW at item 23.


Item 23 detail.


Item 24 showing typical construction of the pads.


Looking NW at Items 24.

Looking SE at items 25 with Shock Tube Road on the right extending toward the Potomac River shore in the background. Note alignment with other foundation pads in the background.

Looking NW at items 25.


Looking NW at Items 26.


Looking NW at Items 27.


Details of item 28 looking NW at the north corner of the item.


Details of Item 28 looking NE.

Item 28 detail looking ENE.

Looking NW at Item 28, note alignment with items 27 and other foundation pads in the background.

Looking SE at item 29. Shock Tube Road on the right leads toward the Potomac River shore in the background.

APPENDIX E

NATURAL RESOURCES AGENCY COORDINATION LETTERS

DEPARTMENT OF THE NAVY
NAVAL SURFACE WARFARE CENTER
DAHLGREN DIVISION
6149 WELSH ROAD, SUITE 203
DAHLGREN, VIRGINIA 22448-5130

IN REPLY REFER TO

5090
Ser CX8/066
18 Nov 08

Mr. Tylan Dean
Endangered Species Biologist
U.S. Fish and Wildlife Service
6669 Short Lane
Gloucester, Virginia 23061

Dear Mr. Dean:

The Navy is preparing an Environmental Assessment (EA) for the construction and operation of a facility for the research, development, testing, and evaluation of an Electromagnetic (EM) Railgun system at the Naval Support Facility Dahlgren, Virginia. The EM Railgun system is comprised of an EM launcher, pulse forming network modules (power supply), and a projectile recovery area. Implementation of the proposed action would facilitate the Navy's need for an eventual full-scale, multiple shot EM railgun system capable of being used on Navy ships for indirect naval gunfire support. The EA will address the potential effects associated with the impacts of construction and operation of the EM Railgun system. Construction will include an EM Railgun facility, a Control and Instrumentation building, Projectile Control and Recovery structures, associated walkways and parking lots and a bypass road, which will increase the total impervious surface at the site by approximately 2.2 acres.

We request a current list of federally listed threatened or endangered species that are known to occur, or that could potentially occur on, or in the vicinity of the enclosed proposed site for the EM Railgun. We would also like to know if there are any other sensitive natural resources that should be considered during the development of the EA.

Please direct all correspondence to:

NAVAL SURFACE WARFARE CENTER DAHLGREN
SAFETY AND ENVIRONMENTAL OFFICE
ATTN: ANN SWOPE, BLDG 189, ROOM 109
17483 DAHLGREN ROAD, STE 104
DAHLGREN VA 22448-5119

5090
Ser CX8/066
18 Nov 08

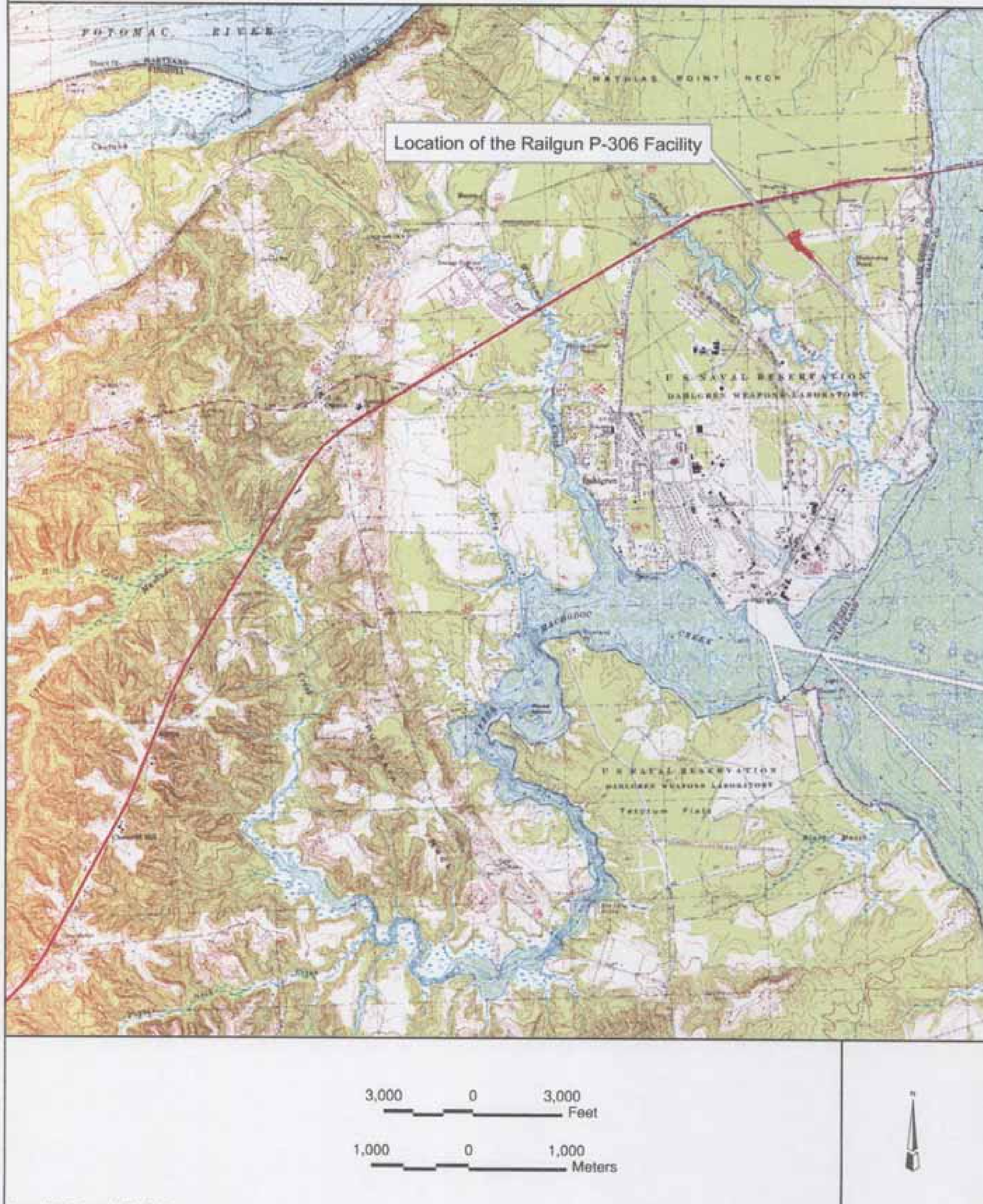
For more information, please contact Dr. Thomas Wray II at (540) 653-4186.

Sincerely,

ANN G. SWOPE
Head, Safety & Environmental
Office
By Direction of the Commander

Enclosure: 1. USGS Dahlgren Quad

Location of the Railgun P-306 Facility



Source: USGS Topographic Map Dahlgren

ENCLOSURE (1)

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United States Department of the Interior

FISH AND WILDLIFE SERVICE
Ecological Services
6669 Short Lane
Gloucester, VA 23061

December 9, 2008

Ms. Ann Swope
Naval Surface Warfare Center Dahlgren
Safety and Environmental Office
117483 Dahlgren Road, Suite 104
Dahlgren, Virginia 22448-5119

Re: Electromagnetic Railgun system, Naval Support Facility, Dahlgren, King George County, Virginia, project # 2009-SL-0096

Dear Ms Swope:

The U.S. Fish and Wildlife Service (Service) has received your request to search our files for occurrences or habitat of threatened or endangered species at the above referenced area. The following comments are provided under provisions of the Endangered Species Act of 1973 (87 Stat. 884, as amended; 16 U.S.C. 1531 *et seq.*), the Bald and Golden Eagle Protection Act (16 U.S.C. 668-668d), and the Migratory Bird Treaty Act (16 U.S.C. 703 – 712).

Enclosed is a list of species with Federal status and species of concern that have been documented or may occur in the county where your project is located. This list was prepared by this office and is based on information obtained from previous surveys for rare and endangered species. Based on the map provided, nesting bald eagles have been documented in past years less than 1,500 feet from the proposed project location. We are not aware of other known occurrences of listed species near the project site. We recommend determining whether suitable habitat for other listed species may occur, and conducting surveys if potential habitat may be present. We are unable to provide information on other species that may be impacted by the project until we receive additional information about the scope of the proposed project.

In order to ensure coordination with the State agencies, we consistently recommend that individuals contact the Virginia Department of Conservation and Recreation, Division of Natural Heritage **and** the Virginia Department of Game and Inland Fisheries, since each agency maintains a different database and has differing expertise and/or regulatory responsibility.

You can contact these agencies at the following addresses:

Virginia Department of Game and Inland Fisheries
Environmental Services Section
P.O. Box 11104
Richmond, VA 23230
(804) 367-1000

Virginia Department of Conservation and Recreation
Division of Natural Heritage
217 Governor Street, 2nd Floor
Richmond, VA 23219
(804) 786-7951

If either of these agencies determines that your project may impact a federally listed, proposed, or candidate species OR federally designated critical habitat, please contact this office and provide a copy of the response letter from each agency and the above referenced project number.

You can find species information and other pertinent information on project reviews within Virginia at our website http://www.fws.gov/northeast/virginiafield/Project_Reviews.html. If you have any questions or need further assistance, please contact me at (804) 693-6694, extension 104.

Sincerely,

Tylan Dean
Acting Supervisor
Virginia Field Office

Enclosure

KING GEORGE COUNTY, VIRGINIA

Federally Endangered, Threatened, Proposed, and Candidate Species

SCIENTIFIC NAME	COMMON NAME	STATUS
FISHES		
Acipenser brevirostrum	Shortnose sturgeon**	LE
INVERTEBRATES		
Alasmidonta heterodon[2]	Dwarf wedgemussel	LE
VASCULAR PLANTS		
Aeschynomene virginica[2]	Sensitive joint-vetch	LT
Isotria medeoloides[2]	Small whorled pogonia	LT

Other Federally Endangered Species

BIRDS		
Haliaeetus leucocephalus[1]	Bald eagle	BGEPA

Species of Concern (No official Federal status)

None documented

[1]Nesting occurs in this county; concentrated shoreline use has been documented on the Rappahannock and Potomac Rivers.
[2]This species has been documented in an adjacent county and may occur in this county.

**Principal responsibility for this species is vested with the National Oceanic and Atmospheric Administration's Fisheries Service.

September 24, 2008
Prepared by U.S. Fish and Wildlife Service, Virginia Field Office

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DEPARTMENT OF THE NAVY
NAVAL SURFACE WARFARE CENTER
DAHLGREN DIVISION
6149 WELSH ROAD, SUITE 203
DAHLGREN, VIRGINIA 22448-5130

IN REPLY REFER TO

5090
Ser CX8/067
18 Nov 08

Ms. Rene Hypes
Virginia Department of Conservation and Recreation Division of Natural Heritage
217 Governor Street, 2nd Floor
Richmond, Virginia 23219

Dear Ms. Hypes:

The Navy is preparing an Environmental Assessment (EA) for the construction and operation of a facility for the research, development, testing, and evaluation of an Electromagnetic (EM) Railgun system at the Naval Support Facility Dahlgren, Virginia. The EM Railgun system is comprised of an EM launcher, pulse forming network modules (power supply), and a projectile recovery area. Implementation of the proposed action would facilitate the Navy's need for an eventual full-scale, multiple shot EM Railgun system capable of being used on Navy ships for indirect naval gunfire support. The EA will address the potential effects associated with the impacts of construction and operation of the EM Railgun system. Construction will include an EM Railgun facility, a Control and Instrumentation building, Projectile Control and Recovery structures, associated walkways and parking lots and a bypass road, which will increase the total impervious surface at the site by approximately 2.2 acres.

We request a current list of federally listed threatened or endangered species that are known to occur, or that could potentially occur on, or in the vicinity of the enclosed proposed site for the EM Railgun. We would also like to know if there are additional sensitive natural resources that should be considered during the development of the EA.

Please direct all correspondence to:

NAVAL SURFACE WARFARE CENTER DAHLGREN
SAFETY AND ENVIRONMENTAL OFFICE
ATTN: ANN SWOPE, BLDG 189, ROOM 109
17483 DAHLGREN ROAD, STE 104
DAHLGREN VA 22448-5119

5090
Ser CX8/067
18 Nov 08

For more information, please contact Dr. Thomas Wray II at (540) 653-4186.

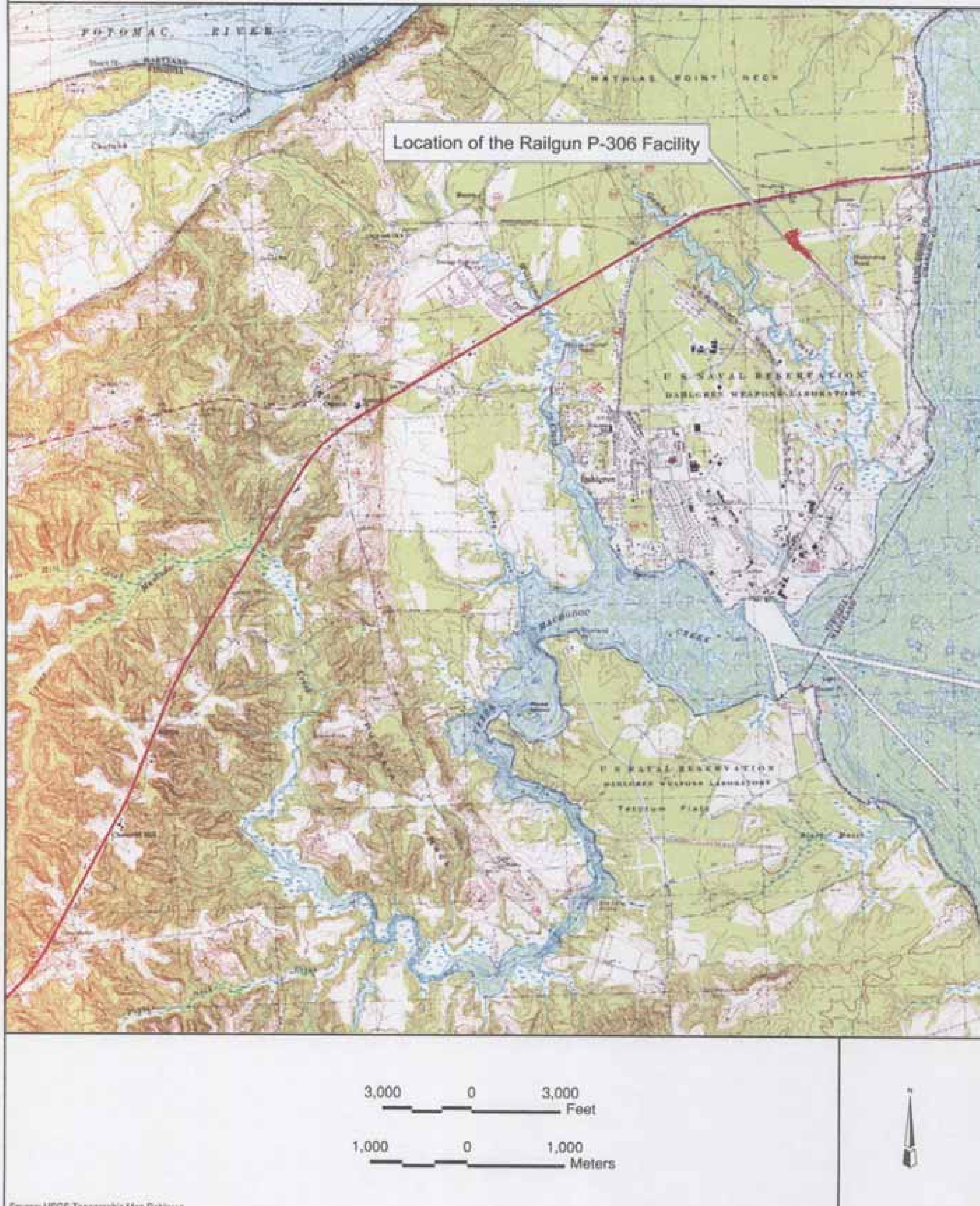
Sincerely,

An G. Swope
ANN G. SWOPE
Head, Safety & Environmental
Office
By the Direction of the Commander

Enclosure: 1. USGS Dahlgren Quad

USGS DAHLGREN QUAD

Location of the Railgun P-306 Facility



Source: USGS Topographic Map Dahlgren

ENCLOSURE (1)

L. Preston Bryant, Jr.
Secretary of Natural Resources

Joseph H. Maroon
Director

COMMONWEALTH of VIRGINIA

DEPARTMENT OF CONSERVATION AND RECREATION

217 Governor Street
Richmond, Virginia 23219-2010
(804) 786-7951 FAX (804) 371-2674

December 22, 2008

Anne Swope
Naval Surface Warfare Center
6149 Welsh Road, Suite 203
Dahlgren, VA 22448

Re: #5090Electromagnetic Railgun System at the Naval Support Facility, Dahlgren

Dear Ms. Swope,

The Department of Conservation and Recreation's Division of Natural Heritage (DCR) has searched its Biotics Data System for occurrences of natural heritage resources from the area outlined on the submitted map. Natural heritage resources are defined as the habitat of rare, threatened, or endangered plant and animal species, unique or exemplary natural communities, and significant geologic formations.

According to the information currently in our files, a Bald Eagle nest site (*Haliaeetus leucocephalus*, G5/S2S3B,S3N/NL/LT) has been documented in the project vicinity. Bald Eagle nest sites are often found in the midst of large wooded areas near marshes or other bodies of water (Byrd, 1991). Bald Eagles feed on fish, waterfowl, seabirds (Campbell et. al., 1990), various mammals and carrion (Terres, 1980). Threats to this species include human disturbance of nest sites (Byrd, 1991), habitat loss, biocide contamination, decreasing food supply and illegal shooting (Herkert, 1992). Please note that this species is currently classified as threatened by the Virginia Department of Game and Inland Fisheries (VDGIF).

Due to the legal status of the Bald Eagle, DCR recommends coordination with the VDGIF to ensure compliance with protected species legislation.

Under a Memorandum of Agreement established between the Virginia Department of Agriculture and Consumer Services (VDACS) and the Virginia Department of Conservation and Recreation (DCR), DCR represents VDACS in comments regarding potential impacts on state-listed threatened and endangered plant and insect species. The current activity will not affect any documented state-listed plants or insects.

In addition, our files do not indicate the presence of any State Natural Area Preserves under DCR's jurisdiction in the project vicinity.

New and updated information is continually added to Biotics. Please contact DCR for an update on this natural heritage information if a significant amount of time passes before it is utilized.

The Virginia Department of Game and Inland Fisheries maintains a database of wildlife locations, including threatened and endangered species, trout streams, and anadromous fish waters, which may contain information not documented in this letter. Their database may be accessed from http://vafwis.org/fwis/, or contact Shirl Dressler at (804) 367-6913.

Should you have any questions or concerns, feel free to contact me at 804-692-0984. Thank you for the opportunity to comment on this project.

Sincerely,

Kristal McKelvey

Kristal McKelvey
Coastal Zone Locality Liaison

Cc: Ernie Aschenbach, DGIF

Literature Cited

Byrd, M.A. 1991. Bald eagle. In Virginia's Endangered Species: Proceedings of a Symposium. K. Terwilliger ed. The McDonald and Woodward Publishing Company, Blacksburg, Virginia. Pp. 499-501.

Campbell, R.W., N.K. Dawe, I. McTaggart-Cowan, J.M. Cooper, G.W. Kaiser, and M.C.E. McNall. 1990. The Birds of British Columbia. Vol. 1. Nonpasserines: Introduction and loons through waterfowl. Royal British Columbia Museum, Victoria, British Columbia, Canada.

Herkert, J. R., editor. 1992. Endangered and threatened species of Illinois: status and distribution. Vol. 2: Animals. Illinois Endangered Species Protection Board. iv + 142 pp.

Terres, J.K. 1980. The Audubon Society encyclopedia of North American birds. Alfred A. Knopf, New York.

DEPARTMENT OF THE NAVY
NAVAL SURFACE WARFARE CENTER
DAHLGREN DIVISION
6149 WELSH ROAD, SUITE 203
DAHLGREN, VIRGINIA 22448-5130

IN REPLY REFER TO

5090
Ser CX8/068
18 Nov 08

Mr. Ray Fernald
Wildlife Diversity Division
Virginia Department of Game and Inland Fisheries
4010 West Board Street
Richmond, Virginia 23230

Dear Mr. Fernald:

The Navy is preparing an Environmental Assessment (EA) for the construction and operation of a facility for the research, development, testing, and evaluation of an Electromagnetic (EM) Railgun system at the Naval Support Facility Dahlgren, Virginia. The EM Railgun system is comprised of an EM launcher, pulse forming network modules (power supply), and a projectile recovery area. Implementation of the proposed action would facilitate the Navy's need for an eventual full-scale, multiple shot EM Railgun system capable of being used on Navy ships for indirect naval gunfire support. The EA will address the potential effects associated with the impacts of construction and operation of the EM Railgun system. Construction will include an EM Railgun facility, a Control and Instrumentation building, Projectile Control and Recovery structures, associated walkways and parking lots and a bypass road, which will increase the total impervious surface at the site by approximately 2.2 acres.

We request a current list of federally listed threatened or endangered species that are known to occur, or that could potentially occur on, or in the vicinity of the enclosed proposed site for the EM Railgun. We would also like to know if there are additional sensitive natural resources that should be considered during the development of the EA.

Please direct all correspondence to:

NAVAL SURFACE WARFARE CENTER DAHLGREN
SAFETY AND ENVIRONMENTAL OFFICE
ATTN: ANN SWOPE, BLDG 189, ROOM 109
17483 DAHLGREN ROAD, STE 104
DAHLGREN VA 22448-5119

5090
Ser CX8/068
18 Nov 08

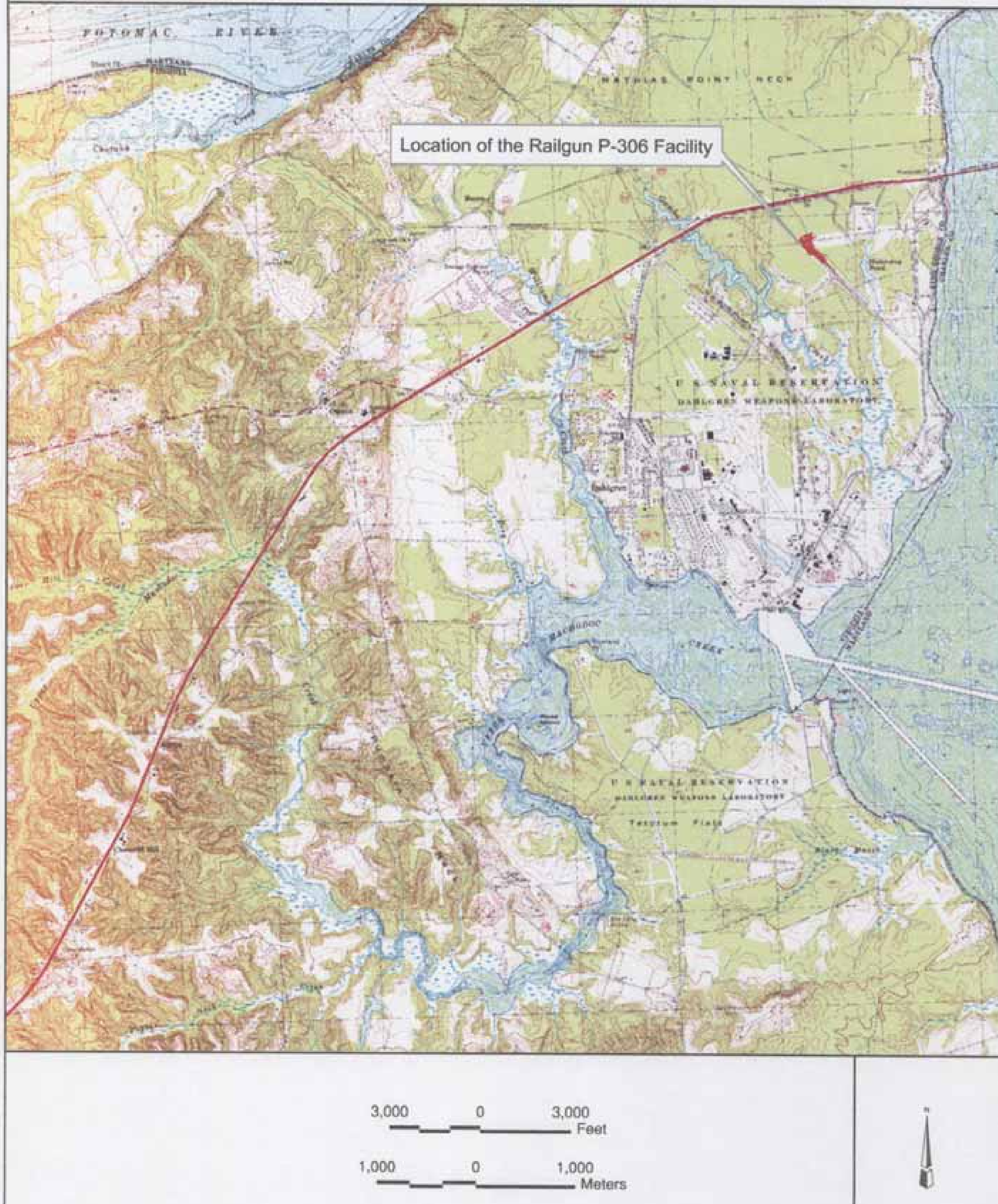
For more information, please contact Dr. Thomas Wray II at (540) 653-4186.

Sincerely,

ANN G. SWOPE
Head, Safety & Environmental
Office
By Direction of the Commander

Enclosure: 1. USGS Dahlgren Quad

Location of the Railgun P-306 Facility



Source: USGS Topographic Map Dahlgren

ENCLOSURE (1)

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From: Ernie.Aschenbach@dgif.virginia.gov
[mailto:Ernie.Aschenbach@dgif.virginia.gov]
Sent: Thursday, January 08, 2009 13:58
To: Wray, Thomas II CIV NAVFAC Washington, Environmental Dept;
Jeff.Cooper@dgif.virginia.gov
Cc: Ernie.Aschenbach@dgif.virginia.gov
Subject: ESSLog# 26019; Scoping request for preparation of Environmental
Assessment: Electromagnetic Railgun system at the Naval Support Facility Dahlgren, Virginia

Dr. Thomas Wray II
Naval Surface Warfare Center Dahlgren
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We have reviewed the National Environmental Policy Act (NEPA) scoping request for the above-referenced project consisting of construction and operation of a facility for the research, development, testing, and evaluation of an Electromagnetic (EM) Railgun system at the Naval Support Facility Dahlgren, Virginia. Components will include an EM launcher facility, power supply, control and instrumentation building, and projectile control and recovery structures, and related appurtenances. The total impervious surface area of the proposed site is approximately 2.2 acres. Instream work is not proposed.

According to our records, there are a number of state Threatened (ST) bald eagle nests known from the project area. The project site is approximately 3,045 feet from the nearest bald eagle nest, outside the protection zone for bald eagle nests. The Caledon Winter Concentration Area for bald eagles is also known from the area; its southern boundary is the western shoreline of the Potomac River at the heavily traveled Route 301 bridge. The project is approximately 4,673 feet from the Caledon Winter Concentration Area. We understand that projectiles will be contained within enclosed projectile control and recovery structures.

Therefore, based on the scope and location of this project, we do not anticipate adverse impact to this species. We recommend adherence to all wildlife management guidelines as detailed in the Naval Surface Warfare Center Dahlgren INRMP. We also recommend contacting DGIF's Region V Biologist, Jeff Cooper (telephone (540) 899-4169) regarding protection of listed avian species.

The Potomac River is a designated Anadromous Fish Use Area. Williams Creek and Gambo Creek are potential Anadromous Fish Use Areas. We understand that instream work is not proposed. Therefore, based on the project scope and location, we do not anticipate the project to result in adverse impact to Anadromous Fish Use Areas. However, if instream work becomes necessary during this project, we recommend further coordination with us, prior to all work.

To minimize overall impacts to wildlife and our natural resources, we recommend that the applicant avoid and minimize impacts to undisturbed forest, wetlands, and streams to the fullest extent practicable. Based on the proximity of the project area to water resources, we recommend maintaining undisturbed wooded buffers of at least 100 feet in width around all on-site wetlands and on both sides of all perennial and intermittent streams. We also recommend implementation and adherence to strict erosion and sediment control measures, as applicable. Assuming adherence to the above recommendations, we find the proposed project acceptable and consistent with the Fisheries Enforceable Policy of the Coastal Zone Management Act.

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