DRAFT ENVIRONMENTAL ASSESSMENT
PROPOSED
CONSTRUCTION AND OPERATION OF INSTRUMENTATION TOWER ON WALLOPS ISLAND
U.S. Air Force Civil Engineer Center
Joint Base San Antonio-Lackland, Texas

Lead Agency:	U.S. Air Force
Cooperating Agencies:	National Aeronautics and Space Administration Naval Air Warfare Center – Aircraft Division Naval Sea Systems Command
Proposed Action:	Construction and Operation of Instrumentation Tower on Wallops Island
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Date:	May 1, 2017

ABSTRACT

Prepared in accordance with the National Environmental Policy Act of 1969 (NEPA), this Environmental Assessment (EA) evaluates the proposed construction, operation, and maintenance of a 750-foot tall, guyed instrumentation tower by the United States Air Force (USAF) on Wallops Island at the National Aeronautics and Space Administration (NASA) Goddard Space Flight Center's Wallops Flight Facility, Accomack County, Virginia (Proposed Action). The USAF is the lead agency for this EA and NASA, Naval Air Warfare Center – Aircraft Division (NAWCAD), and Naval Sea Systems Command (NAVSEA) are cooperating agencies.

This EA analyzes impacts on the environment potentially resulting from two alternatives for the implementation of the Proposed Action. Under Alternative 1, the USAF would build the proposed tower on a site near Building X-015. Under Alternative 2, the USAF would build the proposed tower on a site near Building X-079. The No Action Alternative, under which the proposed tower would not be built and existing conditions on Wallops Island would continue, is also analyzed in the EA to provide a baseline against which impacts potentially resulting from the action alternatives can be compared. Alternative 1 is the USAF's Preferred Alternative. Detailed discussions of impacts on physical, biological, and social resources potentially resulting from each of the alternatives are presented in the EA.

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Draft Finding of No Significant Impact
Draft Finding of No Practicable Alternative
United States Air Force
Proposed Construction and Operation of Instrumentation Tower on Wallops Island
at
National Aeronautics and Space Administration Goddard Space Flight Center Wallops Flight Facility Accomack County, Virginia

Name of Proposed Action

Proposed Construction and Operation of Instrumentation Tower on Wallops Island at National Aeronautics and Space Administration (NASA) Goddard Space Flight Center's Wallops Flight Facility (WFF), Accomack County, Virginia.

Purpose and Need

The purpose of the Proposed Action is to enhance currently operating Department of Defense (DoD) research, development, test, and evaluation (RDT&E) support capabilities for Unmanned Aerial Systems (UAS) and extended communication coverage in the mid-Atlantic operating areas, including but not limited to the Virginia Capes Range Complex adjacent to WFF, thereby allowing for refined communications infrastructure in and around WFF.

The Proposed Action is needed for the DoD to meet current, emerging, and evolving requirements associated with the RDT&E of UAS, which necessitate more robust communications systems that cover areas that are larger and farther offshore than existing systems.

Preliminary analysis conducted by the U.S. Air Force (USAF) has identified the requirement for stationary instrumentation mounted at a height of 750 feet to fulfill the purpose and need for the Proposed Action.

Description of the Proposed Action

The USAF proposes to build, operate, and maintain a 750-foot, guyed instrumentation tower on an approximately 40-acre site at Wallops Island, located within the boundaries of WFF in Accomack County, Virginia. As the federal landowner, NASA would grant the USAF a Land Use Authorization to build and operate the proposed tower on NASA's property. The USAF, NASA, Naval Air Warfare Center – Aircraft Division (NAWCAD), and Naval Sea Systems Command (NAVSEA) would install, operate, and maintain equipment on the proposed tower.

The proposed tower would be built of galvanized steel and would be a three-sided lattice structure approximately 42 inches wide on each side with up to 12 steel guy wires on three sides to provide structural support. The guy wires would be installed along three radii from the tower at angles of 120 degrees from each other, and would extend up to 590 feet as measured from the tower base. Guy wires would be required approximately every 80 feet along the tower's vertical height and would tie into at least two anchor points on the ground positioned in line with each of the three radii. Anchor points for the guy wires would consist either of concrete slabs measuring 14 feet by 14 feet by 5 feet or helical piles, which are installed in the ground by rotation. The three outermost anchor points would be located approximately 590 feet from the tower base and the three inner anchor points would be approximately 430 feet from the base of the tower. Each of the tower's three radii could contain up to 12 individual guys. The tower would support ultra-high frequency (UHF)/very high frequency (VHF) radios, telemetry dishes, global positioning system (GPS) antennas, spectrum-monitoring antennas, a flight termination system, meteorological instrumentation, and other equipment as needed to fulfill mission requirements.

Nighttime illumination of the proposed tower would be limited to the minimum amount required by the Federal Aviation Administration (FAA). Lighting on ground-level support structures and equipment would be down-shielded and motion-activated to the greatest extent practicable to minimize impacts on wildlife.

All structural components of the tower would be pile-supported. Concrete piles would be driven or cast in place to a depth of at least 75 feet. One or more gravel-topped roads would be built to the base of the tower as necessary to provide access for service personnel, vehicles, and equipment.

Two small prefabricated structures would be installed near the base of the tower to house equipment associated with the tower's operation and maintenance. Required utility services would connect to existing infrastructure on Wallops Island. A 30-kilowatt propane-fueled generator and associated 500-gallon above-ground fuel tank would be installed near the prefabricated structures to provide electricity in the event of power outages. The prefabricated structures and all equipment associated with the proposed tower would be installed on elevated platforms at least 11 feet above mean sea level (AMSL) to mitigate potential flooding during storm events.

Construction of the proposed tower would take approximately 18 months. Construction of the tower itself is anticipated to last approximately three months, while other activities (e.g., pile driving, installation and testing of electronics) would occupy the majority of the construction period. Routine maintenance of the tower would include tensioning the guy wires, replacing electronics, and trimming vegetation underneath the guy wires. Periodic top-dressing of the gravel access roads could also be necessary.

A 20-year operational period beginning in 2018 [USAF – confirm this date] is anticipated for the proposed tower. The need for the tower would be re-evaluated prior to the end of the 20-year operational period, and the tower and associated equipment would be dismantled, recycled, and/or disposed of in accordance with applicable requirements when it is determined that the tower is no longer needed.

Summary of Regulatory Requirements and Lead/Cooperating Agencies

The USAF has prepared a Draft Environmental Assessment (EA) analyzing impacts potentially resulting from the Proposed Action in accordance with the National Environmental Policy Act of 1969 (NEPA) (42 United States Code [U.S.C.] §§4321 *et seq*.); Council on Environmental Quality (CEQ) Regulations for Implementing the Procedural Provisions of NEPA (40 Code of Federal Regulations [CFR] §§1500-1508); USAF Environmental Impact Analysis Process (EIAP) (32 CFR §989); the U.S. Navy's Procedures for Implementing the NEPA (32 CFR §775); NASA regulations for implementing NEPA (14 CFR §1216.3); and NASA NEPA Management Requirements (NASA Procedural Requirements 8580.1A). Additional regulatory requirements applicable to the Proposed Action are addressed accordingly throughout this Draft Finding of No Significant Impact (FONSI) / Draft Finding of No Practicable Alternative (FONPA)

The USAF is the lead agency preparing the Draft EA. NASA, NAWCAD, and NAVSEA are serving as cooperating agencies in the preparation of the Draft EA. This Draft FONSI / Draft FONPA summarizes and hereby incorporates by reference the impact analysis presented in the Draft EA.

Alternatives Analyzed in the Draft EA

The USAF identified two reasonable alternatives that fulfill the purpose of and need for the Proposed Action. Those alternatives have been carried forward for detailed analysis in the referenced Draft EA; both alternatives are located on Wallops Island. Alternative 1 would build the proposed instrumentation tower on a site northwest of Building X-015. Alternative 2 would build the proposed tower on a site north of Building X-079. Both sites are located on mid-Wallops Island and are previously disturbed but currently undeveloped. The two alternative sites are located less than 0.5 mile from each other and are virtually identical in location, topography, ecology, existing use, and other physical characteristics.

In addition to the activities and components described above for the Proposed Action, Alternative 1 would include relocating or replacing a telemetry dish currently in use at WFF, as the presence of the proposed tower on the Alternative 1 site would interfere with the continued functionality of the dish in its current location. The relocated or new dish would be installed on existing infrastructure located within the boundaries of WFF to ensure its continued operation.

Alternative 1 is the USAF's Preferred Alternative for the following reasons: the site includes a previously cleared and regularly mowed area of sufficient size to accommodate the proposed tower; jurisdictional wetlands on the site would be avoided to the maximum extent possible; construction and operation of the proposed tower would avoid existing and future mission sites and uses; existing underground broadband communications and electrical connections are available; and the site is located farther from the beach and federal-listed species occurring there than other alternatives considered on Wallops Island.

Alternatives Eliminated from Further Study

The USAF dismissed the following alternatives from detailed analysis in the referenced Draft EA because they failed to meet the Proposed Action's purpose and need and thus were not considered reasonable: locate required instrumentation on an existing tower; construct a non-guyed, free-standing tower; locate the proposed tower further inland and/or in a less ecologically sensitive location.

The USAF also analyzed alternatives for the design and construction of the proposed tower, conducted a regional site selection process, and considered multiple potential sites at WFF. Other than the two alternative sites analyzed in the referenced Draft EA, tower design and site alternatives initially considered by the USAF were dismissed from further study because they failed to meet the purpose and need for the Proposed Action.

Summary of Environmental Consequences

The following sections summarize the detailed analysis of impacts on resources occurring on or in the vicinity of Wallops Island presented in the referenced Draft EA. Unless otherwise noted, impacts resulting from the Proposed Action would be similar for each resource under either Alternative 1 or Alternative 2.

The relocation / installation of the telemetry dish included in Alternative 1 would have no impacts on any of the resources discussed below, as it would be relocated or installed on existing infrastructure in a previously developed area of WFF and would not require the construction of new or additional facilities, or the expansion of existing facilities.

Resources Dismissed from Analysis in the Draft EA. Impacts on the following resources were not analyzed in the referenced Draft EA because the Proposed Action would have no measurable effect on them: agriculture and prime farmland, mineral and energy resources, groundwater, noise, marine biological resources, terrestrial wildlife, terrestrial vegetation, land use, transportation, environmental justice, employment and income, public services, utilities and services, and recreation.

Air Quality and Greenhouse Gases. The Proposed Action would have minor short-term impacts on air quality and negligible long-term impacts. The USAF has prepared a Record of Air Analysis that determined short-term construction-related emissions and long-term operational emissions would not exceed applicable regulatory thresholds established for criteria pollutants by the National Ambient Air Quality Standards (NAAQS) under the Clean Air Act (CAA) or the reporting threshold of 25,000 metric tons per year of greenhouse gases (GHG) required by the U.S. Environmental Protection Agency's (EPA) Greenhouse Gas Reporting Program (40 CFR Part 98). Construction-related emissions would vary throughout the Proposed Action's construction phase and would cease upon the completion of construction activities. The Proposed Action would not create a new major source of emissions that would require permitting under Title V of the CAA. Emissions from the construction and operation of the proposed instrumentation tower would constitute a small fraction of criteria pollutants and GHG emitted at WFF and would have no effect on the attainment status of the Northeastern Virginia Intrastate air quality control region in which WFF and Wallops Island are located.

Climate Change. The Proposed Action would have negligible effects on and from global climate change.

The design of the proposed tower and associated support equipment would minimize the effects of periodic climate change-induced flooding of the site that may occur. Permanent inundation of the proposed tower site as a result of climate change-induced sea level rise is not predicted to occur within the tower's proposed 20-year service life. Emissions of GHG from the construction and operation of the proposed tower would contribute minimally to global climate change trends and corresponding effects such as rising sea levels.

Geology and Soils. The Proposed Action would have negligible short-term impacts and no long-term impacts on geology, and minor short-term impacts and no long-term impacts on soils. Construction of the proposed tower and its associated guy wire anchor points would involve driving piles to a minimum depth of 75 feet. Such pile driving would penetrate surface and subsurface materials but would not disturb underlying bedrock or any particularly unique or pristine geologic materials or formations.

Construction activities would remove vegetation and expose soils, making them susceptible to erosion by wind and water. The nearly level condition of the project site and adherence to erosion and sediment controls during construction would ensure that any such erosion would remain minimal. The construction contractor would be required to prepare an erosion and sediment control plan in accordance with the Virginia Erosion and Sediment Control Regulations (4 Virginia Administrative Code [VAC] 50-30), as construction activities are anticipated to disturb more than 10,000 square feet of soils. Coverage under the General Permit for Discharges of Stormwater from Construction Activities (Construction General Permit) would also be obtained in accordance with 9 VAC 25-880 if it is determined that construction would disturb one or more acres of land. Compliance with requirements of the erosion and sediment control plan and the General Permit, and applicable oversight from the WFF Stormwater, Erosion, and Environmental Development (SEED) Team would minimize impacts resulting from construction-related soil erosion and stormwater runoff. Following the completion of construction activities, any disturbed areas of the project site not built on or otherwise developed would be returned to a pre-construction condition.

The long-term operation of the proposed tower would not involve ongoing disturbance of underlying geology or soils on the alternative site.

Water Resources. Alternative 2 would disturb a larger area of wetlands than the Preferred Alternative. However, in the context of wetlands in the vicinity of WFF, and through adherence to all applicable permit requirements, impacts on wetlands resulting from either alternative would be negligible.

Impacts on floodplains resulting from the Preferred Alternative or Alternative 2 would be negligible.

The Preferred Alternative has been designed and sited to avoid temporary and permanent impacts on wetlands to the greatest extent possible. The tower base, guy wire termini, and associated ground-level support structures would be located in areas of the Alternative 1 site where wetlands are not present. It could be necessary to disturb wetlands during the installation of one intermediate guy wire anchor point; however, to the extent possible, disturbance of the wetland during the construction of this anchor point would be avoided. Best management practices (BMP) would be used to minimize runoff of sediment and pollutants to the wetland. It is estimated that if construction-related disturbance of the wetland were to occur, it would not exceed more than 1,300 square feet, or approximately 0.03 acre.

Implementation of Alternative 2 would temporarily impact approximately 0.3 acre of wetlands and result in approximately 0.06 acre of permanent wetland impacts.

The extent of impacts on wetlands from either action alternative would be determined during the formal engineering design of the proposed tower. In the event that disturbance of wetlands is required, the USAF would obtain a Joint Permit from the United States Army Corps of Engineers (USACE), Virginia Department of Environmental Quality (VDEQ), and Accomack County Wetland Board to address impacts and mitigation requirements, as applicable. Adherence to avoidance, compensation, and/or mitigation measures specified in applicable federal and/or state permit(s) during and following the project's construction phase would ensure that temporary and permanent impacts on wetlands resulting from either the Preferred Alternative or Alternative 2 remain minimal.

Under either action alternative, the proposed tower and its associated guy wire anchor points and ground-level support equipment would be built entirely within the 100-year floodplain on Wallops Island. The proposed tower and all supporting equipment would be elevated to at least 11 feet AMSL to mitigate the potential for flooding during storm events. While the concrete anchor point slabs would prevent the percolation of flood waters into underlying soils, this additional quantity of impermeable surface on the project site (approximately 1,176 square feet) would be minimal in the context of permeable area that would remain on and adjacent to either of the approximately 40-acre sites. The functionality of the floodplain on Wallops Island, provided both by the wetlands on the island and the area of the island itself, would not be substantially reduced because the footprint of the proposed tower and its anchor points would be relatively small and thus, would displace small quantities of water.

The only practicable alternative is to build and operate the proposed tower in the floodplain. The USAF and NASA would ensure that the Proposed Action complies with Executive Order (EO) 11988, *Floodplain Management*, and NASA Regulations on Floodplain and Wetland Management at 14 CFR §1216.2 to the maximum extent possible. The Proposed Action incorporates the recommendations of EO 13690, *Establishing a Federal Flood Risk Management Standard and a Process for Further Soliciting and Considering Stakeholder Input* by considering the best-available, actionable data and methods that integrate current and future flooding predictions based on science; as previously noted, the tower and associated equipment would be elevated to at least 11 feet AMSL, and neither of the alternative sites is likely to experience permanent inundation from rising sea level during the 20-year service life of the proposed tower.

Coastal Zone Management. The USAF and NASA anticipate that the Proposed Action would be consistent to the maximum extent practicable with the nine enforceable policies of Virginia's Coastal Zone Management Program. A Federal Consistency Determination analyzing the applicability of the enforceable policies to the Proposed Action and the Proposed Action's consistency with those policies will be submitted to the VDEQ for review in accordance with the Coastal Zone Management Act of 1972 (CZMA) (16 USC § 1451, *et seq.*, as amended). VDEQ's concurrence with the Federal Consistency Determination is anticipated.

Hazardous Materials and Wastes. Short-term and long-term impacts from hazardous materials and wastes during the implementation of the Proposed Action would be negligible. A Draft Final Environmental Baseline Survey (EBS) prepared for the Preferred Alternative site categorized the site as Category 4, *an area or real property where release, disposal, or migration, or some combination thereof, of hazardous substances has occurred, and all remedial actions necessary to protect human health and the environment have been taken*. In the event that the Alternative 2 site is selected for implementation, the USAF would prepare an EBS for that site and would address any issues identified in the EBS in coordination with NASA and/or other applicable federal or state agencies prior to implementing the Proposed Action.

The construction of the proposed tower would avoid two areas of concern underlying the Alternative 1 site identified in the EBS. The presence of former remediation sites underlying the Alternative 1 site would have no impact on the construction and operation of the proposed tower, as all remedial activities have been completed and closure has been granted by applicable federal and state regulatory agencies. Under the terms of the Land Use Authorization that would be issued by NASA to the USAF, NASA would remain as the landowner of the Alternative 1 site, and the USAF would sign an agreement stating that it understands the liabilities, if any, posed by construction on a former restoration site. If it is determined during the continued planning and design of the proposed tower that disturbance of either or both areas of concern is necessary, the USAF would coordinate with NASA to address contaminants potentially occurring in those areas and ensure the health and safety of workers on the site.

Construction activities associated with either alternative would not require the modification or demolition of buildings or other structures and facilities where hazardous substances are known or suspected to be present, or where hazardous materials and/or hazardous wastes are used or stored. Hazardous substances used during construction activities would be used in accordance with their label directions and requirements set forth in applicable safety data sheets (SDS). Such materials would be used by authorized personnel and would be secured in a hazardous materials locker or similar storage cabinet when not in use. Site-specific BMPs would be implemented for vehicle and equipment fueling and maintenance, as well as spill prevention and control measures as specified in the WFF *Integrated Contingency Plan* (ICP) (NASA 2015a). All on-site fuel and oil storage procedures during construction activities would comply with applicable VDEQ regulations.

Inspections of all temporary or portable fuel storage containers would be conducted in accordance with applicable regulations. All such containers and fuel handling activities would also comply with the requirements of the WFF ICP.

During the proposed tower's operational phase, 500 gallons of propane would be stored in a tank on the site to operate the emergency backup generator during power outages. Small quantities of hazardous substances (e.g., cleaners, lubricants, and solvents) needed to perform maintenance activities would be present on the site only when such activities are being conducted and would either be stored in appropriate locations at WFF or taken off-site by maintenance personnel when not in use. All such materials would be used and disposed of in accordance with the WFF *Hazardous Waste Management Plan*, applicable label instructions, and SDS requirements.

Pesticides would be applied on the site to manage insect populations, and herbicides would likely be applied to manage vegetation around the tower base, ground-level support equipment, and under the guy wires. All such substances would be applied by authorized NASA personnel or licensed contractors in accordance with applicable label directions and regulatory requirements, would be mixed off-site prior to application, and would be stored off-site when not in use.

Hazardous wastes generated during the project's construction and operational phases would be managed and disposed of in accordance with the WFF *Hazardous Waste Management Plan* and all other applicable NASA, federal, and state regulations.

Avifauna (common bird species). Construction and operation of the proposed instrumentation tower could result in the further loss or fragmentation of habitat for avian species available at and in the vicinity of the alternative sites. However, the quantity of habitat potentially available on the sites is small in the context of habitat provided in other areas on and near Wallops Island. Furthermore, the sites are previously disturbed, periodically maintained through trimming and mowing of vegetation, and adjacent to existing development on Wallops Island. Thus, available habitat on the sites is of low quality, and any fragmentation or loss of such habitat resulting from the implementation of the Proposed Action would be negligible.

The construction and operation of the proposed tower would pose a moderate risk of collision to some avian species, and low risk of collision to other species occurring at or in the vicinity of Wallops Island. These risks are summarized in Table 1, generalized by species groups.

Table 1: Potential Risk of Collision by Common Bird Species, Generalized by Species Group

Species Group	Bird Type(s) (common name)
Potential Higher than Average Risk of Collision	
Troglodytidae	Wrens
Tyrannidae	Tyrant flycatchers
Emberizidae	New World sparrows
Cardinalidae	Buntings, cardinals, allies
Vireonidae	Vireos
Parulidae	New World warblers
Potential Low Risk of Collision	
Hirundinidae	Swallows and martins
Strigidae	Owls
Picidae	Woodpeckers
Fringillidae	Finches, siskins, and allies
Icteridae	Blackbirds and allies
Accipitridae	Hawks, eagles, and kites
Turdidae	Thrushes, bluebirds and allies

Waterfowl, shorebirds, and other bird species would also have the potential to collide with the proposed tower and its associated guy wires, particularly when the proximity of the proposed tower to areas within and adjacent to Wallops Island providing habitat for such birds is considered.

To varying degrees, the risk of collision by birds potentially posed by the proposed tower would be reduced with appropriate mitigation. The USAF would incorporate measures to minimize effects on avian species, such as minimizing lighting on the proposed tower to the extent possible in accordance with FAA requirements, and installing using daytime visual markers and/or bird diverters on the proposed tower's associated guy wires. The USAF would also develop and implement monitoring and mitigation plan for avifauna and protected avian species. Such measures would minimize the risk of collision to birds, but would not eliminate such risk altogether. However, with implementation of these mitigation measures, impacts on avifauna would be less than significant.

The implementation of the Proposed Action would be in accordance with the Final Rule authorizing take of birds protected by the Migratory Bird Treaty Act by DoD agencies during military readiness activities dated February 28, 2007. In accordance with the Final Rule, the USAF has assessed the effects of the Proposed Action on migratory birds in accordance with NEPA and would develop and implement a monitoring and mitigation plan as described above.

Special Status Species. As described for avifauna, implementation of the Proposed Action would have negligible effects on the loss and/or fragmentation of habitat for special status species, as the sites are relatively small in the context of available habitat on and in the vicinity of Wallops Island; previously disturbed and periodically maintained; adjacent to existing development; removed from the shoreline habitat of Wallops Island special status species; and of generally low habitat quality.

Implementation of the Proposed Action would have no impacts on areas providing known nesting or foraging habitat for the federally threatened piping plover (*Charadrius melodus*) and federally threatened red knot rufa subspecies (*Calidris canutus rufa*), as no activities associated with the Proposed Action would occur in such areas.

The Proposed Action would have the potential to affect individual piping plovers and red knots while in flight as a result of possible collision with the proposed tower and associated guy wires. The rate of such collisions could increase as a result of poor weather or other conditions of reduced visibility; flocking behavior by the birds; and/or from increased prevalence of the birds at Wallops Island during migration periods.

The Proposed Action would generally pose the same risks of collisions to Birds of Conservation Concern (BCC) as described for common species of birds. Risks would vary from low to high depending on the species. Adherence to measures set forth in the monitoring and mitigation plan for avifauna and protected avian species to be developed by the USAF would minimize effects on special status species of birds to the greatest extent possible.

The USAF has consulted with the USFWS in accordance with Section 7 of the Endangered Species Act (ESA) concerning effects on federal-listed species of birds and the federal-listed northern long-eared bat (*Myotis septentrionalis*) potentially resulting from the Proposed Action. In April 2017, the USFWS concurred with the USAF's determination that the Proposed Action may affect, but is not likely to adversely affect, rufa red knots, piping plovers, and northern long-eared bats occurring at Wallops Island.

Health and Safety. The Preferred Alternative would have no adverse impacts on human health and safety at or in the vicinity of Wallops Island.

Under Alternative 2, guy wires associated with the proposed tower would cross an active road along the eastern side of the Alternative 2 site between the tower itself and one or more guy wire anchor points located east of the road. The lowest of the guy wires would be mounted at an elevation sufficient to allow traffic to pass freely below. However, while the risk to vehicles and passers-by posed by the presence of the guy wires over the road would be manageable, it would nonetheless remain marginal. Thus, Alternative 2 would have negligible impacts on human health and safety in the long term.

During the construction phase of either alternative, worker safety practices would be in accordance with relevant regulations established by the USAF, Navy, NASA, the Occupational Safety and Health Administration (OSHA), and other federal and state agencies. The construction site would be fenced and only accessible to workers and other authorized persons, thereby minimizing risks to the safety of workers and passers-by and eliminating the possibility of unusual risks.

It is anticipated that any injuries to workers during the construction of the proposed tower under either alternative, if any injuries were to occur, would remain minor and would be within the treatment capabilities of WFF's health unit or health care facilities in the vicinity of WFF.

The presence of the proposed tower on either alternative site would not penetrate clearance zones associated with the WFF airfield on Main Base, and its operation would not require the establishment of new hazardous substance or explosive buffer zones on Wallops Island. Equipment on the proposed tower would not emit energy that would be harmful to the health of people working nearby, nor would the tower's operation generate hazardous substances that could adversely affect human health. The installation and removal of equipment on the tower, and the periodic maintenance of such equipment, the tower itself, its associated ground-level support equipment, and the guy wires, would be conducted in accordance with all applicable USAF, Navy, NASA, federal, and state health and safety regulations.

Cultural Resources. Both alternative sites are located in an area of Wallops Island modeled as having low sensitivity for prehistoric and historic archaeological sites. Thus, it is anticipated that no archeological resources would be encountered. In the event that previously unknown archaeological artifacts or human remains are encountered during ground-disturbing activities associated with the Proposed Action, work would stop immediately and the WFF Historic Preservation Officer would consult with the Virginia State Historic Preservation Officer (SHPO) to: 1) determine the significance of the resource, 2) evaluate the effects of the undertaking on the resource, and 3) identify the appropriate avoidance or mitigation measures.

The proposed tower would have the potential to be visible from six properties and one historic district listed or eligible for listing in the National Register of Historic Places (NRHP) evaluated in a cultural resources assessment prepared for the Proposed Action in 2016. The 2016 assessment only evaluated effects on historic properties resulting from the Preferred Alternative; however, it is anticipated that effects from Alternative 2 would be similar to those from the Preferred Alternative based on the proximity of the sites to each other and their similar topography and elevation.

The USAF and NASA have determined that the Proposed Action would not adversely affect NRHP-listed or eligible properties and historic district from which the proposed tower would be visible as identified in the 2016 cultural resources assessment. Consultation between the USAF and the Virginia SHPO in accordance with Section 106 of the National Historic Preservation Act is ongoing, and SHPO concurrence with this determination is pending.

No effects on traditional cultural resources are anticipated to result from the implementation of the Proposed Action, as no such resources are known to occur on Wallops Island. The USAF has consulted with Native American tribes with cultural or historic ties to Wallops Island and Accomack County. The Catawba Nation informed the USAF that it has no immediate concerns with regard to traditional cultural properties, sacred sites or Native American archaeological sites within the boundaries of the proposed project areas. The Catawba Nation requested that it be notified if Native American artifacts and/or human remains are located during ground-disturbing activities associated with the Proposed Action. To date, no responses from the Pocomoke Indian Nation and the Pamunkey Indian Tribe have been received.

Visual Quality and Aesthetics. The Proposed Action would have negligible short-term impacts and minor long-term impacts on visual quality and aesthetics on and in the vicinity of Wallops Island.

During construction, the appearance of either alternative site would be characterized by construction vehicles and equipment, areas of cleared vegetation and disturbed soils, and temporary fencing to restrict access to the site by unauthorized personnel. The appearance of the project site during construction would be similar to that of other construction projects and similar activities occurring with relative frequency on

Wallops Island, and would not be particularly unusual to personnel and other observers who work at or frequently visit the island. Visual conditions on the project site would return to a pre-project condition following the completion of construction.

Once complete, the proposed tower would be the tallest structure visible in comparison to other nearby towers and elevated structures on Wallops Island. It is likely that the proposed tower would be visible from several miles away. However, the tower would be located in an area of Wallops Island that has been previously developed with other, similar tower structures. The appearance of the proposed tower would be consistent with these other vertical structures on Wallops Island that support the missions of NASA and its mission partners, and would not contribute to the degradation of an otherwise undisturbed visual landscape. It is likely that the structure of the proposed tower would be virtually indistinguishable at night, although pilot warning and obstruction lighting would be visible.

Cumulative Effects. The Proposed Action would have no, negligible, or minor short- and long-term impacts on the resources analyzed in the Draft EA and thus, would not contribute to cumulatively significant impacts on those resources when considered with other past, present, and reasonably foreseeable future actions occurring at or in the vicinity of Wallops Island, with one exception: the operation of the proposed tower would likely contribute to increased mortality of birds occurring in the vicinity of Wallops Island as a result of collisions with the tower or its associated guy wires, thereby resulting in moderately adverse impacts on some birds. The severity of such impacts would likely vary and would be influenced by a number of factors and characteristics particular to each bird species. It is unlikely that the proposed tower would inhibit the continued propagation of special status avian species, nor is it anticipated that the continued propagation of common bird species would be adversely impacted by the proposed tower, either individually or cumulatively. Thus, impacts on birds resulting from the operation of the proposed instrumentation tower, though moderately adverse, would not be significant.

No similar towers are currently planned or proposed on Wallops Island. The presence of similar vertical structures in the vicinity of Wallops Island resulting from future, though currently unforeseen federal and/or non-federal actions, could similarly contribute to the increased mortality of birds occurring near such structures. As with the proposed tower, the severity of such increases in mortality potentially resulting from future structures would vary and would be contingent on factors such as the height, bulk, density, and operational characteristics of any such structures as well as the behavior and characteristics of birds interacting with them. However, as adverse impacts on birds resulting from the implementation of the Proposed Action would be non-significant, the Proposed Action would not contribute to cumulatively significant impacts on birds when considered with projects of similar scale potentially occurring in the future.

Mitigation

The USAF and/or its contractor(s) would adhere to all applicable mitigation measures identified in the referenced Draft EA in accordance with USAF, NASA, federal, state, and/or local regulatory requirements during the construction and/or operation of the proposed instrumentation tower.

The USAF is preparing and would implement a monitoring and mitigation plan for avifauna and protected avian species that would be potentially impacted by the operation of the proposed tower. Monitoring and mitigation measures specified in the plan would be periodically reviewed during the proposed tower's operational period to review their effectiveness and develop new or revised measures as needed. [Additional summary of the monitoring and mitigation plan to be provided when the plan is available.]

Public Review and Agency Coordination

The USAF conducted two rounds of targeted public and agency scoping period for the Proposed Action in February 2016 and March 2017. Comments received during the scoping periods were considered by the USAF and addressed accordingly in the analysis presented in the referenced Draft EA.

In accordance with Section 7 of the ESA, the USAF consulted with the USFWS to identify impacts on federally listed threatened and endangered species potentially resulting from the implementation of the

Proposed Action. In April 2017, the USFWS concurred with the USAF's determination that the Proposed Action may affect, but is unlikely to adversely affect, such species occurring at Wallops Island.

The USAF is consulting with the Virginia SHPO in accordance with Section 106 of the NHPA to determine effects on properties listed or eligible for listing in the NRHP potentially resulting from the Proposed Action. The USAF has determined that the Proposed Action would not adversely affect such properties. SHPO concurrence with this determination is pending.

In accordance with the CZMA, the USAF will prepare a Federal Consistency Determination analyzing the applicability of the enforceable policies of the Virginia Coastal Zone Management Program to the Proposed Action and the Proposed Action's consistency with those policies. The Federal Consistency Determination will be submitted to VDEQ for review and concurrence.

Because the Proposed Action would involve federally funded and authorized construction in the 100-year floodplain, the referenced Draft EA will serve as the USAF's and NASA's means for facilitating public review as required by EO 11988 and 32 CFR §989.24.

The Draft EA and Draft FONSI / Draft FONPA will be distributed to relevant federal, state, and local regulatory agencies, organizations, and persons requesting copies during the 30-day public review period, which will begin on [date to be determined] and end on [date to be determined]. Copies of the Draft EA and Draft FONSI / Draft FONPA will be made available for public review at the Eastern Shore Public Library, the Chincoteague Island Library, and the NASA WFF Visitor's Center. The Draft EA and Draft FONSI / Draft FONPA will be made available for electronic download on USAF and NASA WFF websites [provide hyperlinks when available].

Notice of Availability

A Notice of Availability will be published in the *Eastern Shore News*, *Eastern Shore Post*, and *Chincoteague Beacon* at the beginning of the 30-day public review period for the Draft EA and Draft FONSI / Draft FONPA.

Conclusions

Finding of No Significant Impact

Based on the findings of the EA conducted in accordance with requirements of the National Environmental Policy Act, Council on Environmental Quality regulations, and 32 CFR Part 989, *et. seq.*, and after careful review of the potential impacts, implementation of the Proposed Action would not result in significant impacts on the quality of the human or natural environment. Therefore, a Finding of No Significant Impact is warranted and an Environmental Impact Statement (EIS) is not required for this action, and will not be prepared.

USAF Signatory [to be provided]	Date
NASA Signatory [to be provided]	Date
NAWCAD Signatory [to be provided]	Date

Finding of No Practicable Alternative

A federal agency proposing to conduct an activity in a floodplain and/or wetland is required to consider alternatives to the action and modify its actions, to the extent feasible, to avoid adverse effects or potential harm in accordance with EO 11988, *Floodplain Management*, and EO 11990, *Protection of Wetlands*, respectively.

The referenced Draft EA identified two alternatives to meet the purpose of and need for the Proposed Action. Although it does not meet the purpose of and need for the Proposed Action, the No Action Alternative was also analyzed by the USAF in accordance with CEQ regulations at 40 CFR Part 1501.14 to provide a baseline against which the impacts of the action alternatives can be meaningfully compared. Due to mission requirements and logistical, safety, and security factors, the USAF determined that the only reasonable and practicable alternative that meets the purpose and need is located on Wallops Island, the majority of which is located in the 100-year floodplain. Implementation of the Preferred Alternative would also have the potential to impact jurisdictional wetlands on the project site.

The Preferred Alternative would create approximately 1,176 square feet of new impervious surface on the project site resulting from the installation of concrete slabs to provide anchor points for guy wires associated with the proposed tower. This area would be exceedingly small in the context of the approximately 40-acre site, the majority of which consists of vegetation and other permeable surface. The approximate footprint of prefabricated structures and propane tank associated with the proposed tower would total approximately 229 square feet; however, supporting equipment associated with the proposed tower would be elevated to at least 11 feet above mean sea level to mitigate the potential for flooding during storm events. The functionality of the floodplain on Wallops Island, provided by wetlands on the island and the area of the island itself, would not be substantially reduced because the footprint of the proposed tower and its anchor points would be relatively small and thus, would displace small quantities of water.

The Preferred Alternative has been designed and sited to avoid impacts on jurisdictional wetlands on the project site to the greatest extent possible. However, the installation of one of the guy wire anchor points associated with the Preferred Alternative could potentially disturb up to 1,300 square feet (approximately 0.03 acre) of a jurisdictional wetland on the project site. The extent of impacts on wetlands would be determined during the formal engineering design of the proposed tower. Construction-related impacts on wetlands, such as that noted above, could result from excavation, pile driving and drilling, and leveling and grading. Such impacts could include disturbance or removal of vegetation, soil compaction, and/or alteration of hydrologic flow patterns. In the event that disturbance of wetlands is required, the USAF would obtain a Joint Permit from the USACE, VDEQ, and Accomack County Wetland Board to address impacts and mitigation requirements, as applicable. Adherence to avoidance, compensation, and/or mitigation measures specified in applicable federal and/or state permit(s) during and following the project's construction phase would ensure that impacts on wetlands remain negligible. Any impacts on wetlands on the site of Alternative 1, if they were to occur, would be minimal in the context of wetlands on and in the vicinity of Wallops Island.

Based on the analysis presented in the referenced Draft EA, there is no practicable alternative to implementing the Proposed Action to build, operate, and maintain a 750-foot, guyed instrumentation tower on Wallops Island.

USAF Signatory [to be provided]	Date
NASA Signatory [to be provided]	Date
NAWCAD Signatory [to be provided]	Date

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APPENDICES

Figures

Tables

Abbreviations and Acronyms

ACM	asbestos containing material(s)
AGL	above ground level
AMSL	above mean sea level
APE	Area of Potential Effects
AST	aboveground storage tank
BCC	Birds of Conservation Concern
BGEPA	Bald and Golden Eagle Protection Act
bgs	below ground surface
BMP	best management practice(s)
CAA	Clean Air Act
CAAA	Clean Air Act Amendments
CEQ	Council on Environmental Quality
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
CO	carbon monoxide
CO_2	carbon dioxide
CO_2e	carbon dioxide equivalent(s)
CZM	Coastal Zone Management
CZMA	Coastal Zone Management Act
DBH	diameter at breast height
DNH	Division of Natural Heritage Program
DoD	Department of Defense
DoDI	Department of Defense Instruction
EA	Environmental Assessment
EBS	Environmental Baseline Survey
EIS	Environmental Impact Statement
EO	Executive Order
EPA	Environmental Protection Agency
ESA	Endangered Species Act
F	Fahrenheit
FAA	Federal Aviation Administration
FCC	Federal Communications Commission
FEMA	Federal Emergency Management Agency
FONPA	Finding of No Practicable Alternative
FONSI	Finding of No Significant Impact
GHG	greenhouse gas(es)
GISS	Goddard Institute for Space Studies
GPS	global positioning system
IBA	Important Bird Area
ICP	Integrated Contingency Plan
IFR	Instrument Flight Rules
IICEP	Interagency and Intergovernmental Coordination for Environmental Planning
LBP	lead based paint
MBTA	Migratory Bird Treaty Act of 1918
MEC	munitions and explosives constituent(s)
METAR	Meteorological Terminal Aviation Routine
NA	not applicable
NAAQS	National Ambient Air Quality Standards

NASA	National Aeronautics and Space Administration
NAVSEA	Naval Sea Systems Command
NAWCAD	Naval Air Warfare Center – Aircraft Division
NEPA	National Environmental Policy Act of 1969
NFA	No Further Action
NHPA	National Historic Preservation Act
NO_2	nitrogen dioxide
NO_x	nitrogen oxides
NRHP	National Register of Historic Places
NWR	National Wildlife Refuge
O_3	ozone
OSH Act	Occupational Safety and Health Act of 1970
OSHA	Occupational Safety and Health Administration
OWS	oil/water separator(s)
PA	Programmatic Agreement
PAH	polycyclic aromatic hydrocarbon(s)
Pb	lead
PCB	polychlorinated biphenyls
$PM_{2.5}$	particulate matter with a diameter less than or equal to 2.5 micrometers
PM_{10}	particulate matter with a diameter less than or equal to 10 micrometers
RCRA	Resource Conservation and Recovery Act
RDT&E	research, development, test, and evaluation
ROAA	Record of Air Analysis
ROI	region of influence
SCSC	Surface Combat Systems Center
SDS	safety data sheet(s)
SEED	Stormwater, Erosion, and Environmental Development
SHPO	State Historic Preservation Office(r)
SO_2	sulfur dioxide
SVOC	semi-volatile organic compound(s)
SWPPP	stormwater pollution prevention plan
TPH	total petroleum hydrocarbons
TSCA	Toxic Substances Control Act
UAS	Unmanned Aerial System(s)
UHF	ultra-high frequency
U.S.	United States
USACE	United States Army Corps of Engineers
USAF	United States Air Force
U.S.C.	United States Code
USFWS	United States Fish and Wildlife Service
UST	underground storage tank
VAC	Virginia Administrative Code
VDCR	Virginia Department of Conservation and Recreation
VDEQ	Virginia Department of Environmental Quality
VDGIF	Virginia Department of Game and Island Fisheries
VDHR	Virginia Department of Historic Resources
VHF	very high frequency
VLR	Virginia Landmarks Registry
VOC	volatile organic compound(s)
WFF	Wallops Flight Facility
WHSRN	Western Hemisphere Shorebird Reserve Network

1 PURPOSE OF AND NEED FOR THE PROPOSED ACTION

1.1 INTRODUCTION

The United States Air Force (USAF) proposes to build, operate, and maintain a 750-foot tall, guyed instrumentation tower on Wallops Island at the National Aeronautics and Space Administration (NASA) Goddard Space Flight Center's Wallops Flight Facility (WFF) in Accomack County, Virginia. The location of WFF is shown on **Figure 1-1**Error! Reference source not found.. The proposed tower would be used to conduct testing in collaboration with other Department of Defense (DoD) services and government agencies and would have a service life of at least 20 years. As the federal landowner, NASA would authorize the construction and operation of the proposed tower on its property. The United States (U.S.) Navy's Naval Air Warfare Center – Aircraft Division (NAWCAD) and Naval Sea Systems Command (NAVSEA) would install, operate, and maintain equipment on the proposed tower.

In accordance with the National Environmental Policy Act of 1969 (NEPA) (42 United States Code [U.S.C.] §§4321 *et seq*.); Council on Environmental Quality (CEQ) Regulations for Implementing the Procedural Provisions of NEPA (40 Code of Federal Regulations [CFR] §§1500-1508); USAF Environmental Impact Analysis Process (32 CFR §989); the U.S. Navy's Procedures for Implementing the NEPA (32 CFR §775); NASA regulations for implementing NEPA (14 CFR §1216.3); and *NASA NEPA Management Requirements* (NASA Procedural Requirements 8580.1A), the USAF has prepared this Environmental Assessment (EA) to evaluate a reasonable range of alternatives for the Proposed Action and the impacts potentially resulting from their implementation. Under NEPA, the USAF is the lead agency for the preparation of this EA, with NASA, NAWCAD, and NAVSEA serving as cooperating agencies (see **Section 1.5**).

1.2 LOCATION AND SETTING

WFF is located in Accomack County, Virginia along the Atlantic coastline at the northern end of Virginia's Eastern Shore. Encompassing approximately 6,530 acres, WFF consists of three distinct land areas in close proximity to each other: Main Base, Mainland, and Wallops Island (**Figure 1-1**Error! Reference source not found.). WFF is owned and operated by NASA and hosts a number of mission partners including the Navy Surface Combat Systems Center (SCSC) (WFF's largest mission partner), United States Coast Guard, and the National Oceanic and Atmospheric Administration (NASA 2016a).

Comprising approximately 2,200 acres, Wallops Island is approximately seven miles long and 0.5 mile wide. Most development on the island is concentrated in its central portion (hereafter referred to as "mid-Wallops Island"). Such development primarily consists of rocket launch pads and associated gantries and assembly buildings, and U.S. Navy facilities. Vehicular access to the island from Mainland is provided by Causeway Road, which connects to Wallops Island at its approximate midpoint.

The U.S. Navy's Virginia Capes Range Complex is adjacent to Wallops Island and consists of surface and subsurface areas as well as restricted airspace used for training activities by the Navy and other branches of the DoD. The shore boundary of the complex follows the Atlantic shoreline from Delaware to North Carolina, while the seaward boundary extends 155 nautical miles over the Atlantic Ocean. The Navy has authority to restrict access by non-military vessels and aircraft to all or portions the Virginia Capes Range Complex when conducting training activities. In addition, restricted airspace managed by NASA overlies all of Wallops Island, the majority of Wallops Mainland, and a portion of Main Base (Navy 2014).

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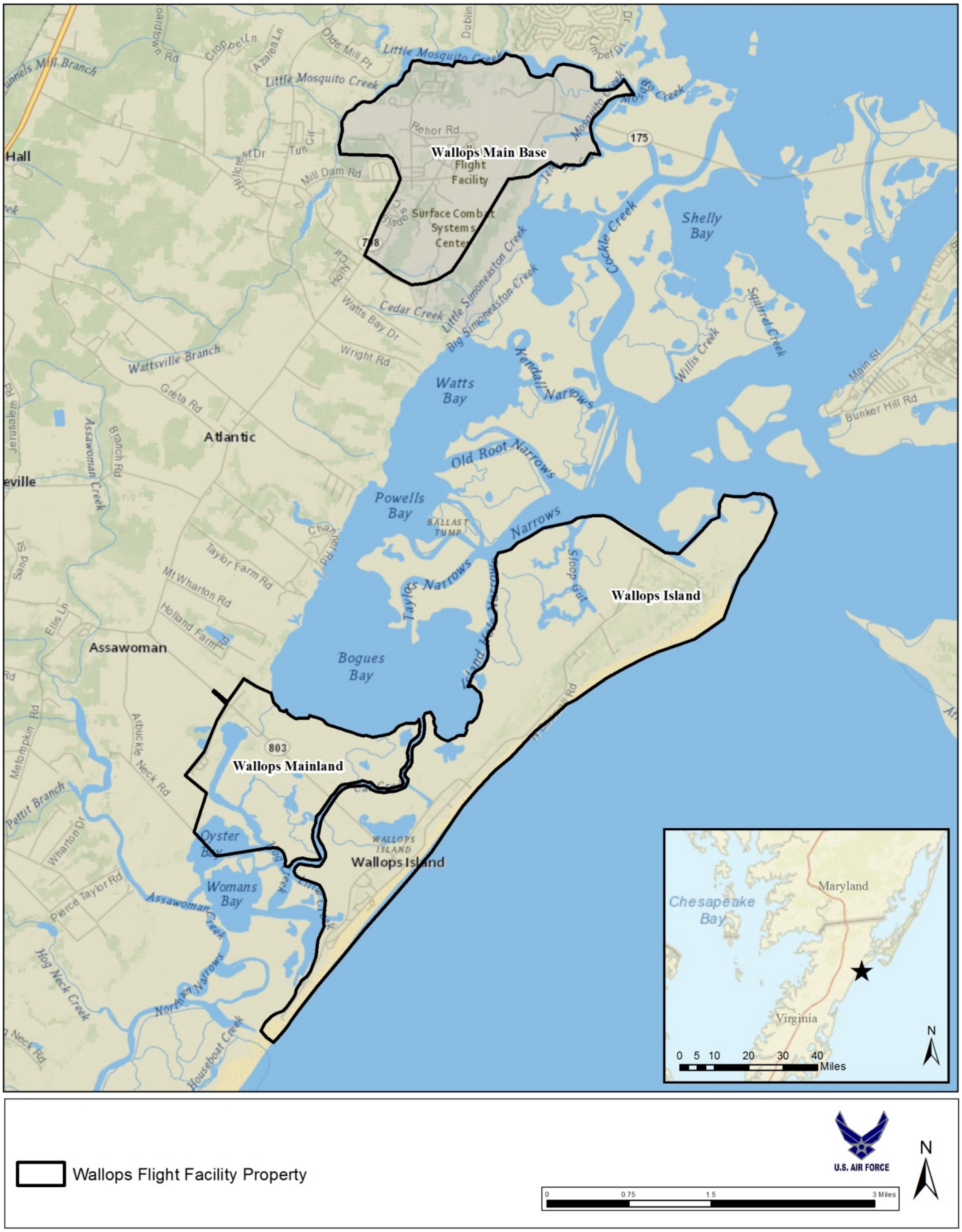
Figure 1-1: Location of Wallops Flight Facility



Sources: Spatial Data courtesy of NASA (2016); Esri (2016) Disclaimer: No warranty is made by AECOM as to the accuracy, reliability, or completeness of these data for individual use or aggregate use with other data. This map is a "living document", in that it is intended to change as new data become available and is incorporated into the GIS database.

1.3 PURPOSE OF THE PROPOSED ACTION

The purpose of the Proposed Action is to enhance currently operating DoD research, development, test, and evaluation (RDT&E) support capabilities for Unmanned Aerial Systems (UAS) and extended communication coverage in the mid-Atlantic operating areas, including but not limited to the Virginia Capes Range Complex, thereby allowing for refined communications infrastructure in and around WFF. The increased operations of UAS have led the DoD to identify requirements to effectively support off-shore UAS testing. Current systems are limited in providing airspace management, flight test control and range safety functions, and spectrum management (collectively referred to as "integrated capabilities"). The Proposed Action would enhance these capabilities and minimize the limitations of technology currently in use, thereby fulfilling mission requirements in terms of effectiveness, area of coverage, and technology.

1.4 NEED FOR THE PROPOSED ACTION

The RDT&E of integrated capabilities is more complex and requires larger test footprints than any one facility currently accommodates. New integrated capabilities would minimize the usage of costly airborne and surface instrumentation systems currently in use and provide the communication coverage necessary to safely conduct testing and gather data on new and evolving systems being developed. Existing equipment is not sufficient to meet the new mission requirements. Through preliminary analysis of its testing and technology requirements, the USAF has determined that stationary instrumentation with an elevation of 750 feet located in a coastal setting would provide the extended communication coverage necessary to fulfill RDT&E mission requirements. Instrumentation mounted at a lower elevation and located at an inland area would not provide sufficient coverage and thus, would fail to meet the USAF's need.

Overall, the Proposed Action is needed for the DoD to meet current, emerging, and evolving requirements associated with the RDT&E of UAS, which necessitate more robust communications systems that cover areas that are larger and farther offshore than existing systems. The proposed 750-foot instrumentation tower and associated equipment would provide the necessary extended coverage for refined and improved test fidelity. These enhancements would better support offshore RDT&E of UAS and associated systems by DoD branches such as the USAF and the U.S. Navy, as well as other DoD and non-DoD federal agencies. In addition, extending the range of communication coverage would enable UAS to operate farther offshore, thereby minimizing the risk of crashes or other incidents over land and corresponding risks to human safety and personal property.

1.5 COOPERATING AGENCIES

As the federal landowner of WFF, NASA manages the facility in accordance with the National Aeronautics and Space Act (hereafter referred to as the Space Act) (51 U.S.C. §§20101 *et seq*.). Pursuant to Section 20113 of the Space Act, NASA is authorized to enter into agreements with other federal agencies for the use of its real property. Section 20114 of the Space Act directs NASA and the DoD to advise, coordinate, and consult with one another with regard to aerospace matters under each organization's respective jurisdiction. NASA's cooperation with the USAF with respect to the Proposed Action is consistent with this statutory authority and direction. NASA, therefore, is serving as a cooperating agency during the preparation of this EA.

Under the Proposed Action, NAWCAD and NAVSEA would install, operate, and maintain equipment on the proposed tower that would enhance and support their capabilities at both WFF and the offshore areas within which they conduct their test operations. Thus, NAWCAD and NAVSEA are also serving as cooperating agencies during the preparation of this EA.

Under NEPA, a cooperating agency is a federal, state, local, or tribal government agency having legal jurisdiction and/or special expertise regarding an action proposed by a federal agency or the environmental effects potentially resulting from that action. As the federal landowner, NASA meets both of these criteria. NAWCAD and NAVSEA also have special expertise concerning local mission requirements, as well as the nature of equipment that would be placed on the tower. As federal agencies, NASA and the U.S. Navy each have their own NEPA policies and procedures with which they must comply (14 CFR §1216.3 and 32 CFR §775, respectively). As such, this EA has been prepared to satisfy NASA's and the Navy's NEPA obligations, in addition to those of the USAF (32 CFR §989).

1.6 DECISIONS TO BE MADE

The Proposed Action considered in this EA is the proposed construction, operation, and maintenance of a 750-foot tall instrumentation tower at WFF, and the issuance by NASA to the USAF of a Land Use Authorization to build, operate, and maintain such a tower. The USAF's decision to be made is whether to build, operate, and maintain the proposed instrumentation tower. NASA's decision to be made is whether to grant a Land Use Authorization to the USAF to allow the USAF to build, operate, and maintain the proposed tower on NASA-owned land. The decision to be made by NAWCAD and NAVSEA is whether to install, operate, and maintain equipment on the proposed tower.

1.7 SUMMARY OF ENVIRONMENTAL STUDY REQUIREMENTS

1.7.1 NATIONAL ENVIRONMENTAL POLICY ACT

NEPA provides for the consideration of environmental issues in federal agency planning and decision-making. Under NEPA, federal agencies must prepare an EA or an EIS for any federal action, except those actions that are determined to be "categorically excluded." An EIS is prepared for those federal actions that may significantly affect the quality of the human environment. An EA is a concise public document that provides sufficient evidence and analysis for determining whether to prepare an EIS. An EA includes brief discussions of the following:

- The need for the proposal.
- The alternatives (as required under Section 102 [2] [E] of NEPA).
- The environmental impacts of the proposed action and alternatives.
- A listing of agencies and persons consulted.

The regulations governing NEPA compliance for the USAF are contained in 32 CFR §989. Paragraph 14 of the regulations describes requirements applying to the preparation of an EA, including the following:

> The length of an EA should be as short and concise as possible, while matching the magnitude of the proposal. An EA briefly discusses the need for the proposed action, reasonable alternatives to the proposed action, the affected environment, the environmental impacts of the proposed action and alternatives (including the "no action" alternative), and a listing of agencies and persons consulted during preparation. The EA should not contain long descriptions or lengthy, detailed data. Rather, incorporate by reference background data to support the concise discussion of the proposal and relevant issues (32 CFR §989.14[d]).

Every EA must lead to either a Finding of No Significant Impact (FONSI), a decision to prepare an Environmental Impact Statement (EIS), or no action on the proposal (32 CFR §989.14[a]). Should the USAF determine that the proposed action would have a significant impact on the quality of the human environment, an EIS would be prepared.

1.7.2 INTERAGENCY AND INTERGOVERNMENTAL COORDINATION FOR ENVIRONMENTAL PLANNING (IICEP)

1.7.2.1. Endangered Species Act

In accordance with Section 7 of the Endangered Species Act (ESA) (16 U.S.C. §§1531-1544), the USAF and NASA consulted with the U.S. Fish and Wildlife Service (USFWS) concerning the potential impacts of the proposed action on biological resources, including rare, threatened, and endangered species known or suspected to occur on or near Wallops Island[1]. In its response dated April 11, 2017 the USFWS concurred with the USAF's and NASA's determination that the Proposed Action may affect, but is not likely to adversely affect the federally threatened rufa subspecies of the red knot (*Calidris canutus rufa*), the federally threatened piping plover (*Charadrius melodus*), and the federally threatened northern long eared bat (*Myotis septentrionalis*). The USFWS also requested to review a copy of the draft avifaunal and protected avian species monitoring and mitigation plan for the proposed tower, being prepared concurrently with this EA, prior to the plan's implementation (this plan is further discussed in **Section 2.2.3.1**).

Biological resources and protected species are discussed in **Sections 3.2.1 and 3.2.2**, respectively. Copies of relevant Section 7 correspondence are included in **Appendix A**. A copy of the draft avifaunal monitoring and mitigation plan is included in **Appendix C** [draft monintoring plan to be provided].

1.7.2.2. National Historic Preservation Act

In compliance with Section 106 of the National Historic Preservation Act (NHPA) (16 U.S.C. §470f), the USAF is consulting with the Virginia Department of Historic Resources (VDHR), which serves as the State Historic Preservation Officer (SHPO) for the Commonwealth of Virginia, concerning the potential effects of the Proposed Action on historic properties listed or eligible for listing in the National Register of Historic Places (NRHP). The USAF and NASA have determined that the Proposed Action would not adversely affect such properties. VDHR's concurrence with this determination is pending.

Cultural resources are discussed in **Section 3.3.2.** Copies of relevant Section 106 correspondence are included in **Appendix A.**

1.7.3 TRIBAL CONSULTATION

The 1999 Department of Defense *American Indian and Alaska Native Policy* recognizes the "importance of increasing understanding and addressing tribal concerns, past, present, and future" and states that "these concerns should be addressed prior to reaching decision on matters that may have the potential to significantly affect protected tribal resources, tribal rights, or Indian lands." Procedures for complying with this policy are set forth in Department of Defense Instruction (DoDI) 4710.02, *DoD Interactions with Federally Recognized Tribes*. Based on this policy and DoDI 4710.02, all organizational entities with the DoD must consult with tribes when its proposed actions may have the potential to significantly affect Indian lands, treaty rights, or other tribal interests protected by statute, regulation, or executive order.

The USAF consulted with the following Native American tribes during the preparation of this EA: Pocomoke Indian Nation, Catawba Indian Nation, and Pamunkey Indian Tribe. In its response dated March 8, 2016, the Catawba Nation stated that it has no immediate concerns with regard to traditional cultural properties, sacred sites or Native American archaeological sites within the boundaries of the proposed project areas. In addition, the Catawba Nation requested that it be notified if Native American artifacts and/or human remains are located during ground-disturbing activities associated with the Proposed Action. To date, no responses from the Pocomoke Indian Nation and the Pamunkey Indian Tribe have been received.

Traditional cultural resources are further discussed in **Section 3.3.2.2**. Copies of relevant correspondence with Native American tribes are included in **Appendix A**.

1.7.4 COASTAL ZONE MANAGEMENT ACT

The Coastal Zone Management Act (CZMA) of 1972 (16 USC § 1451, *et seq*., as amended) provides assistance to states, in cooperation with federal and local agencies, for developing land and water use

[1] Consultation with National Marine Fisheries Service was not conducted during the preparation of this EA, as the USAF and NASA determined that the Proposed Action would have no potential to affect species under the jurisdiction of that agency.

programs in coastal zones. Section 307 of the CZMA stipulates that federal projects that affect land uses, water uses, or other coastal 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.

Virginia's federally approved Coastal Zone Management (CZM) Program is administered by the Virginia Department of Environmental Quality (VDEQ). Accomack County, which includes WFF, is located within Virginia's coastal zone. The USAF and NASA have determined that the Proposed Action would be consistent to the maximum extent practicable with the enforceable policies of the Virginia CZM Program. Submission of a Federal Consistency Determination for the Proposed Action to VDEQ is pending.

The CZMA and applicable Federal Consistency Requirements are discussed in **Section 3.1.5**. A copy of the Federal Consistency Determination prepared for the Proposed Action is included in **Appendix A** [Federal Consistency Determination to be provided].

1.7.5 AIR CONFORMITY REQUIREMENTS

The Clean Air Act Amendments of 1990 (CAAA) expanded the scope and content of the Clean Air Act's (CAA) conformity provisions. Under Section 176(c) of the amendments, a project is in "conformity" if it corresponds to a state air quality implementation program's purpose of eliminating or reducing the severity and number of violations of the National Ambient Air Quality Standards (NAAQS) and achieving the expeditious attainment of these standards. Conformity requires that such activities do not:

(1) Cause or contribute to any new violations of any standards in any area.

(2) Increase the frequency or severity of any existing violation of any standards in any area.

(3) Delay the timely attainment of any standard or any required interim emission reductions or other milestones in any area.

The U.S. Environmental Protection Agency (EPA) has published final rules on general conformity (40 CFR Parts 51 and 93) that apply to federal actions in areas designated as being in nonattainment for any of the NAAQS. The rules specify *de minimis* emission levels by pollutant to determine the applicability of conformity requirements for a project.

Wallops Island is located in the Northeastern Virginia Intrastate air quality control region (40 CFR § 81.144). This air quality control region, which includes Accomack County, is designated as in attainment/unclassifiable for all criteria pollutants. Because the region is in attainment, the Clean Air Act General Conformity Rule (40 CFR Parts 51 and 93) does not apply, and a General Conformity Applicability Analysis is not required. However, the operation of construction vehicles and equipment during the implementation of the Proposed Action would have the potential to emit criteria pollutants regulated by the CAA and CAAA.

Air quality is discussed in **Section 3.1.1.** The USAF has prepared a Record of Air Analysis (ROAA) for the Proposed Action. A copy of the ROAA is included in **Appendix B.**

1.7.5.1. Greenhouse Gas Emissions

Greenhouse gases (GHG) are compounds that contribute to the greenhouse effect, a natural phenomenon where gases trap heat within the lowest portion of the earth's atmosphere and cause heating at the surface of the earth. The heating effect from these gases is considered the probable cause of global warming trends observed over the last 50 years. Global warming is also suspected to contribute to sea level rise and increased severity of storms occurring in coastal areas (USEPA 2009).

Implementation of the Proposed Action would have the potential to influence global warming trends as a result of GHG that would be emitted by construction vehicles and equipment. In addition, the Proposed Action would occur in a coastal location susceptible to effects from severe storms as well as inundation from rising sea levels.

GHG emissions are discussed in **Section 3.1.1** of this EA, in accordance with the USAF's Environmental

Impact Analysis Process at 32 CFR 989.

1.7.6 SCOPING

The USAF initially solicited comments on the Proposed Action from local governments, federal and state agencies, and non-governmental organizations in February 2016. Following the continued refinement of alternatives, conceptual design, and other project details, a second scoping period was conducted in March 2017. During both scoping periods, predominant themes of the responses received consisted of the following:

- Prepare an EIS for the Proposed Action, rather than an EA;
- Locate the tower in a less-ecologically sensitive area;
- Build and operate a non-guyed tower 500 feet or less in height; build and operate multiple non-guyed towers 200 feet or less in height; and/or place proposed equipment on existing towers;
- Minimize lighting on the proposed tower to the extent feasible; and
- Address interference potentially resulting from the proposed tower with other communication systems in the vicinity of Wallops Island.

In addition, comments from regulatory agencies generally identified aspects of the Proposed Action or potentially impacted resources within or outside a particular agency's jurisdiction, and/or applicable procedures or requirements to which the construction and operation of the proposed tower must adhere.

Comments received during the scoping periods conducted in 2016 and 2017 for the Proposed Action have been considered by the USAF and NASA, and are addressed accordingly in the analysis presented in this EA.

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2 DESCRIPTION OF THE PROPOSED ACTION AND ALTERNATIVES

This section provides a detailed description of the Proposed Action and the alternatives that would meet the USAF's purpose and need as discussed in Sections 1.3 and 1.4, respectively. In accordance with 40 CFR §1502.14, this section also describes the No Action Alternative and discusses alternatives considered but not carried forward for detailed analysis in the EA.

2.1 SELECTION CRITERIA FOR ALTERNATIVE SITES

The USAF developed criteria in the early stages of project planning to guide the identification and selection of alternative sites on which to build and operate the proposed tower. To be considered a reasonable alternative, the location for the proposed instrumentation tower must meet the following criteria:

1) Within 10 nautical miles of the Atlantic coast in the region of southern Maryland or northern Virginia, with sites closer to the coast preferred;
2) On a guarded military or other government-owned facility to meet security requirements;
3) On a site that provides vehicular access and is served by existing electrical and communications infrastructure, and does not require substantial site preparation and/or additional infrastructure investment;
4) In an open area that accommodates the approximately 590-foot radius of the required guy wire footprint (i.e., approximately 25 acres, at minimum);
5) Outside of an established or proposed aircraft flight corridor, thereby enabling the construction of a 750-foot tower; and
6) Result in no or manageable impacts on uses and activities adjacent to or near the tower site.

2.1.1 SITING

2.1.1.1. Macro-Scale (Regional) Siting

No naturally occurring elevation meeting the USAF's security and operational requirements occurs in the region where the enhanced communication coverage is needed, as described in **Sections 1.3** and **1.4**. Thus, options involving the operation of the necessary systems on topography providing the required elevation were rejected by the USAF from further consideration.

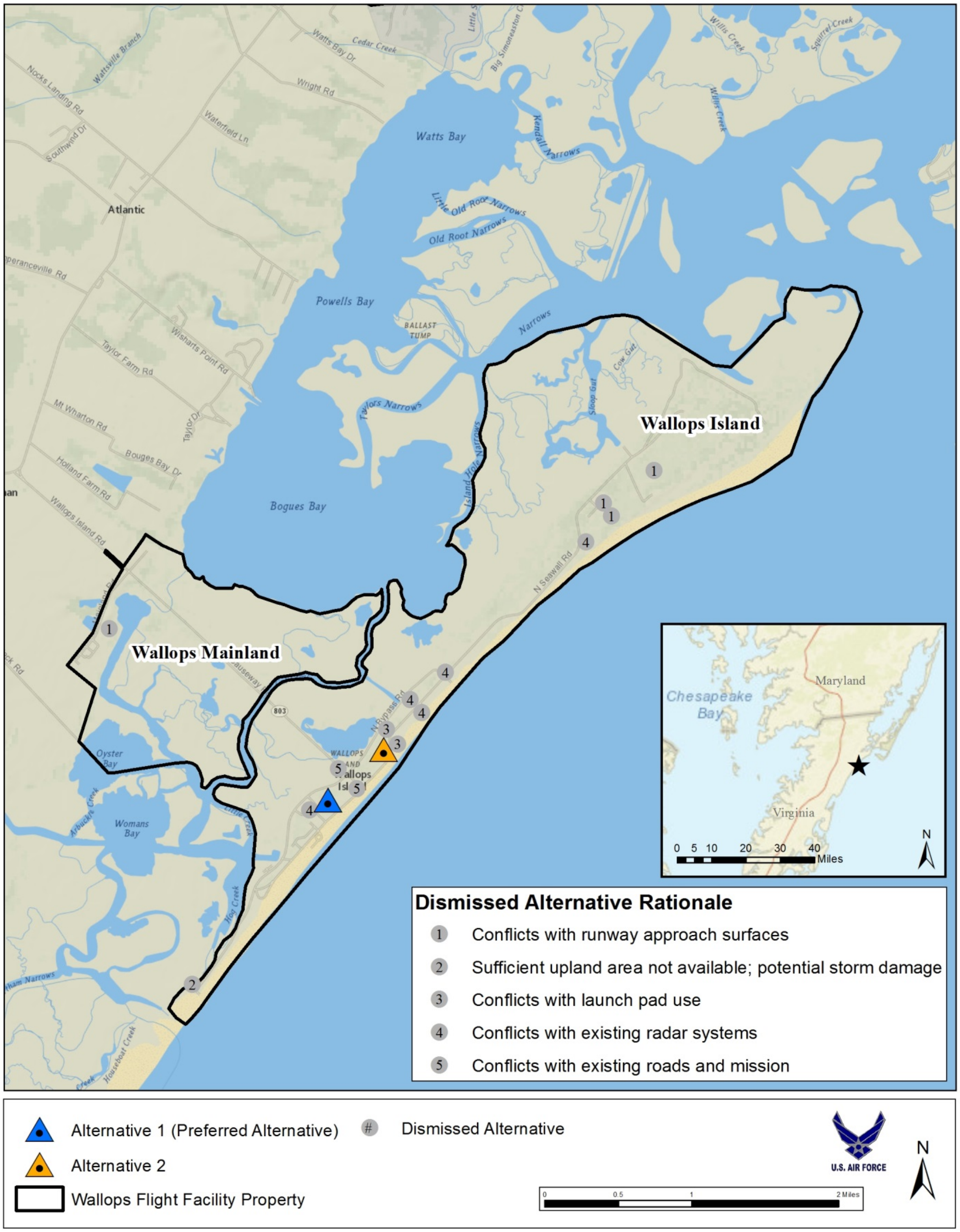
In addition to WFF, the USAF considered a range of potential sites including those in Laurel, Delaware; Ocean City, Maryland; Salisbury, Maryland; Westover, Maryland; Chincoteague Island, Virginia; and Accomac, Virginia. Ultimately, sites at WFF ranked the highest based on the selection criteria presented above, and were carried forward by the USAF for further analysis.

2.1.1.2. Micro-Scale (Site-Specific) Siting

Based on the presence of existing development and operations, as well as the six selection criteria listed above, 16 sites were initially identified as possible alternative locations within WFF. Those sites are shown on **Figure 2-1**. One of the sites was located on Mainland and the remainder were located on Wallops Island. The USAF, in coordination with NASA and Navy SCSC, reviewed each site for compatibility with mission operations, range safety, constructability, and natural resources. Based on this analysis, the Mainland site and 13 of the potential Wallops Island sites were rejected from further consideration for the following reasons:

- The Mainland site and three sites on north Wallops Island encroach on approach surfaces associated with the airfield on Main Base.

Figure 2-1: Locations of Wallops Island Alternative Sites Evaluated by the USAF



Sources: Spatial Data courtesy of NASA (2016); Esri (2016) Disclaimer: No warranty is made by AECOM as to the accuracy, reliability, or completeness of these data for individual use or aggregate use with other data. This map is a "living document", in that it is intended to change as new data become available and is incorporated into the GIS database.

- Implementation of the Proposed Action on two potential sites on mid-Wallops Island would encroach on existing launch pads near the sites and render them unusable for future NASA missions.
- Implementation of the Proposed Action at any of four other potential sites on mid-Wallops Island would generate interference with existing SCSC radar systems near the sites.
- Implementation of the Proposed Action on two mid-Wallops Island sites would create safety concerns with respect to icing of the proposed tower and/or its associated guy wires potentially occurring during winter months, and the presence of main access roads under one or more guy wire footprints. In addition, the presence of the proposed tower in either of these locations would adversely impact WFF's operations and mission by precluding the release of mission-critical NASA weather balloons from a neighboring facility.
- Implementation of the Proposed Action at either of two sites just southwest of those ultimately selected for analysis in this EA would adversely impact the operations of NASA radar systems.
- A potential site on south Wallops Island, while possibly compatible with WFF's missions, would be susceptible to storm damage and has limited upland area on which to site the proposed tower.

Figure 2-1 includes a summary of the rationale for why each site was considered unreasonable by the USAF and eliminated from further consideration in the EA.

2.1.1.3. Identification of the Alternative Sites

Based on the site selection and alternatives review process discussed above, the USAF identified two alternative sites located on mid-Wallops Island for further analysis in this EA. The USAF has determined that these two sites best meet the selection criteria and would fulfill the purpose and need for the Proposed Action. The Alternative 1 site is located northwest of Building X-015 and the Alternative 2 site is located northwest of Building X-079. The locations of these sites are shown on **Figure 2-2**.

A detailed discussion of the USAF's Proposed Action is presented in **Section 2.2**. Alternatives analyzed in the EA, including the No Action Alternative, are further discussed in **Section 2.3**.

2.1.2 ALTERNATIVES CONSIDERED BUT DISMISSED

In parallel with the site selection process, the USAF evaluated other alternatives for the design, construction, and location of the proposed tower that would potentially meet the purpose and need described in **Sections 1.3** and **1.4**, respectively. These alternatives were developed, in part, based on comments received during initial project scoping conducted in February 2016 (see **Section 1.7.6)** and consisted of the following:

1. **Locate required instrumentation on an existing tower.** As described in **Sections 1.3** and **1.4**, the USAF requires stationary instrumentation at an elevation of 750 feet to fulfill its purpose and need for the Proposed Action. The USAF considered placing equipment on an existing tower, which was given a higher priority in selection due to cost and time considerations. However, the USAF failed to identify an existing tower that provided the elevation required (i.e., 750 feet) or met the applicable selection criteria. Consequently, additional consideration of this option was abandoned.
2. **Construct a non-guyed, free-standing tower.** The USAF and NASA considered constructing a non-guyed, free-standing, self-supporting tower. However, through its preliminary analysis, the USAF determined that such an alternative would require substantially more robust and invasive construction methods, such as a wider base (approximately 200 feet by 200 feet, at minimum), the use of heavier and stronger structural components, and larger and deeper foundational elements (Bundick, pers. comm., April 12, 2017). Construction of such a tower would also result in a wider visual profile, making it more noticeable from the surrounding landscape, and would generally result in a structure more akin to a permanent facility on Wallops Island, making removal more difficult and less likely to occur in the event the use of the tower is discontinued in the future. For these reasons, this option was dismissed from further consideration.

Figure 2-2: Locations of the Action Alternative Sites

Sources: Spatial Data courtesy of NASA (2016); Esri (2016) Disclaimer: No warranty is made by AECOM as to the accuracy, reliability, or completeness of these data for individual use or aggregate use with other data. This map is a "living document", in that it is intended to change as new data become available and is incorporated into the GIS database.

3. **Locate the proposed tower further inland and/or in a less ecologically sensitive location.** As described in **Section 2.1.1**, the USAF and NASA conducted a site identification and screening process that resulted in the identification of the two mid-Wallops Island sites shown on **Figure 2-2** as the only reasonable alternative locations.

2.2 PROPOSED ACTION

The Proposed Action analyzed in this EA consists of the associated activities and design, construction, and operational components described in **Section 2.2.1**. The USAF, in cooperation with NASA, NAWCAD, and NAVSEA, would implement the Proposed Action at one of the two alternative sites on mid-Wallops Island described in **Section 2.1.1.3**. General mitigation measures, as well as measures that have been incorporated into the Proposed Action to minimize adverse impacts on wildlife (particularly birds) potentially resulting from the Proposed Action at either alternative site, are discussed in **Section 2.2.2** and **Section 2.2.3,** respectively. **Section 2.3** presents a detailed discussion of the alternatives, including the No Action Alternative, analyzed in this EA.

2.2.1 PROJECT COMPONENTS AND ACTIVITIES

In response to the USAF's request to build and operate the instrumentation tower at WFF, NASA would issue a Land Use Authorization to the USAF in accordance with the Space Act (51 U.S.C. §§20101 *et seq*.) to permit the construction, operation, and maintenance of the proposed 750-foot tower. The Land Use Authorization would specify the terms and conditions under which the tower must be built and operated at WFF. NAWCAD and NAVSEA would place equipment on the tower in coordination with, and as authorized by, the USAF and NASA.

The proposed tower would be 750 feet tall and would be a three-sided lattice structure built of galvanized steel approximately 42 inches wide on each side. The tower would require up to 12 steel guy wires on three sides to provide structural support. The guy wires would be installed along three radii from the tower at angles of 120 degrees from each other, and would extend up to 590 feet as measured from the tower base. Guy wires would be required approximately every 80 feet along the tower's vertical height and would tie into at least two anchor points on the ground positioned in line with each of the three radii. Anchor points for the guy wires would consist either of concrete slabs measuring 14 feet by 14 feet by 5 feet or helical piles, which consist of one to three bearing plates attached to a central shaft and installed by rotation, similar to a screw. The three outermost anchor points would be located approximately 590 feet from the tower base, while the three inner anchor points would be approximately 430 feet from the base of the tower. Based on preliminary engineering for the proposed tower, each of the tower's three radii could contain up to 12 individual guys. Drawings showing preliminary design details for the proposed tower are included in **Appendix D**. The tower would support, at appropriate elevations, a variety of equipment including ultra-high frequency (UHF)/very high frequency (VHF) radios, telemetry dishes, global positioning system (GPS) antennas, spectrum-monitoring antennas, a flight termination system, and meteorological instrumentation.

Nighttime illumination of the proposed tower would be limited to the minimum amount required by the Federal Aviation Administration (FAA). Lighting on ground-level support structures and equipment would be down-shielded and motion-activated to the greatest extent practicable to minimize impacts on wildlife.

All structural components of the tower would be pile-supported, as necessitated by underlying geologic conditions (i.e., silty material beneath a thin layer of sand). Concrete piles would be driven or cast in place. Piles would be installed to a depth of at least 75 feet (USTS 2015). As necessary, one or more gravel-topped roads would be built from an existing nearby paved road or parking lot to the base of the tower to provide access for service personnel, vehicles, and equipment.

Two prefabricated structures measuring approximately 10 feet by 20 feet would be installed near the base of the tower to house equipment associated with the tower's operation and maintenance. Utility services required for the operation of the proposed tower, including electricity and broadband network communication, would be provided by existing infrastructure adjacent to the alternative sites. A 30-

kilowatt propane-fueled generator and associated 500-gallon above-ground fuel tank would be installed near the prefabricated structures to provide electricity in the event of power outages. To mitigate potential flooding during storm events, the prefabricated structures and all equipment associated with the proposed tower would be installed on one or more elevated platforms at least 11 feet above mean sea level (AMSL).

Construction of the proposed tower would occur over a period of approximately 18 months. Construction of the tower itself is anticipated to require approximately three months, while other activities (e.g., pile driving, installation and testing of electronics) would occupy the majority of the construction period. Routine maintenance of the tower would include tensioning the guy wires, replacing electronics, and trimming vegetation underneath the guy wires. Periodic top-dressing of the gravel access roads could also be necessary.

For the purposes of this EA, it is assumed that the tower would operate for an approximately 20-year period beginning in 2018 [USAF – confirm this date is still valid]. Prior to the end of this 20-year operational period, the USAF would reevaluate the need for the tower. When it is determined that the tower is no longer needed, the tower and associated equipment would be dismantled, recycled, and/or disposed of in accordance with applicable requirements at that time.

2.2.2 GENERAL MITIGATION AND MINIMIZATION MEASURES

The USAF has incorporated multiple measures into the Proposed Action to mitigate or minimize adverse impacts on a number of the resources analyzed in **Section 3** of this EA. Such measures would be implemented and adhered to during the Proposed Action's construction and/or operational phases in accordance with NASA and WFF policies as well as other applicable federal, state, and local requirements. General mitigation and minimization measures that have been incorporated into the Proposed Action are discussed in **Section 2.3.1** and in **Section 4** of this EA.

2.2.3 AVIFAUNA AND PROTECTED SPECIES MITIGATION AND MINIMIZATION MEASURES

[This section may need additional revision following the preparation of the Draft Monitoring and Mitigation Plan.]

2.2.3.1. Monitoring and Mitigation Plan

The USAF recognizes that the implementation of the Proposed Action has the potential to adversely impact common as well as protected species of migratory and resident birds breeding, nesting, migrating, or otherwise occurring at and in the vicinity of Wallops Island. Substantial numbers of birds are present at and in the vicinity of Wallops Island throughout the year due to the island's coastal location, the presence of available habitat, and its proximity to the Atlantic Flyway, a major migratory bird corridor along the U.S. Atlantic coast. The presence of the proposed instrumentation tower and its associated guy wires would present a collision risk to birds flying in the vicinity of Wallops Island. Therefore, the USAF has prepared a plan to monitor and mitigate impacts potentially resulting from the proposed tower on common and protected species of birds. This plan is included in **Appendix C** of this EA and briefly summarized below.

[Summarize Draft Monitoring and Mitigation Plan.]

2.2.3.2. Avifauna Mitigation and Minimization Measures Included in the Proposed Action

In addition to adhering to the Monitoring and Mitigation Plan during the construction and operation of the proposed tower, the USAF has incorporated multiple measures into the Proposed Action to minimize impacts on common species of birds. These measures are primarily based on USFWS guidance dated August 2016 titled *Recommended Best Practices for Communication Tower Design, Siting, Construction, Operation, Maintenance, and Decommissioning* (USFWS 2016). The August 2016 USFWS guidance presents multiple measures to be considered and used, when feasible, in the siting, design, and construction of communication towers to minimize impacts on birds. A copy of this guidance is included in **Appendix C.**

Measures included in the USFWS guidance that have been incorporated into the Proposed Action, and summaries of how the USAF would adhere to those measures, are presented below (note that the numbering of items presented below corresponds to the August 2016 USFWS guidance).

Tower Siting and Construction

1. Collocation. Co-locate communications equipment on existing communication towers or other structures. This recommendation is intended to reduce the number of towers across the landscape.

> **USAF compliance:** *While the Proposed Action would result in the construction of a new tower, it would enable the co-location of equipment by multiple users, thereby minimizing the number of new towers that would potentially need to be built otherwise.*

3. Placement. All new towers should be sited to minimize environmental impacts to the maximum extent practicable.

> a. Place new towers within existing "antenna farms" (i.e., clusters of towers) when possible;
>
> b. Select already degraded areas for tower placement;
>
> e. Towers and associated facilities should be designed, sited, and constructed so as to avoid or minimize habitat loss within and adjacent to the tower "footprint".
>
> **USAF compliance:** *The proposed tower would be built in a previously developed area near similar types of vertical structures, including rocket launch gantries, water towers, and communication towers. The proposed tower would be designed and built in such a way to avoid or minimize disturbance of wetlands and vegetation potentially providing habitat to the greatest extent possible.*

4. Construction. During construction, the following considerations can reduce the risk of take of birds:

> a. Schedule all vegetation removal and maintenance (e.g., general landscaping activities, trimming, grubbing) activities outside of the peak bird breeding season to reduce the risk of bird take.
>
> b. When vegetation removal activities cannot avoid the bird breeding season, the following factors should be considered:
>
> > i. Surveys should be conducted no more than five days prior to the scheduled activity to ensure recently constructed nests are identified;
> >
> > ii. Timing and dimensions of the area to be surveyed vary and will depend on the nature of the project, location, and expected level of vegetation disturbance; and
> >
> > iii. If active nests are identified within or in the vicinity of the project site, avoid the site until nestlings have fledged or the nest fails. If the activity must occur, establish a buffer zone around the nest and no activities will occur within that zone until nestlings have fledged. The buffer should be a distance that does not elicit a flight response by the adult birds.
>
> c. Prevent the introduction of invasive plants during construction to minimize vegetation community degradation by:
>
> > i. Use only native and local (when possible) seed stock for all temporary and permanent vegetation establishment; and
> >
> > ii. Use vehicle wash stations prior to entering sensitive habitat areas to prevent accidental introduction of non-native plants.
>
> **USAF compliance:** *The USAF would incorporate these factors into the construction as well as the long-term operation of the tower to the greatest extent practicable. The USAF would also adhere to applicable guidelines established by WFF with respect to the disturbance of vegetation potentially providing habitat and wildlife potentially occurring on or in the vicinity of the project site, including*

protected species. Procedures to prevent the introduction of non-native or invasive plants, particularly the common reed (Phragmites australis; hereafter referred to as Phragmites), *would also be adhered to during construction of the proposed tower in accordance with the WFF* Wallops Island Phragmites Control Plan (NASA 2014a) *and other applicable guidance* (see **Section** Error! Reference source not found. for additional discussion).

5. Tower Design. Tower design should consider the following attributes:

b. If guy wires are required for tower design:

i. The minimum number of guy wires necessary should be used; and

ii. Guy wired towers that are proposed to be located in known raptor or waterbird concentrations areas, daily movement routes, major daytime migratory bird movement routes, staging areas, or stopover sites should have daytime visual markers or bird flight diverters installed on the guy wires to attempt to prevent daytime collisions.

c. Lights are a primary source of bird aggregation around towers; thus, minimizing all light is recommended.

iii. If taller (i.e., greater than 199 feet above ground level [AGL]) towers requiring lights for aviation safety must be constructed, the minimum amount of pilot warning and obstruction avoidance lighting required by the FAA should be used.

iv. Security lighting for on-ground facilities, equipment, and infrastructure should be motion or heat-sensitive, down-shielded, and of a minimum intensity to reduce nighttime bird attraction and eliminate constant nighttime illumination while still allowing safe nighttime access to the site.

USAF compliance: *The proposed tower would incorporate multiple types of daytime visual markers. Lighting on the proposed tower would be limited to the minimum needed to comply with FAA regulations. As project planning and design continues, the USAF would determine the number, type, and placement of daytime visual markers on the guy wires and/or tower, and would consult with the FAA to determine the number and type (e.g., flashing, non-flashing, and/or strobe) of lights to be used on the proposed tower. Lighting on support facilities associated with the proposed tower would be down-shielded and motion-activated to the greatest extent practicable.*

Tower Operation and Maintenance

4. Birds Nesting on Towers: If birds are nesting on communication towers that require maintenance activities, contact the state natural resource protection agency and/or the USFWS for permits, recommendations, and requirements. Schedule construction and maintenance activities around the nesting and activity schedule of protected birds. Minimize excess wires and securely attach wires to the tower structure to reduce the likelihood of birds becoming entangled on the tower.

USAF compliance: *The USAF would adhere to applicable federal, state, and NASA requirements in the event that ongoing maintenance activities would potentially disturb birds nesting on the proposed tower. To the greatest extent feasible, the tower would be built and maintained in such a way as to prevent the entanglement of birds in the tower structure or equipment installed on the tower.*

5. Tower Access: Representatives from the USFWS or researchers should be allowed access to the site to evaluate bird use, conduct dead-bird searches, and conduct other research, as necessary.

USAF compliance: *USFWS personnel, researchers, and/or other visitors with a pertinent interest in the interaction of birds or other wildlife with the proposed tower would be admitted to the tower site in accordance with applicable USAF and NASA security and safety requirements.*

Tower Decommissioning

1. Tower Removal. Towers no longer in use, not re-licensed by the Federal Communications Commission (FCC) for use, or determined to be obsolete should be removed from the site within 12 months of cessation of use, preferably sooner.

USAF compliance: *As noted in **Section 2.2.1**, the proposed tower would be removed in accordance with applicable requirements following the determination that the tower is no longer needed.*

2.3 DESCRIPTION OF ALTERNATIVES ANALYZED IN THE EA

2.3.1 ACTIVITIES AND REQUIREMENTS APPLICABLE TO THE ACTION ALTERNATIVES

Under either action alternative, NASA would grant a Land Use Authorization to the USAF for the construction, operation and maintenance of a 750-foot tall, guyed instrumentation tower at one of the Wallops Island sites described in **Section 2.1.1.3**. Following the issuance of the Land Use Authorization, the USAF would build, operate, and maintain the proposed tower for a period of at least 20 years, incorporating the associated project components and activities discussed in **Section 2.2.1** as well as the mitigation measures summarized in **Sections 2.2.2** and **2.2.3**.

Construction and operation of the proposed tower would adhere to all applicable requirements to protect human health and safety, including those set forth by the Occupational Safety and Health Administration (OSHA), NASA, and the USAF. A discussion of these requirements is presented in **Section 3.3.1**.

The construction of the proposed instrumentation tower at either of the alternative sites would include all associated site preparation, to include minor excavation, grading, and/or removal of vegetation as necessary. The sites are currently vacant; thus, implementation of the Proposed Action at either site would not require the demolition or removal of existing facilities or operations. Electrical and communications utilities associated with the proposed tower would connect to existing infrastructure underlying or adjacent to the alternative sites.

As applicable, the construction contractor would prepare and adhere to the requirements of an erosion and sediment control plan in accordance with the Virginia Erosion and Sediment Control Regulations (4 Virginia Administrative Code [VAC] 50-1435 30) for land disturbance equal to or exceeding 10,000 square feet. If it is determined that one acre or more of land would be disturbed during the construction of the proposed tower, the construction contractor also obtain coverage under the General Permit for Discharges of Stormwater from Construction Activities (Construction General Permit) in accordance with 9 VAC 25-880. Acquisition of coverage under the permit would require the preparation of a stormwater pollution prevention plan (SWPPP). The WFF Stormwater, Erosion, and Environmental Development (SEED) Team would review and approve applicable construction and development plans involving land disturbance and would conduct periodic inspections and any necessary enforcement in accordance with the terms of the erosion and sediment control and/or stormwater management plans. Additional discussion of these requirements is presented in **Section 3.1.3**.

To prevent the introduction of seeds and rhizomes of the invasive *Phragmites* to areas of WFF where the plant is not currently present, the construction contractor would adhere to the requirements of WFF's *Wallops Island Phragmites Control Plan* (NASA 2014a). Wetlands and associated vegetation on and near the alternative sites are discussed in **Section 3.1.4**.

The construction contractor would implement site-specific best management practices (BMP) for the fueling and maintenance of vehicles and equipment, as well as spill prevention and control measures as specified in WFF's *Integrated Contingency Plan* (ICP) (NASA 2015a). Adherence to such BMPs would minimize or eliminate the potential for inadvertent spills of petroleum products during construction activities. Hazardous substances and associated requirements are discussed in additional detail in **Section 3.1.6**.

2.3.2 ALTERNATIVE 1 (PREFERRED ALTERNATIVE): BUILDING X-015 SITE

Under Alternative 1, the USAF would build, operate, and maintain a 750-foot tall, guyed tower on an approximately 40-acre site northwest of Building X-015 following the issuance of a Land Use Authorization by NASA. A conceptual rendering of the proposed tower on the Alternative 1 site is shown on **Figure 2-3**.

In addition to the construction, operation, and maintenance of the proposed 750-foot tower, Alternative 1 would include the installation or relocation of an existing NASA telemetry dish to Mainland to minimize or eliminate impacts on the operation of the dish from the proposed tower that would otherwise occur if the dish were not relocated. The telemetry dish would be installed on existing infrastructure on Mainland. The installation of the telemetry dish would not require the construction of new or additional facilities, nor would it require the expansion of existing facilities.

The USAF has incorporated the locations of known jurisdictional wetlands on and adjacent to the Alternative 1 site into the preliminary design of the proposed tower to minimize or eliminate impacts on wetlands to the extent possible. Impacts on wetlands potentially resulting from Alternative 1 are discussed in **Section** Error! Reference source not found..

There are no known hazardous materials or hazardous wastes on or underlying the Alternative 1 site that would adversely impact the construction and operation of the proposed tower. Activities have been previously conducted on portions of the site to remediate soil and groundwater that was contaminated by pollutants released from operations that historically occurred on the site. All such remedial actions have been granted closure or a determination of No Further Action (NFA) required by the EPA and/or VDEQ. A Draft Final Environmental Baseline Survey (EBS) prepared for the site by the USAF in April 2017 (USAF 2017) characterized the site at Category 4, a*n area or real property where release, disposal, or migration, or some combination thereof, of hazardous substances has occurred, and all remedial actions necessary to protect human health and the environment have been taken* (see **Section 3.1.6** for additional discussion).

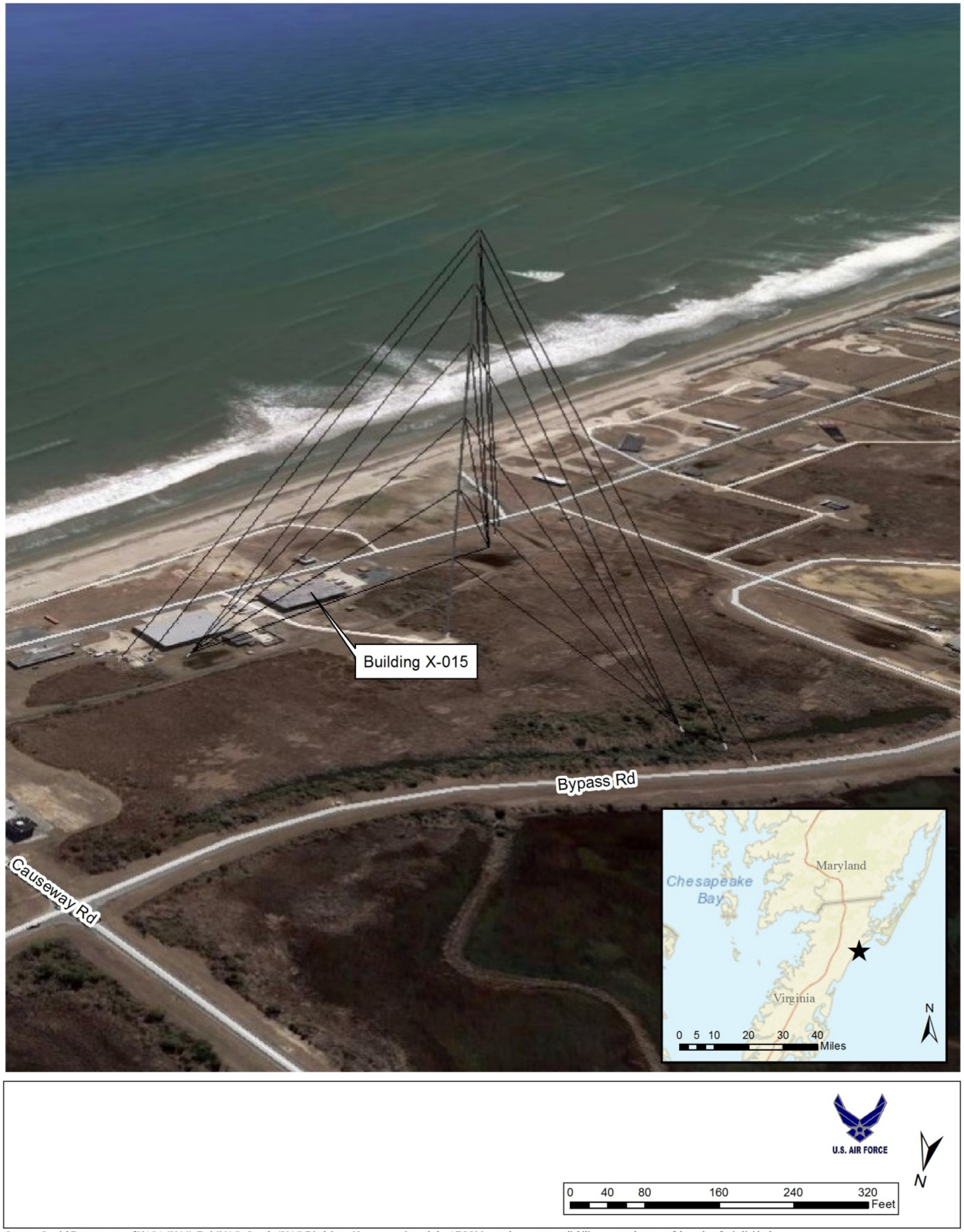
The USAF has identified Alternative 1 as its Preferred Alternative for the following reasons: the site includes a previously cleared and regularly mowed area of sufficient size to accommodate the Proposed Action; implementation would avoid jurisdictional wetlands to the maximum extent possible; construction and operation of the proposed tower would avoid existing and future mission sites and uses; existing underground broadband communications and electrical connections are available nearby; and the site is located farther from the beach and listed species than other alternatives considered on Wallops Island.

2.3.3 ALTERNATIVE 2: BUILDING X-079 SITE

Under Alternative 2, the USAF would build, operate, and maintain a 750-foot tall, guyed tower on an approximately 40-acre site north of Building X-079 following the issuance of a Land Use Authorization by NASA. The Alternative 2 site is considered by the USAF to be less favorable than the Alternative 1 site for the following reasons: the implementation of the Proposed Action on the Alternative 2 site would require disturbance, to potentially include draining and/or filling, of a jurisdictional wetland on the site; and the operation of the proposed tower on the Alternative 2 site would have minimal but manageable adverse impacts on U.S. Navy operations occurring to the north of the site. Alternative 2 would not require the relocation of the NASA telemetry dish as described for Alternative 1.

If Alternative 2 is selected for implementation of the Proposed Action, the USAF would acquire all applicable federal, state, and local permits to impact wetlands on the site, and would adhere to the avoidance, compensation, and/or mitigation requirements specified in such permits. In addition, the USAF would prepare an EBS for the Alternative 2 to characterize the current and/or historical presence and use of hazardous substances on the site.

Figure 2-3: Conceptual Rendering of the Proposed Tower on the Alternative 1 (Preferred Alternative) Site



Sources: Spatial Data courtesy of NASA (2016); Esri (2016); Google (2016) Disclaimer: No warranty is made by AECOM as to the accuracy, reliability, or completeness of these data for individual use or aggregate use with other data. This map is a "living document", in that it is intended to change as new data become available and is incorporated into the GIS database.

2.3.4 NO ACTION ALTERNATIVE

Under the No Action Alternative, the USAF would not build, operate, or maintain the proposed 750-foot tall, guyed instrumentation tower on Wallops Island, and NASA would not grant a Land Use Authorization to the USAF for such a tower. Existing conditions at Wallops Island would continue. Implementation of the No Action Alternative would result in the continued use of existing, costly airborne and surface instrumentation systems for joint service test safety and data acquisition. Further, the No Action Alternative would not provide the additional, mission-critical test range capability required by the USAF. Existing ongoing, deficient methods would continue to be used to attempt to meet these requirements. The No Action Alternative does not meet the USAF's purpose and need for the Proposed Action, and therefore, is considered unreasonable. However, the No Action Alternative is analyzed in this EA in accordance with CEQ regulations at 40 CFR §1502.14, to provide a baseline against which impacts potentially resulting from the action alternatives can be meaningfully compared.

2.4 COMPARISON OF ALTERNATIVES

As required by 40 CFR §1501.14, this section compares the potential environmental impacts associated with the alternatives carried forward for detailed analysis in this EA. **Table 2-1** identifies the technical resource areas subject to environmental review[2] as determined by the USAF, and briefly describes the potential effects of Alternative 1, Alternative 2, and the No Action Alternative.

Table 2-1: Summary of Environmental Impacts by Alternative

Resource Area	No Action	Alternative 1 (Preferred Alternative): X-015 Site	Alternative 2: X-079 Site
Air Quality and Greenhouse Gases	No impacts.	**Air Quality:** Minor short-term impacts and negligible long-term impacts. **Greenhouse Gases:** Minor short-term impacts and negligible long-term impacts.	Impacts would be similar to those described for the Preferred Alternative.
Climate Change	No impacts	**Climate Change:** Negligible short-term and long-term impacts on and from climate change.	Impacts would be similar to those described for the Preferred Alternative.
Geology and Soils	No impacts.	**Geology:** negligible short-term impacts and no long-term impacts. **Soils:** minor short-term impacts and no long-term impacts.	Impacts would be similar to those described for the Preferred Alternative.
Water Resources	No impacts.	**Wetlands:** negligible short-term and negligible long-term impacts. **Floodplains:** negligible impacts.	Alternative 2 would disturb a larger area of wetlands relative to the Preferred Alternative; however, short-term and long-term impacts on wetlands would remain negligible. Impacts on floodplains would be similar to the Preferred Alternative.
Coastal Zone Management	No impacts.	**TBD**; submission of Federal Consistency Determination to Virginia CZM Program by NASA is pending.	Impacts would be similar to those described for the Preferred Alternative.

[2] Technical resource areas dismissed from further analysis in the EA are summarized in **Table 3-1**.

Resource Area	No Action	Alternative 1 (Preferred Alternative): X-015 Site	Alternative 2: X-079 Site
Hazardous Materials and Wastes	No impacts.	Negligible short-term and long-term impacts from the use of hazardous substances and generation of hazardous waste during the construction and operation of the proposed tower. No impacts from former remediation sites that have received regulatory closure underlying the Alternative 1 site. Additional investigation would be conducted if proposed construction activities would disturb either of two areas of concern underlying the Alternative 1 site.	With the exception of pesticdes, no hazardous substances are used on the site, and no hazardous wastes are generated or stored on the site. The presence of hazardous substances exceeding regulatory thresholds in soil or groundwater is not known. The USAF would prepare an EBS for the Alternative 2 site if it is selected for implementation of the Proposed Action.
Avifauna (common bird species)	No impacts.	Low to moderate adverse effects on avifauna.	Impacts would be similar to those described for the Preferred Alternative.
Special Status Species	No impacts.	The UFWS concurred with the USAF's determination that the Proposed Action may affect, but is not likely to adversely affect, special status species of birds and the northern long-eared bat at Wallops Island. The Proposed Action would have no potential to affect any other special status terrestrial or marine species.	Impacts would be similar to those described for the Preferred Alternative.
Health and Safety	No impacts.	No or negligible short-term impacts and no long-term impacts.	No or negligible short-term impacts and negligible long-term impacts from the presence of guy wires above an active roadway.
Cultural Resources	No impacts.	No adverse effects on NRHP-listed or eligible historic properties. Concurrence by VDHR is pending.	Impacts would be similar to those described for the Preferred Alternative.
Visual Quality and Aesthetics	No impacts.	Negligible short-term impacts and minor long-term impacts.	Impacts would be similar to those described for the Preferred Alternative.
Cumulative Effects	No impacts.	Would not contribute to significant cumulative effects on any resource.	Would not contribute to significant cumulative effects on any resource.

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3 AFFECTED ENVIRONMENT AND ENVIRONMENTAL CONSEQUENCES

This section describes existing resources at WFF and effects on those resources that could potentially result from the implementation of the Proposed Action described in **Section 2.2** under Alternative 1 or Alternative 2. Although it does not meet the USAF's purpose and need for the Proposed Action, impacts potentially resulting from the No Action Alternative are also presented in this section, in accordance with CEQ regulations (40 CFR §1502.14), to provide a baseline against which impacts potentially resulting from the Proposed Action can be compared.

The terms "effects" and "impacts" are used synonymously throughout this EA to describe conditions that would potentially result from the implementation of the Proposed Action described in **Section 2.2**. Unless otherwise noted, short-term impacts refer to impacts that would result from activities associated with the construction of the proposed instrumentation tower, while long-term impacts are those that would potentially occur during the proposed tower's operational phase.

Table 3-1 summarizes the resources included for analysis in this EA, as well as those that were dismissed from detailed analysis because the Proposed Action would have no or only marginal effects on them.

Table 3-1: Resources Considered for Evaluation in this Environmental Assessment

Resource Area	Analyzed in Detail in this EA?	If *Yes*, EA Section Number If *No*, Rationale for Dismissal
Physical Environment: Section 3.1		
Air Quality and GHG	Yes	See **Section 3.1.1**.
Agriculture and Prime Farmland	No	Both alternative sites are located on federal property where access is restricted to authorized personnel, and neither of the sites are in active agriculture. None of the soils underlying the sites are designated as prime farmland. Thus, the Proposed Action would have no impact on agriculture or soils designated as prime farmland on or in the vicinity of Wallops Island.
Mineral and Energy Resources	No	No commercial mineral or energy resources are known to underlie the alternative sites and no activities to extract such resources are occurring on the sites. As such, the Proposed Action would have no impact on mineral and energy resources on or in the vicinity of Wallops Island.
Climate Change	Yes	See **Section 3.1.2**.
Groundwater	No	The Proposed Action would not require new or addition withdrawals of groundwater, nor would it result in new or additional discharges to groundwater. Therefore, the Proposed Action would have no impact on groundwater underlyng Wallops Island.
Noise	No	Noise generated during the Proposed Action's construction phase would vary in volume, duration, and intensity but would be similar to that generated by other construction and development activities occurring on Wallops Island with relative frequency. Construction activities would occur during normal daytime working hours (approximately 8:00 a.m. to 5:00 p.m. Monday through Friday) and would not have the potential to disturb noise sensitive receptors, as no such receptors are located on Wallops Island. Ambient noise at the alternative site selected for implementation of the Proposed Action would return to pre-construction conditions following the completion of construction activities, and the operation of the proposed tower would not create a new, permanent source of noise. For these reasons, the Proposed Action would have negligible short-term impacts and no long-term impacts on noise at and in the vicinity of the alternative sites.
Geology and Soils	Yes	See **Section 3.1.3**.
Water Resources	Yes	See **Section 3.1.4**.
Coastal Zone Management	Yes	See **Section 3.1.5**.

Resource Area	Analyzed in Detail in this EA?	If *Yes*, EA Section Number If *No*, Rationale for Dismissal
Hazardous Materials and Waste	Yes	See **Section 3.1.6**.
Biological Environment: Section 3.2		
Avifauna (common species of birds)	Yes	See **Section 3.2.1**.
Marine Biological Resources	No	The construction and operation of the proposed tower would not involve activities or disturbance below, on, or above the surface of marine waters near the alternative sites. Although energy emitted by the proposed tower would have the potential to penetrate the surface of marine waters near the alternative sites, the operation of the tower would not introduce new emissions or stressors on marine fauna beyond those already occurring at WFF. Thus, the Proposed Action would have no impacts on marine biological resources.
Terrestrial Wildlife	No	Noise and disturbance from construction activities associated with the Proposed Action, as well as periodic trimming and removal of vegetation around the tower, guy wires, and support equipment would have the potential to disturb and remove vegetation providing habitat for wildlife on the alternative site and would likely cause the displacement of some individuals. However, such disturbance would be limited to the footprints of the proposed tower's base, ground-level support equipment, guy wire anchor points, and areas beneath the guy wires, and would remain small in the context of the approximately 40-acre project site. It is anticipated that displaced individuals would return to available habitat on the alternative site following the completion of construction activities as well periodic vegetation maintenance activities. Generally, the alternative sites are previously disturbed, and wildlife habitat potentially occurring on the sites is not considered particularly pristine, unique, or valuable in the context of available habitat elsewhere in the vicinity of Wallops Island. As such, short-term and long-term impacts on terrestrial wildlife resulting from the Proposed Action would be negligible.
Special Status Species	Yes	See **Section 3.2.2**.
Terrestrial Vegetation	No	Vegetation disturbance and removal associated with the construction of the proposed tower as well as periodic maintenance activities during the proposed tower's operational phase would be limited to that necessary to conduct such activities and would affect a relatively small area in the context of the approximately 40-acre site. The alternative sites are previously disturbed, and no particularly pristine, unique, or valuable vegetation is present in the context of other areas in the vicinity of Wallops Island that experience minimal or no human-caused disturbance. Therefore, short-term and long-term impacts on terrestrial vegetation would be negligible.
Social Environment: Section 3.3		
Health and Safety	Yes	See **Section 3.3.1.**
Land Use	No	The Proposed Action would occur entirely within the boundaries of WFF and would be consistent with NASA's land use plan for Wallops Island. The alternative sites are currently undeveloped; construction and operation of the proposed tower would not displace existing uses from either of the alternative sites. Further, the Proposed Action would not impede the continuation of uses occurring adjacent to or near the alternative sites. Thus, the Proposed Action would have no short-term or long-term impacts on land use.
Transportation	No	Short-term increases in construction-related traffic traveling to and from the alternative site would vary during the Proposed Action's construction phase but would remain within the capacity of local public roads as well as roads within the boundaries of WFF, as such increases would be similar to those occurring during other construction and development projects of similar scale that occur with relative frequency at WFF. If required during construction, permits for oversize loads would be coordinated with the Virginia Department of Transportation and/or other applicable federal, state, and local regulatory agencies. The operation of the proposed tower would not increase employment at WFF and thus, would not generate additional traffic on local public or WFF roads. Siting of proposed tower has been coordinated with the WFF airfield and the FAA and would not inhibit the continued safe operation of aircraft in the vicinity of Wallops Island. For these reasons, the Proposed Action would have negligible short-term impacts and no long-term impacts on transportation.
Cultural Resources	Yes	See **Section 3.3.2**.

Resource Area	Analyzed in Detail in this EA?	If *Yes*, EA Section Number If *No*, Rationale for Dismissal
Environmental Justice	No	There are no low-income or minority populations on WFF property and the Proposed Action would not affect populations outside the boundaries of WFF. Thus, the Proposed Action would have no short-term or long-term impacts on Environmental Justice populations.
Employment and Income	No	The Proposed Action would have beneficial impacts on employment and income, particularly for workers in or near Accomack County if local contractors are used to design and build the proposed tower; however, any such impacts would be of limited duration and would cease upon the completion of the proposed tower, and would likely be small in the context of economic activity in Accomack County. Long-term maintenance activities would have similarly beneficial impacts through the employment of contractors, but would be of limited duration (i.e., a few hours to a few days) and would occur relatively infrequently throughout the year. Thus, while the Proposed Action would have beneficial short-term and long-term impacts on employment and income, such impacts would remain negligible.
Public Services	No	The implementation of the Proposed Action would have no short-term or long-term impacts on public services, as the construction and operation of the proposed tower would not require the use of such services, and no such services are located on or near the alternative sites.
Utilities and Services	No	The proposed tower would connect to existing utilities located on or near the alternative sites; required utilities (particularly, electricity and communications) are maintained by NASA and have ample capacity to support the operation of the proposed tower. As such, the Proposed Action would have no short-term or long-term impacts on utilities at WFF.
Recreation	No	No recreational facilities are located on or near the alternative sites. Thus, the Proposed Action would have no short-term or long-term impacts on recreation.
Visual Quality and Aesthetics	Yes	See **Section 3.3.3**.

In accordance with 40 CFR §1508.20, general mitigation and minimization measures discussed in **Section 2.2.2** and **Section 2.3.1** that would be implemented to avoid, minimize, or compensate for adverse impacts potentially resulting from the Proposed Action, are presented with the discussion of each resource in this section, as applicable. Such measures are also summarized in **Section 4**.

3.1 PHYSICAL ENVIRONMENT

This section describes the physical resources that could be affected by the action alternatives described in **Section 2.3.2** and **Section 2.3.2**. Physical resources discussed in this section include air quality and greenhouse gases, climate change, geology and soils, water resources (including wetlands and floodplains), coastal zone management, and hazardous materials and wastes.

3.1.1 AIR QUALITY AND GREENHOUSE GASES

Air quality in a particular location is characterized by the ambient concentration of specific pollutants of concern in the atmosphere. A region's air quality is influenced by multiple factors including the type and amount of pollutants emitted into the atmosphere from various sources, the size and topography of the air basin, and prevailing meteorological conditions.

GHG are compounds that contribute to the greenhouse effect, a naturally occurring phenomenon where gases trap heat within the lowest portion of the earth's atmosphere and cause heating at the surface of the earth. The heating effect from these gases is considered the probable cause of global warming trends observed over the last 50 years (USEPA 2009). Climate change and global warming are discussed in **Section 3.1.2**.

3.1.1.1. Regulatory Context

Criteria Pollutants

Six air pollutants are regulated by the EPA under the NAAQS in compliance with the CAA because of the risks they create for human health and welfare when present in excessive amounts in the environment. These pollutants, known as "criteria pollutants," are ground-level ozone (O_3), carbon monoxide (CO), sulfur dioxide (SO_2), nitrogen dioxide (NO_2), lead (Pb), and particulate matter (i.e., small particles suspended in the air; two types are included: particulate matter less than 10 micrometers in size [PM_{10}] and particulate matter less than 2.5 micrometers in size [$PM_{2.5}$]).

Areas where concentration levels are below the NAAQS for criteria pollutants are designated as being in "attainment" in accordance with the CAA. Areas where a criteria pollutant level equals or exceeds the NAAQS are designated as being in "nonattainment." Where insufficient data exist to determine an area's attainment status, it is designated as either unclassifiable or in attainment.

General Conformity

The EPA General Conformity Rule applies to federal actions occurring in nonattainment or maintenance areas when the total direct and indirect emissions of nonattainment pollutants (or their precursors) exceed specified thresholds. The emissions thresholds that trigger requirements for a conformity analysis are called *de minimis* levels. *De minimis* levels (in tons per year) vary by pollutant and also depend on the severity of the nonattainment status for the air quality management area in question.

Greenhouse Gases

The primary long-lived GHG directly emitted by human activities are carbon dioxide, methane, nitrous oxide, hydrofluorocarbons, perfluorocarbons, and sulfur hexafluoride. The EPA issued an endangerment finding under Section 202(a) of the CAA recognizing the potential risks to public health or welfare from greenhouse gases (USEPA 2009). The endangerment finding concluded that the current and projected concentrations of the aforementioned primary greenhouse gases in the atmosphere threaten the public health and welfare of current and future generations.

To estimate global warming potential, all greenhouse gases are expressed relative to a reference gas, carbon dioxide, which is assigned a global warming potential equal to 1. All six greenhouse gases are multiplied by their global warming potential and the results are added to determine the total carbon dioxide (CO_2) equivalent (CO_2e) emissions. Industrial facilities and other sources of GHG in the United States emitting 25,000 metric tons or more of CO_2e annually are required by the EPA to report their emissions inventories (USEPA 2017a).

Emissions of greenhouse gases are believed to contribute to global warming and climate change trends observed over the last 50 years. Climate change is discussed in **Section 3.1.2**.

In August 2016, the CEQ issued final guidance on the consideration of greenhouse gas effects on climate change in NEPA documents (CEQ 2016). This guidance recommended that agencies consider both the potential effects of a proposed action on climate change, as indicated by its estimated GHG emissions, and the implications of climate change for the environmental effects of a proposed action. While this guidance was rescinded by EO 13783, *Promoting Energy Independence and Economic Growth* issued on March 28, 2017, the USAF continues to analyze emissions of GHG in NEPA documents prepared for its proposed actions until implementing regulations or other guidance is issued by the Office of the Secretary of Defense and/or Air Force Headquarters.

3.1.1.2. Affected Environment

WFF and Wallops Island are located in the Northeastern Virginia Intrastate air quality control region (defined in 40 CFR § 81.144), which also includes Accomack County. This air quality control region is designated as in attainment/unclassifiable for all criteria pollutants regulated by the NAAQS. Because the region is in attainment, the CAA General Conformity Rule (40 CFR Parts 51 and 93) does not apply to the Proposed Action.

WFF is not a major source for any criteria air pollutants. Because WFF's annual emissions levels do not exceed the Title V of the CAA major source threshold of 100 tons per year of any criteria pollutant, WFF is regulated as a synthetic minor source (i.e., a source with annual emissions capped under the major source threshold) for air pollutants. WFF maintains two synthetic minor air permits, one for Main Base and a combined permit for Mainland and Wallops Island. As of 2014, emissions from WFF did not exceed seven tons per year for any criteria pollutant, with emissions of nitrogen oxides (NO_x) (a precursor of ozone) representing the largest quantity of criteria pollutant emitted (6.1 tons). No emissions of any other criteria pollutants from activities at WFF exceeded 3.5 tons in that year (Navy 2017). The intensity of activities emitting criteria pollutants at WFF has remained similar to 2014 levels [need NASA confirmation of this statement, or updated data].

Greenhouse Gas Emissions

WFF provides annual estimates of facility-wide total GHG emissions in accordance with the EPA's final rule on mandatory reporting of GHG. Between 2009 and 2014, annual GHG emissions at Wallops Mainland/Island varied from 734 to 1,667 tons of CO_2e (VDEQ 2015). These emissions are well below the EPA reporting threshold of 25,000 metric tons for CO_2e. As noted above, the intensity of activities emitting GHG at WFF has remained similar to 2014 levels [need NASA confirmation of this statement, or updated data].

3.1.1.3. Environmental Consequences

No Action Alternative

Under the No Action Alternative, the proposed instrumentation tower would not be built and existing conditions with respect to air quality at Wallops Island would continue. This would have no effect on air quality or GHG at Wallops Island or in the Northeastern Virginia Intrastate air quality control region.

Alternative 1 (Preferred Alternative): Building X-015 Site

Activities associated with the construction of the proposed tower would generate emissions of criteria pollutants and GHG, primarily from diesel-powered construction equipment as well as workers' vehicles and delivery trucks traveling to and from the project site. The quantities of these emissions would vary throughout the project's construction phase but would generally be similar to those typically associated with construction and development projects of similar scale occurring with relative frequency on Wallops Island. Emissions of criteria pollutants from construction-related vehicles and equipment would cease following the completion of construction activities associated with the proposed tower, and conditions with respect to air quality and GHG would return to pre-project conditions in the vicinity of the project site.

In the long term, the implementation of the Proposed Action would not create a new major source of emissions (i.e., a source emitting 100 tons per year or more of criteria pollutants). While operation of the back-up generator included in the Proposed Action would emit criteria pollutants and GHG, it is anticipated that such operation would occur infrequently and would be limited to periodic testing and maintenance, as well as during interruptions of electrical service to the proposed tower and its associated support facilities.

The USAF has prepared a ROAA to analyze emissions of criteria pollutants and GHG that would potentially be emitted during the construction and operation of the proposed tower, and to determine if such emissions would exceed thresholds triggering General Conformity Review (i.e., 100 tons per year of criteria pollutants). A copy of the ROAA is included in **Appendix B** of this EA. The ROAA determined that construction-related emissions occurring over a hypothetical three-year period beginning in 2017 would not exceed 2.3 tons of any criteria pollutants or 405 tons of CO_2e in the first year of construction and would decrease substantially in the second and third years. Once operational, criteria pollutant emissions resulting from the proposed tower would remain below 0.1 ton and would not exceed 3 tons of CO_2e in any year. Such emissions would remain well below the EPA's Prevention of Significant Deterioration thresholds of 250 tons per year for criteria pollutants and reporting threshold of 25,000 metric tons per year for sources of GHG emissions. In addition, emissions from the construction and operation of the proposed tower would constitute a small portion of annual criteria pollutant and GHG emissions occurring at WFF as described in **Section 3.1.1.2**.

It is noted that the model used by the USAF to develop the ROAA does not allow the input of propane as a fuel source; thus, diesel fuel was substituted as the nearest equivalent to calculate long-term operational emissions from the periodic use of the back-up generator that is included in the Proposed Action. As the higher emissions factor of diesel fuel is reflected in the ROAA calculations, it is likely that actual emissions from the operation of the propane-fueled back-up generator would be substantially less than those calculated for a diesel fuel source used in the ROAA model.

To the greatest extent possible, the USAF would implement measures to minimize emissions of criteria pollutants and GHG during construction activities. Such measures could include prohibiting the idling of construction vehicles and equipment for extended periods, and requiring contractors to maintain exhaust systems on construction vehicles and equipment in optimal condition.

For these reasons, Alternative 1 would have minor short-term impacts on air quality and GHG, and negligible long-term impacts. Overall, impacts on air quality and GHG resulting from the implementation of Alternative 1 would not be significant.

Alternative 2: Building X-079 Site

Short-term and long-term impacts on air quality resulting from the implementation of Alternative 2 would be similar to those described for the Preferred Alternative.

3.1.2 CLIMATE CHANGE

3.1.2.1. Regulatory Context

Climate change refers to significant changes in measures of climate, such as temperature, precipitation, or wind patterns, that occur over periods of several decades or longer. The overall effect of climate change has been an increase in the average global temperature, which has risen by 1.5° Fahrenheit (F) over the past century, and is projected to rise another 0.5° to 8.6° F over the next 100 years. Global warming and climate change influence the severity of storms and contribute to rising sea levels in coastal areas (USEPA 2017b).

In August 2016, the CEQ issued final guidance on the consideration of greenhouse gas effects on climate change in NEPA documents (CEQ 2016). This guidance was subsequently rescinded by EO 13783, *Promoting Energy Independence and Economic Growth* issued on March 28, 2017. As noted above, the USAF continues to analyze emissions of GHG and climate change in NEPA documents prepared for its proposed actions until implementing regulations or other guidance is issued by the Office of the Secretary of Defense and/or Air Force Headquarters.

3.1.2.2. Affected Environment

Sea level is an indicator of the physical and climatic stability of the global environment. A number of factors affect sea level, including changes in sea temperature, salinity, and total water volume and mass. Sea level rises with warming sea temperatures and falls with cooling. Coastal environments, such as those found at Wallops Island, are highly dynamic and particularly vulnerable to climate change. Rising sea levels may cause beach erosion, land submersion, wetland loss, coastal flooding, saltwater intrusion into estuaries and aquifers, and greater damages from hurricanes due to higher storm surge (NASA 2016a).

The portion of the Atlantic coast between Boston, Massachusetts and Cape Hatteras, North Carolina in which Wallops Island is located has been identified as a “hotspot” with respect to rising sea levels, as the rate of sea level rise is increasing three to four times faster than in other locations around the world. Models developed by NASA’s Goddard Institute for Space Studies (GISS) project sea level at Wallops Island to rise by two to five inches through the 2020s, seven to 11 inches through the 2050s, and 12 to 21 inches through the 2080s. Similarly, the U.S. Army Corps of Engineers (USACE) has projected sea level at Wallops Island to rise by 1.91 feet over the next 50 years. While little change is expected in average annual precipitation, heavy rainfall events may be more intense, leading to increased risks of flooding (NASA 2016a).

The sandy portion of Wallops Island has an elevation of about seven feet AMSL. The highest elevation on Wallops Island is approximately 15 feet AMSL, although most of the island is less than 10 feet AMSL (NASA 2016a). Elevations on the Alternative 1 site vary from five to seven feet AMSL (USAF 2017); elevations on the Alternative 2 site are not known but are likely similar to those present on the Alternative 1 site.

The location of Wallops Island along the Atlantic coast increases its exposure to strong storms, such as hurricanes and nor'easters, and high winds and flooding associated with such storms. The combination of rising sea level and severe storms, magnified by the effects of climate change, have the potential to produce detrimental impacts on WFF and its infrastructure, natural resources, and other assets. Climate change-related design considerations for new construction projects on Wallops Island include a requirement to build critical facility support systems at elevations that would minimize or eliminate effects potentially resulting from inundation by floodwater (NASA 2016a).

3.1.2.3. Environmental Consequences

No Action Alternative

Under the No Action Alternative, the proposed tower would not be built and existing conditions on Wallops Island would continue. This would have no impact on or from global climate change.

Alternative 1 (Preferred Alternative): Building X-015 Site

In the long term, climate change and associated sea level rise could contribute to increased frequency of flooding on Wallops Island and affect infrastructure and activities on the island, including the proposed tower, accordingly. However, as described in **Section 2.2.1**., ground-level support equipment associated with the proposed tower would be installed at an elevation of approximately 11 feet AMSL, thereby minimizing or eliminating its potential for inundation by floodwaters. It is unlikely that flooding would affect the tower itself, as it would consist of a lattice structure that would allow any floodwaters to pass through it. Similarly, occasional flooding would not affect the guy wire anchor points, as they would be securely mounted in concrete foundations. Such impacts would be negligible.

Increases in sea level projected by GISS and the USACE are anticipated to remain below the elevation of the Alternative 1 site during the service life of the proposed tower (approximately 20 years). Thus, adverse impacts on the proposed tower resulting from permanent inundation of the site from rising sea level associated with global climate change are not anticipated to occur.

As described in **Section 3.1.1.3**, emissions of GHG resulting from the implementation of Alternative 1 would constitute and exceedingly small fraction of global emissions of such substances. Such emissions would have only marginal potential to influence global climate trends and corresponding effects such as rising sea level and thus, would have negligible impacts on global climate change.

Alternative 2: Building X-079 Site

Impacts on and from global climate change and sea level rise resulting from Alternative 2 would be similar to those described for the Preferred Alternative.

3.1.3 GEOLOGY AND SOILS

3.1.3.1. Affected Environment

Located within the Atlantic Coastal Plain physiographic province, WFF is underlain by approximately 7,000 feet of sediment. The sediment lies atop crystalline basement rock. The sedimentary section consists of a thick sequence of terrestrial, continental deposits overlain by a much thinner sequence of marine sediments. These sediments are generally unconsolidated and consist of clay, silt, sand, and gravel. The two uppermost stratigraphic deposits at WFF are the Yorktown Formation and the Columbia Group; the Columbia Group is not subdivided into formations. The Yorktown Formation, the uppermost unit in the Chesapeake Group, occurs at depths of 60 to 140 feet in Accomack County and generally consists of fine to coarse, glauconite quartz sand, which is greenish gray, clayey, silty, and partly shelly.

The Coastal Plain soils of the Eastern Shore are generally very level. Dominant soils in the region are high in sand content, resulting in a highly leached condition, an acidic pH, and a low natural fertility. A number of soil types on the Eastern Shore are classified as prime and unique farmland by the U.S. Department of Agriculture Natural Resources Conservation Service. Such soils are those that are considered favorable for the production of food, feed, forage, fiber, and oilseed crops. Soils classified as prime and unique farmland occur within the boundaries of WFF (USDA 1994).

The sites of the action alternatives are underlain primarily by Camocca fine sand and Chincoteague silt loam. With 0 to 2 percent slopes, these soils are nearly level, very deep, and frequently flooded. Surficial materials consist of topsoil and possibly fill, while subsurface soils include clean sand, clayey sand, silty sand, clay, silt, and combinations thereof (USTS 2015). None of the soils within the footprints of the action alternatives are designated as prime farmland (USDA 2016).

3.1.3.2. Environmental Consequences

No Action Alternative

Under the No Action Alternative, the proposed instrumentation tower would not be built and existing conditions at the alternative sites would remain unchanged. As such, no impacts on geological or soil resources would occur.

Alternative 1 (Preferred Alternative): Building X-015 Site

Construction of the proposed tower would require driving foundation piles at least 75 feet below grade to provide support for the base of the structure. Guy wires could be anchored with concrete blocks measuring 14 feet by 14 feet by 5 feet or with helical piles, which consist of one to three bearing plates attached to a central shaft and installed by rotation, similar to a screw (USTS 2015). Assuming the use of six anchor points (two on each of the tower's three radii), construction of the anchor points would displace a minimum of 218 cubic yards of soils.

Installing foundation piles to support the base of the proposed tower and helical piles (if used to support the guy wire anchor points) would require penetrating surface and subsurface materials and possibly sediments of the Yorktown Group underlying the site. However, due to the depth of bedrock (i.e., at a depth of approximately 7,000 feet), such piles would have no potential to penetrate bedrock underlying the stratigraphic deposits. Installation of the piles would occur during the project's construction phase and would be similar to foundation piles used to support other structures and facilities at WFF. In the context of other structures and facilities at WFF, the number of piles needed to support the proposed tower would be relatively small (USTS 2015). No particularly unique or pristine geologic materials or features would be altered or destroyed as a result of the pile installation. In the long term, the operation of the proposed tower would not include activities involving the penetration of underlying geology. Therefore, Alternative 1 would have negligible short-term impacts and no long-term impacts on geology at WFF.

Soil excavation and vegetation removal during the construction of the proposed tower would expose soils and make them susceptible to erosion from wind and water. The nearly level condition of the project site and adherence to erosion and sediment controls during construction would ensure that any such erosion would remain minimal.

Because construction of the Proposed Action would disturb more than 10,000 square feet of land, the construction contractor would be required to prepare an erosion and sediment control plan in accordance with the Virginia Erosion and Sediment Control Regulations (4 VAC 50-30). Adherence to measures specified in the erosion and sediment control plan, such as establishing and maintaining an entrance to the project site for construction vehicles and equipment, would minimize the erosion of exposed soils and the sedimentation of receiving water bodies.

If, as the design of the project is finalized, it is determined that one acre or more of land would be disturbed during the construction of the proposed tower, the construction contractor also would be required to obtain coverage under the General Permit for Discharges of Stormwater from Construction

Activities (Construction General Permit) in accordance with 9 VAC 25-880. Acquisition of coverage under the permit would require the preparation of an SWPPP. The WFF SEED Team would review and approve applicable construction and development plans involving land disturbance and would conduct periodic inspections and any necessary enforcement in accordance with the terms of the erosion and sediment control and/or stormwater management plans. Compliance with the requirements set forth in the erosion and sediment control plan, the General Permit, the SWPPP, and oversight from the WFF SEED Team would minimize impacts resulting from construction-related soil erosion and stormwater runoff. As such, no adverse effects would be anticipated.

Following the completion of construction activities, any disturbed areas of the project site not built on or otherwise developed would be returned to a pre-construction condition. As necessary, clean fill soils would be imported to the site if existing soils are determined to be inadequate to support the construction of the proposed tower. Soils remaining exposed following the completion of the proposed tower would be re-vegetated with native grasses.

Construction equipment would use petroleum-based fuels and lubricants. Inadvertent spills or leaks of these substances would have the potential to adversely affect soils underlying the Alternative 1 site. NASA would require the USAF's construction contractor to implement site-specific BMPs for vehicle and equipment fueling and maintenance, as well as spill prevention and control measures as specified in the WFF ICP (NASA 2015a). Adherence to such BMPs would ensure that the potential for inadvertent spills of petroleum products during construction activities would be eliminated or remain minimal.

The proposed relocation of the antenna dish to Wallops Mainland would not involve soil or ground disturbance, as the dish would be installed on existing infrastructure. Thus, this component of the proposed action would have no short-term or long-term impacts on geological resources.

For these reasons, Alternative 1 would have minor short-term impacts and no long-term impacts on soils.

Alternative 2: Building X-079 Site

Impacts on geology and soils resulting from Alternative 2 would be similar to those described for Alternative 1.

3.1.4 WATER RESOURCES

3.1.4.1. Regulatory Context

Section 404 of the Clean Water Act established a permit program to regulate the discharge of fill material into waters of the United States. Managed jointly by the USACE and the EPA, the primary intent of the program is to minimize adverse effects on the aquatic environment. USACE is responsible for day-to-day administration and permit review, while the EPA provides program oversight. Executive Order (EO) 11990, *Protection of Wetlands*, also requires analyses of potential impacts to wetlands related to proposed federal actions.

Floodplains are lowland areas located adjacent to bodies of water in which the ordinary high water level fluctuates on an annual basis. Floodplains are frequently discussed in terms of the 100-year flood and 500-year flood. The 100-year flood, or base flood, is a flood having a 1 percent chance of occurring in any given year. The 500-year floodplain designates the area having a 0.2 percent chance of being inundated in any given year.

EO 11988, *Floodplain Management*, requires federal agencies to avoid, to the extent possible, the short- and long-term adverse impacts associated with the occupancy and modification of floodplains and to avoid direct and indirect support of floodplain development, wherever there is a practicable alternative. EO 13690, *Establishing a Federal Flood Risk Management Standard and a Process for Further Soliciting and Considering Stakeholder Input* amends EO 11988 and provides federal agencies with flexibility to select one of the following three approaches for establishing the flood elevation and hazard area during the siting, design, and construction of proposed facilities (FEMA 2017a):

- Climate-informed Science Approach: An agency can utilize the best-available, actionable data and methods that integrate current and future flooding predictions based on science.
- Freeboard Value Approach: An agency can add two or three feet of elevation, depending on the criticality of the action, to the 1-percent annual base (i.e., 100-year) flood elevation.
- 500-year Elevation Approach: An agency can use the 0.2-percent chance annual (i.e., 500-year) flood elevation.

Under EO 13690, an agency may be exempt from incorporating these approaches if the proposed action is in the interest of national security or is a mission-critical requirement related to a national security interest (FEMA 2017).

The USAF is required to prepare a Finding of No Practicable Alternative (FONPA) in accordance with 32 CFR §989.14(g) when a proposed action would result in impacts on wetlands or floodplains.

3.1.4.2. Affected Environment

More than 2,500 acres of estuarine emergent wetlands occur on Wallops Island. Non-tidal wetlands are located in depressional areas in the island's interior and extensive tidal marsh wetlands occur on its western side along Cat Creek. No tidal wetlands have been identified along the eastern (Atlantic Ocean) side of Wallops Island (NASA 2016a).

The invasive *Phragmites* covers approximately 687 acres throughout Wallops Island. WFF has implemented the *Wallops Island Phragmites Control Plan* (NASA 2014a) to prevent the introduction of the plant's seeds and rhizomes to areas of WFF where it is not currently present. The plan specifies BMPs and other measures that are to be adhered to by WFF employees and contractors as applicable.

Delineations of wetlands conducted on the alternative sites in 2015 identified tidal and predominantly non-tidal wetlands within the boundaries of both sites (NASA 2015b). The USACE issued a preliminary Jurisdictional Determination for the delineated wetlands on July 24, 2015 (USACE 2015). Tidal and non-tidal wetlands on and in the vicinity of the alternative sites are shown on **Figure 3-1** and **Figure 3-2**.

Flood Insurance Rate Maps produced by the Federal Emergency Management Agency (FEMA) indicate that the majority of Wallops Island is located in the 100-year floodplain. The entirety of each alternative site is located in a portion of the 100-year floodplain designated Zone AE, Special Flood Hazard Areas Subject to Inundation by the 1% Annual Chance Flood, Base Flood Elevations Determined (FEMA 2017b).

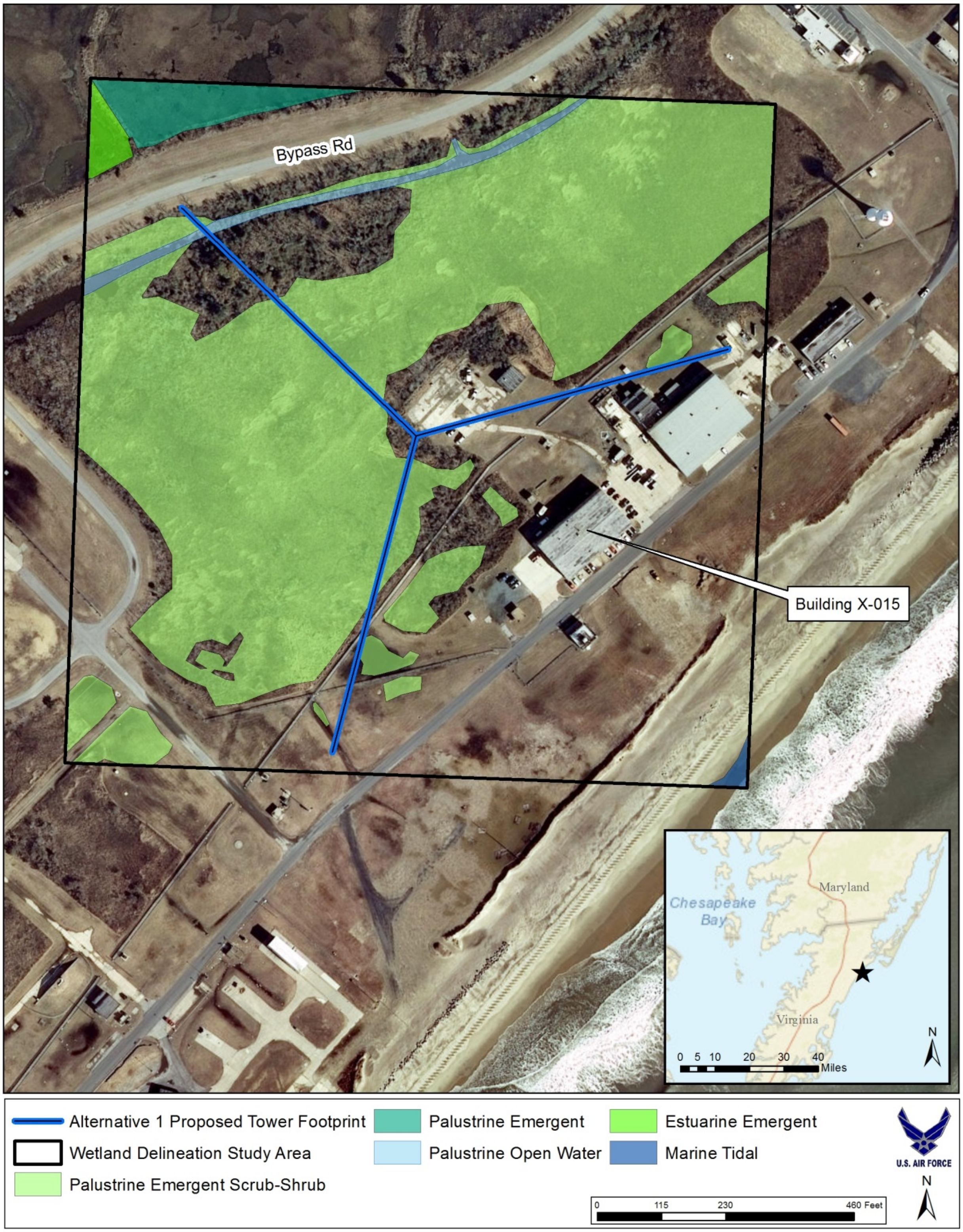
Access to Wallops Island is controlled and only authorized personnel are allowed on the facility. Therefore, public education regarding flood hazards (e.g., marking flood heights on buildings) is not applicable. However, flood elevations are marked on some Wallops Island facilities to inform NASA personnel and visiting personnel of other agencies. Other flood control measures that are implemented at WFF include locating water-sensitive equipment, supplies, and other associated materials above the flood level (i.e., approximately 11 feet AMSL), and securing or moving sensitive equipment outside the floodplain when substantial storms are imminent.

3.1.4.3. Environmental Consequences

No Action Alternative

Under the No Action Alternative, the proposed instrumentation tower would not be built and existing conditions at WFF would continue. As such, no impacts on water resources would occur.

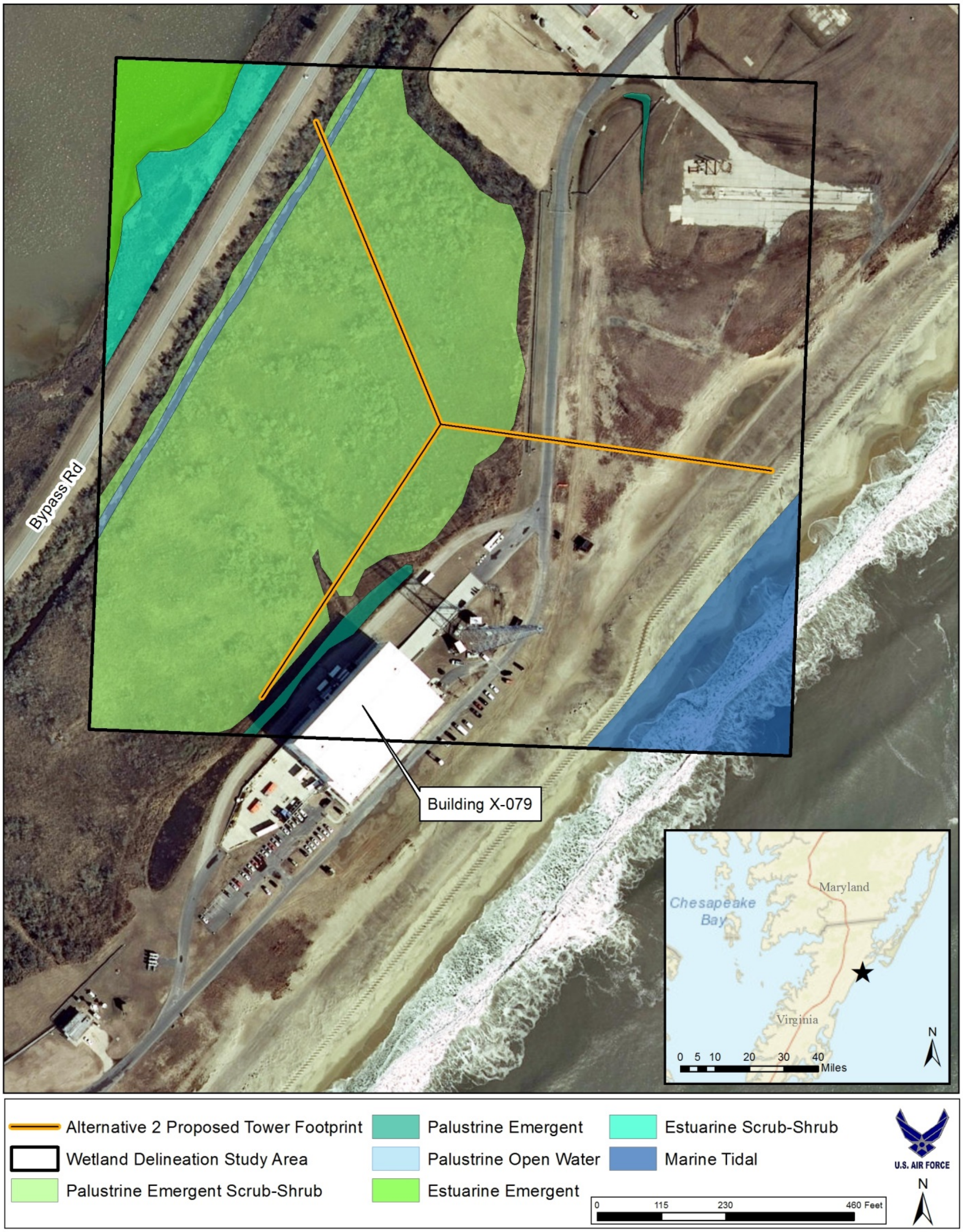
1727 **Figure 3-1: Wetlands Occurring in the Vicinity of the Alternative 1 (Preferred Alternative) Site**



Sources: Spatial Data courtesy of NASA (2016); Esri (2016) Disclaimer: No warranty is made by AECOM as to the accuracy, reliability, or completeness of these data for individual use or aggregate use with other data. This map is a "living document", in that it is intended to change as new data become available and is incorporated into the GIS database; VHB (2015); USACE (2015).

1728

Figure 3-2: Wetlands Occurring in the Vicinity of the Alternative 2 Site



Sources: Spatial Data courtesy of NASA (2016); Esri (2016) Disclaimer: No warranty is made by AECOM as to the accuracy, reliability, or completeness of these data for individual use or aggregate use with other data. This map is a "living document", in that it is intended to change as new data become available and is incorporated into the GIS database; VHB (2015); USACE (2015).

Alternative 1 (Preferred Alternative): Building X-015 Site

The proposed tower has been designed and sited to avoid temporary and permanent impacts on wetlands to the greatest extent possible. As shown on **Figure 3-1**, the tower base and guy wire termini are sited in areas where wetlands are not present. Similarly, as shown on Sheet C-1 of the preliminary engineering drawings for the proposed tower (included in **Appendix D**), the prefabricated buildings, propane tank, and other support structures and equipment associated with the proposed tower would be sited on previously disturbed areas adjacent to the tower base where wetlands are not present.

Two of the three intermediate guy wire anchor points have also been sited outside of wetland areas, as shown on Sheet C-1 of the preliminary engineering drawings for the proposed tower. However, the construction and permanent presence of the southernmost intermediate anchor point could potentially impact an adjacent area of wetlands. To the extent possible, disturbance of the wetland during the construction of this anchor point would be avoided. The contractor would use BMP such as silt fences or similar measures to minimize runoff of sediment and pollutants to the wetland. It is estimated that if construction-related disturbance of the wetland were to occur, it would not exceed more than 1,300 square feet, or approximately 0.03 acre.

The extent of impacts on wetlands would be determined during the formal engineering design of the proposed tower. Construction-related impacts on wetlands, such as that noted above, could result from excavation, pile driving and drilling, and leveling and grading. Such impacts could include disturbance or removal of vegetation, soil compaction, and/or alteration of hydrologic flow patterns. In the event that disturbance of wetlands is required, the USAF would obtain a Joint Permit from the USACE, VDEQ, and Accomack County Wetland Board to address impacts and mitigation requirements, as applicable. Adherence to avoidance, compensation, and/or mitigation measures specified in applicable federal and/or state permit(s) during and following the project's construction phase would ensure that impacts on wetlands remain minimal. Any impacts on wetlands on the site of Alternative 1, if they were to occur, would be minimal in the context of wetlands on and in the vicinity of WFF.

During construction activities, the contractor would implement and adhere to BMPs specified in WFF's *Wallops Island Phragmites Control Plan* (NASA 2014a) to prevent the introduction of seeds and rhizomes of *Phragmites* to areas of WFF where the plant is not present. Such measures would include the inspection and cleaning of tracked vehicles and equipment to remove any rhizomes and seeds prior to arrival on the project site, and conducting earth-disturbing activities where the plant is present on the site near the end of the project, and/or cleaning the equipment prior to use on any other portion of the site where *Phragmites* is not present. Construction vehicles and equipment would be cleaned using hand tools such as brushes, brooms, rakes, or shovels on all track and bucket or blade components to adequately remove all visible dirt and plant debris. If water should be used during the cleaning of vehicles and equipment, the runoff water or slurry would be contained so as to restrict introduction of *Phragmites* rhizomes and seeds into the project site as well as to prevent off-site introduction during debris disposal. Construction vehicle and equipment rinse-out areas would be located in upland areas, and runoff would be contained to minimize or eliminate impacts. Adherence to these measures would minimize short-term and long-term impacts from the introduction of an invasive species on wetlands on and adjacent to the project site as well as elsewhere on or in the vicinity of WFF.

The proposed relocation of the telemetry dish would have no potential to impact wetlands, as it would be installed on existing infrastructure located elsewhere at WFF. Thus, this component of Alternative 1 would have no short-term or long-term impacts on wetlands.

The proposed tower and its associated guy wires and anchor points would be built entirely within the 100-year floodplain on Wallops Island. As currently designed (see preliminary engineering drawings for the proposed tower in **Appendix D**), each of the six guy wire anchor points (assuming 14 foot by 14 foot concrete slabs) would have an area of 196 square feet, for a total cumulative area of 1,176 square feet. While these slabs would prevent the percolation of flood waters into underlying soils, this additional quantity of impermeable surface on the project site would be minimal in the context of permeable area that would remain on and adjacent to the site.

As discussed in **Section 2.1.1**, the only practicable alternative is to build and operate the proposed tower at a site on Wallops Island located in the 100-year floodplain. The USAF and NASA would ensure that the Proposed Action complies with EO 11988, *Floodplain Management*, and NASA Regulations on Floodplain and Wetland Management at 14 CFR §1216.2 to the maximum extent possible. The Proposed Action incorporates the recommendations of EO 13690 by considering the best-available, actionable data and methods that integrate current and future flooding predictions based on science; as noted in **Section 3.1.2**, neither of the alternative sites are likely to experience permanent inundation from rising sea level during the 20-year service life of the proposed tower. Because the Proposed Action would involve federally funded and authorized construction in the 100-year floodplain, this EA also serves as the USAF's and NASA's means for facilitating public review as required by EO 11988 and 32 CFR §989.24.

The approximate footprint of the prefabricated structures and propane tank associated with the proposed tower would total approximately 229 square feet. However, as described in **Section 2.2.1**, supporting equipment associated with the proposed tower would be elevated to at least 11 feet AMSL to mitigate the potential for flooding during storm events. The functionality of the floodplain on Wallops Island, provided both by the wetlands on the island and the area of the island itself, would not be substantially reduced because the footprint of the proposed tower and its anchor points would be relatively small and thus, would displace small quantities of water. The installation of the telemetry dish would have no impact on floodplains, as it would be installed on existing infrastructure. Therefore, impacts on floodplains resulting from the implementation of Alternative 1 would be negligible.

The USAF has prepared a Draft FONPA in accordance with 32 CFR §989.14(g) to address impacts on wetlands and floodplains potentially resulting from the implementation of the Proposed Action.

Alternative 2: Building X-079 Site

Alternative 2 would disturb a larger area of wetlands than the Preferred Alternative. The installation of the tower base, prefabricated structures and propane tank, a gravel access road to the tower base, and at least three guy wire anchor points under Alternative 2 would likely occur within jurisdictional wetlands, as shown on **Figure 3-2**. The types of disturbance to wetlands would be similar to that described for Alternative 1. It is estimated that the construction of these components, as well as temporary gravel-surfaced roads to provide access for construction vehicles, equipment, and personnel, would collectively disturb a minimum of approximately 0.3 acre of wetlands. Of this disturbance, permanent impacts on wetlands resulting from the presence of three anchor points, the prefabricated structures, the propane tank, and a permanent access road to the tower base would total an estimated of 0.06 acre, at minimum.

Disturbance of wetlands resulting from Alternative 2 would occur in accordance with applicable federal and/or state permits that the USAF would obtain for the project. Adherence to the requirements of applicable permit(s) would minimize temporary and permanent impacts on wetlands. In the context of wetlands on and in the vicinity of Wallops Island, wetlands impacts would remain minimal. As described for Alternative 1, the contractor would implement and adhere to BMP specified in WFF's *Wallops Island Phragmites Control Plan* (NASA 2014a) to prevent the introduction of seeds and rhizomes of *Phragmites* to areas of WFF where the plant is not present.

For these reasons, impacts on wetlands resulting from Alternative 2 would remain negligible and not significant. Impacts on floodplains at Wallops Island resulting from Alternative 2 would be similar to those described for the Preferred Alternative.

3.1.5 COASTAL ZONE MANAGEMENT

3.1.5.1. Regulatory Context

Section 307 of the CZMA (16 U.S.C. §1456) requires that federal activities affecting a state's coastal uses or resources be conducted in a manner consistent with the enforceable policies of that state's approved coastal management plan. The VDEQ administers Virginia CZM Program. Although federal lands (such as WFF) are excluded from Virginia's coastal zone, activities occurring on federal lands that have reasonably foreseeable effects on coastal zone resources must be consistent with the CZM Program.

3.1.5.2. Affected Environment

Federal lands, the use of which is by law subject solely to the discretion of or which is held in trust by the federal government, its officers or agents, are excluded from Virginia's coastal management area. However, activities on federal lands with any reasonably foreseeable coastal effects must be consistent with the Virginia CZM Program.

As a federal property, WFF is statutorily excluded from the CZMA's definition of the Commonwealth of Virginia's "coastal zone" (16 U.S.C §1453 [1]). However, NASA and the USAF have determined that the Proposed Action has the potential to have reasonably foreseeable effects on Virginia's coastal zone resources.

3.1.5.3. Environmental Consequences

No Action Alternative

Under the No Action Alternative, the proposed instrumentation tower would not be built and existing conditions at Wallops Island would continue. This alternative would have no effect on Virginia's coastal zone resources.

Alternative 1 (Preferred Alternative): Building X-015 Site

The USAF and NASA anticipate that the Proposed Action would be consistent to the maximum extent practicable with the nine enforceable policies of Virginia's CZM Program. A Federal Consistency Determination analyzing the applicability of the enforceable policies to the Proposed Action and the Proposed Action's consistency with those policies will be prepared by the USAF and NASA and submitted to the VDEQ for review. VDEQ's concurrence with the Federal Consistency Determination is anticipated. A copy of the Federal Consistency Determination and relevant documentation will be included in **Appendix A** when available [preparation of the Federal Consistency Determination is pending].

Alternative 2: Building X-079 Site

Based on the similarity and proximity of the Alternative 2 site to that of Alternative 1, it is anticipated that implementation of Alternative 2 would be consistent to the maximum extent practicable with the nine enforceable policies of Virginia's CZM Program. VDEQ's concurrence is pending.

3.1.6 HAZARDOUS MATERIALS AND WASTE

Hazardous substances are defined as any solid, liquid, contained gaseous, or semi-solid waste, or any combination of wastes that pose a potential hazard to human health and the environment. Improper management and disposal of hazardous substances can contribute to the pollution of groundwater or other drinking water supplies, and the contamination of surface water and soil.

3.1.6.1. Regulatory Context

The primary federal legislation regulating the management and disposal of hazardous substances and wastes is the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA; also known as Superfund); the Resource Conservation and Recovery Act (RCRA); and the Toxic Substance Control Act (TSCA). Regulations pertaining to CERCLA are codified at 42 U.S.C. §§9601 e*t seq*. and cover hazardous waste site clean-up management. RCRA regulations are codified at 40 CFR §§239-282 and address the accumulation, handling, storage, and shipment of hazardous and non-hazardous wastes. TSCA regulations are codified at 15 USC §§2601 *et seq*. and set forth requirements for reporting, record-keeping, and testing requirements, as well as restrictions relating to chemical substances and/or mixtures.

3.1.6.2. Affected Environment

Hazardous materials used in operations and activities conducted at WFF include liquid and solid rocket propellants, cutting fluids, solvents, flammables, laboratory reagents, and paint thinners. Consequently, the use of such materials generates corresponding quantities of hazardous waste. WFF is classified as a large quantity generator of hazardous waste and has been issued separate generator identification numbers by the EPA for Main Base and Mainland/Wallops Island. In addition, WFF maintains a hazardous waste transporter license and a RCRA Permit for Open Burning Treatment of Hazardous Waste for the treatment of waste solid rocket propellant. Hazardous materials and hazardous wastes are used, handled, stored, and disposed of at WFF in accordance with the WFF *Hazardous Waste Management Plan* and all other applicable NASA, federal, and state regulations (NASA 2016a).

Pesticides are periodically applied on the alternative sites to manage insect populations, particularly mosquitoes. These substances are applied by authorized NASA personnel or licensed private contractors in accordance with all applicable label directions and regulatory requirements, are mixed off-site prior to application, and are stored off-site when not in use. No other hazardous substances are used, stored, handled, or disposed of on the alternative sites.

As discussed in **Section 2.3.2**, a Draft Final EBS (USAF 2017) was prepared by the USAF for the Alternative 1 site in April 2017. A copy of the Draft Final EBS is included in **Appendix D**. The Draft Final EBS identified multiple former remediation sites or other areas of concern within the boundaries of the Alternative 1 site, and presented the following determinations:

- Site 5 is located approximately 185 feet east of the planned excavation footprint for the proposed tower and encompasses approximately two acres where operations associated with a former paint booth (Building X-30, now demolished) resulted in soils impacted by total petroleum hydrocarbons (TPH), polychlorinated biphenyls (PCBs), pesticides, volatile organic compounds (VOCs), semi-volatile organic compounds (SVOCs), polycyclic aromatic hydrocarbons (PAHs), and metal. Remediation of the site was completed and a letter of NFA was issued by the EPA and VDEQ).
- Site 6 is located approximately 400 feet southeast of the planned excavation footprint of the tower base. The site underwent remediation for petroleum-impacted soils associated with former Building X-005 (now demolished) and was granted closure by VDEQ in 2000. Additional remediation was conducted for the remainder of the site and was conducted, and the site was granted closure by VDEQ in 2008.
- Site 12 encompasses approximately 3.4 acres and underlies Building X-015 and the area where the base of the proposed tower would be located. Groundwater underlying Site 12 was found to be impacted with TPH-Diesel Range Organics associated with a power generating plant (Building X-020) formerly located on the property. Site 12 was granted closure under the VDEQ Spills Program in 2008.

  Two additional areas of concern are also located within Site 12:

  - Backfill containing munitions and explosives constituents (MEC) was used in an approximately 0.15-acre area of the former power generating plant approximately 165 feet southeast of where the base of the proposed tower would be located. A surface sweep of the area was completed and anomalies were excavated to two feet below ground surface (bgs). No soil contaminant testing specific to munitions has reportedly been conducted, and a dig restriction was recommended for any activities that would disturb the soil of the backfill area and immediately surrounding areas.
  - An approximately 0.15-acre area underlain by soils contaminated with PAH associated with four creosote-coated wooden piling that were abandoned in place are located approximately 200 feet northeast of where the base of the proposed tower would be located. These soils were addressed during the aforementioned remedial actions for Site 5 and Site 12 and the PAH contamination was determined not to be a CERCLA release.

The Draft Final EBS also identified the potential for asbestos containing materials (ACM), lead based paint (LBP), and PCBs to be present in buildings adjacent to the Alternative 1 site, based on their estimated construction dates. These buildings, and areas described in the bulleted list above, are illustrated in Figure 2 of the Draft Final EBS included in **Appendix D** of this EA. No active or closed above ground storage tanks (AST), underground storage tanks (UST), or oil/water separators (OWS) are known to be present on the Alternative 1 site.

Overall, the Draft Final EBS categorized the entirety of the Alternative 1 site as Category 4, *an area or real property where release, disposal, or migration, or some combination thereof, of hazardous substances has occurred, and all remedial actions necessary to protect human health and the environment have been taken*. This categorization recognizes that the construction and operation of the proposed tower by the USAF would be contingent on the issuance of a Land Use Authorization by NASA for that purpose, rather than a deed transfer. Areas within the subject property that have known or potential contamination that would not be impacted by the construction and/or operation of the proposed tower (i.e., areas containing the creosote-covered pilings and soils formerly contaminated with MEC) were assigned a lower category than they may have been if a deed transfer were to occur.

Based on the findings of the Draft Final EBS, no additional investigations or actions are recommended for the Alternative 1 site. However, additional investigation may be warranted for the areas within Site 12 containing the abandoned wood pilings and/or backfill soils formerly contaminated with MEC, if it is determined during continued planning and design of the proposed tower that construction of the tower would disturb either or both of those areas.

No current or historical conditions involving the use, storage, disposal, or release of hazardous materials or hazardous waste are known to occur at the Alternative 2 site.

3.1.6.3. Environmental Consequences

No Action Alternative

Under the No Action Alternative, there would be no change in conditions pertaining to hazardous materials or wastes at Wallops Island and existing conditions would continue. There would be no impacts on or from hazardous materials and wastes as a result of the No Action Alternative.

Alternative 1 (Preferred Alternative): Building X-015 Site

As currently designed, the construction of the proposed tower would avoid areas of the Alternative 1 site underlain by the creosote-coated piles and former MEC-contaminated soils. Under the terms of the Land Use Authorization that would be issued by NASA to the USAF, NASA would remain as the landowner of the Alternative 1 site, and the USAF would sign an agreement stating that it understands the liabilities, if any, posed by construction in a former restoration site. If it is determined during the continued planning and design of the proposed tower that disturbance of either or both of those areas is necessary, the USAF would coordinate with NASA to address contaminants potentially occurring in those areas and ensure the health and safety of workers on the site.

The presence of former remediation Sites 5, 6, and 12 underlying the Alternative 1 site would have no impacts on the construction and operation of the proposed tower, as all remedial activities have been completed and closure has been granted by applicable regulatory agencies.

The construction of the proposed tower would not require the modification or demolition of buildings or other structures and facilities where hazardous substances such as ACM, LBP, and PCB are known or suspected to be present, or where hazardous materials and/or hazardous wastes are used or stored. Construction activities associated with Alternative 1 would likely involve the use of hazardous materials (e.g., lubricants, solvents, and cleaners) and would generate corresponding quantities of hazardous waste (e.g., empty cartons or containers, oily rags). In addition, the construction of the proposed tower and the installation of the telemetry dish would involve the use of vehicles and equipment using petroleum-based fuels and lubricants.

During construction activities, hazardous substances would be used in accordance with their label directions and requirements set forth in applicable safety data sheets (SDS). Such materials would only be available to personnel authorized to use them and would be secured at the project site in a hazardous materials locker or similar storage cabinet when not in use. As discussed in **Section 3.1.3.2**, the USAF's construction contractor would be required to implement site-specific BMPs for vehicle and equipment fueling and maintenance, as well as spill prevention and control measures as specified in the WFF ICP (NASA 2015a). In addition, all fuel and oil storage during the operations would comply with VDEQ regulations. If greater than 55 gallons of fuel would be stored on the project site in portable or temporary ASTs, the following conditions would apply:

- WFF Facilities Management Division would be notified of the AST
- A spill prevention plan would be prepared by the construction contractor
- The AST would be registered with DEQ if on-site for more than 120 days.

Inspections of all fuel storage containers would be conducted in accordance with applicable regulations. All fuel storage containers and fuel handling activities would also comply with the requirements of the WFF ICP. Any spills would be reported immediately to the WFF Fire Department at 757-824-1333.

The use of hazardous materials during ongoing operation and maintenance of the proposed tower would include 500 gallons of propane stored in a tank near the tower base to operate the emergency backup generator during power outages, as well as small quantities of hazardous substances (e.g., cleaners, lubricants, and solvents) needed to perform maintenance activities. Small quantities of hazardous materials used for ongoing maintenance activities would be present on the site only when such activities are being conducted and would either be stored in appropriate locations at WFF or taken off-site by maintenance personnel when not in use. All such materials would be used and disposed of in accordance with the WFF *Hazardous Waste Management Plan*, applicable label instructions, and SDS requirements.

Pesticides would continue to be applied on the site to manage insect populations, and herbicides would likely be applied to manage vegetation around the tower base, ground-level support equipment, and under the guy wires. All such substances would be applied by authorized NASA personnel or licensed contractors in accordance with applicable label directions and regulatory requirements, would be mixed off-site prior to application, and would be stored off-site when not in use.

Hazardous wastes generated during the project's construction and operational phases would be managed and disposed of in accordance with the WFF *Hazardous Waste Management Plan* and all other applicable NASA, federal, and state regulations.

For these reasons, short-term and long-term impacts from hazardous materials and wastes would be negligible and less than significant.

Alternative 2: Building X-079 Site

Impacts on and from hazardous materials and wastes resulting from Alternative 2 would be similar to those described for Alternative 1. If this site is selected by the USAF for construction and operation of the proposed tower, an EBS would be prepared for the site to characterize the historic and current presence of hazardous materials and/or hazardous waste.

3.2 BIOLOGICAL ENVIRONMENT

This section describes biological resources occurring on or in the vicinity of the action alternative sites and Wallops Island. Biological resources of concern, as identified in **Table 3-1**, include avifauna (common species of birds) as well as special status species. Scientific names of all birds discussed in the following analysis are presented in **Tables C-1** and **C-2** included in **Appendix C**.

Avifauna is discussed in **Section 3.2.1**. Special status species, including those protected under the ESA as well as other federal and state laws, and Birds of Conservation Concern (BCC), are addressed in **Section 3.2.2**.

3.2.1 AVIFAUNA (COMMON BIRD SPECIES)

3.2.1.1. Regulatory Context

The Migratory Bird Treaty Act of 1918 (MBTA) (16 U.S.C. §§70-712) makes it unlawful to take, possess, buy, sell, purchase, or barter any migratory bird, including feathers or other parts, nests, eggs, or products, without an appropriate permit. As of November 2013, the MBTA protects 1,026 species of birds in the United States (50 CFR §10.13). The majority of the birds occurring at WFF are protected under the MBTA.

A Final Rule authorizing take of birds protected by the MBTA by DoD agencies during military readiness activities was published in the Federal Register on February 28, 2007. The Final Rule directs the Armed Forces to assess the effects of military readiness activities on migratory birds, in accordance with NEPA, and requires the Armed Forces to develop and implement appropriate conservation measures if a proposed action may have a significant adverse effect on a migratory bird population. In addition, the rule requires DoD agencies to retain data for five years when conservation measures associated with a proposed action require monitoring of migratory bird populations.

3.2.1.2. Affected Environment

Wallops Island and its vicinity are home to a wide variety of bird species, high numbers of migratory birds, and important bird habitats (Paxton and Wilson 2015). Barrier islands, including Wallops, Assateague, Chincoteague, and Assawoman Islands, are particularly important for migratory birds. Some species use these islands as a stopover point, while others use the islands and surrounding habitats as an overwintering area. The bay (west) side of the islands tends to contain the highest concentrations of BCC and other migratory birds. Shorebirds would be expected to frequently cross Wallops Island when making foraging forays between the beach and bayside mudflats. The island is along the coastal route of the Atlantic Flyway, a corridor for migrating land and water birds that winter on the waters and marshes south of Delaware Bay. For these reasons, the National Audubon Society has designated Wallops Island as part of the Barrier Island Lagoon System Important Bird Area (IBA), an approximately 260,000-acre area of Global Significance for a variety of species of water birds (National Audubon Society 2013).

Adjacent to the WFF Main Base is the Wallops Island National Wildlife Refuge (NWR), which consists of 373 acres of upland and marsh (USFWS 2014). Chincoteague NWR (part of Assateague Island National Seashore), located directly north of Wallops Island, was established in 1943 to provide habitat for migratory birds (USFWS 2007). In addition to its IBA status, Wallops Island is included in the Maryland-Virginia Barrier Islands Western Hemisphere Shorebird Reserve Network (WHSRN), an internationally important shorebird area visited by more than 100,000 shorebirds annually (WHSRN 2017). Within the WHSRN, Wallops Island is located approximately six miles north of The Nature Conservancy's Metompkin Island Reserve (TNC 2017).

Birds are categorized in the following discussion as either land birds or water birds, corresponding to the habitats on which they rely. Land birds are species relying primarily on terrestrial habitats dominated by forest, scrub, or fields, or the aerial space over these habitats. Water birds spend most of their time in tidal or non-tidal aquatic habitats. Scientific names of avifauna species discussed in the following analysis, including those that have been documented or could potentially occur at WFF, are presented in **Tables C-1** and **C-2** in **Appendix C**.

Land Birds

Neotropical migratory birds breed in North America and spend the rest of the year in the tropical and subtropical Americas. Neotropical migrants arrive in the spring, breed and raise their young throughout the summer, and then migrate south to overwinter. Southbound migration begins between July and September for most species. With the inclusion of young birds born in the summer, the number of birds migrating is larger during fall migration than during northerly spring migration because many birds do not survive their first year, die during migration, or die on their wintering grounds (Mabey *et al.* 1993; Klaassen *et al.* 2014).

The Neotropical Migratory Bird Conservation Act of 2000 (Public Law 106-247) lists 386 bird species as neotropical migrants, while other sources list 330 species of birds as neotropical migrants (Elphick 2007). The majority of birds breeding in North American forests, including warblers, hummingbirds, swallows, orioles, tanagers, vireos, thrushes, flycatchers, sparrows, cuckoos, and nighthawks, are neotropical migrants. Raptors, shorebirds, and a few species of waterfowl (e.g., blue-winged teal) are also considered neotropical migrants because they migrate from their breeding grounds in North America to the tropics.

The geographic distribution of migrating neotropicals changes predictably between fall and spring. During fall, the majority of neotropical migrants follow the Atlantic Flyway close to the coast, while on their return in the spring they cover a broader front across the continent (Mabey *et al.* 1993). Neotropical migrants make up 60 to 80 percent of breeding birds in forests of eastern North America (Mabey *et al.* 1993). The most significant stopover area for land birds in this flyway is coastal habitat from Cape May, New Jersey; to Cape Charles, Virginia (Mabey *et al.* 1993), which includes Wallops Island. On the Delmarva Peninsula, neotropical migrants are more abundant within one mile of the coast than further inland. In addition, bay coastal zones have higher densities of neotropical migrants than the coast or further inland, and migratory songbirds are more common on barrier islands than the mainland (Mabey *et al.* 1993).

Approximately 65 species of breeding land birds and 70 species of wintering land birds use the Delmarva Peninsula and Virginia Barrier Island region (Paxton and Wilson 2015). The 10 most common species of native songbirds found in Accomack County, and therefore likely to occur at WFF, are red-winged blackbird, northern cardinal, American robin, boat-tailed grackle, American crow, common grackle, Carolina wren, yellow-rumped warbler, Carolina chickadee, and northern mockingbird (NASA 2010; eBird 2017). Other songbirds that commonly occur in open and developed areas of the WFF Mainland and Main Base include song sparrow, tree and barn swallows, fish crow, brown-headed cowbird, and blue jay[3].

Diurnal (i.e., active during the day) raptor species commonly found in Accomack County, and therefore likely to occur at WFF, include osprey, bald eagle, northern harrier, red-tailed hawk, Cooper's hawk, sharp-shinned hawk, red-shouldered hawk, merlin, American kestrel, peregrine falcon, turkey vulture, and black vulture[4]. Other raptor species that could occur infrequently at WFF include broad-winged hawk, rough-legged hawk, swallow-tailed kite, and Swainson's hawk (eBird 2017).

Owls commonly found in Accomack County include great horned owl, eastern screech-owl, short-eared owl, barred owl, and barn owl[5]. Other owl species that could occur infrequently at WFF include northern saw-whet owl, long-eared owl, and snowy owl (eBird 2017; Allen 2000; Dunn and Alderfer 2011).

For soaring birds such as hawks, migration begins as the thermals and updrafts upon which they rely develop during the morning hours. As the temperatures increase, soaring activity increases and so does the elevation of activity. Over the course of a day, soaring birds such as raptors are typically migrating at 600 feet to 1,500 feet and higher, with a maximum height of approximately 3,500 to 4,000 feet (Kerlinger 1995).

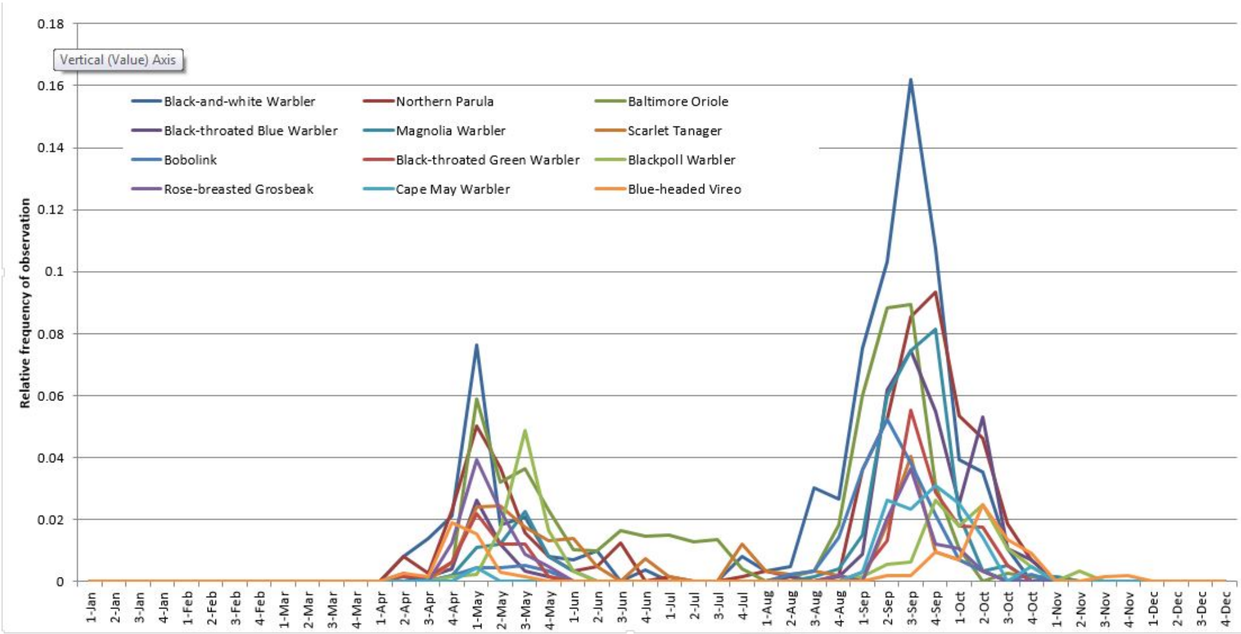
Most nocturnally migrating songbirds fly at approximately 2,000 feet AGL or lower (Kerlinger 1995). A dozen of the more common neotropical migrant songbirds in Accomack County show similar migration patterns, with peaks in spring migration occurring in early May and in fall migration occurring in September though early October. These patterns are illustrated in **Figure 3-3**.

[3] Non-native bird species, such as house sparrow, rock pigeon, and European starling that occur at WFF are not protected under the MBTA.

[4] Bald eagles and peregrine falcons are discussed further in **Section 3.2.2**.

[5] Great horned owls have been observed in the coastal forest (VDCR 1996 in NASA 2016a).

Figure 3-3: Relative Frequency of Observation of 12 Common Neotropical Migrants* in Accomack County, by Quarter Month



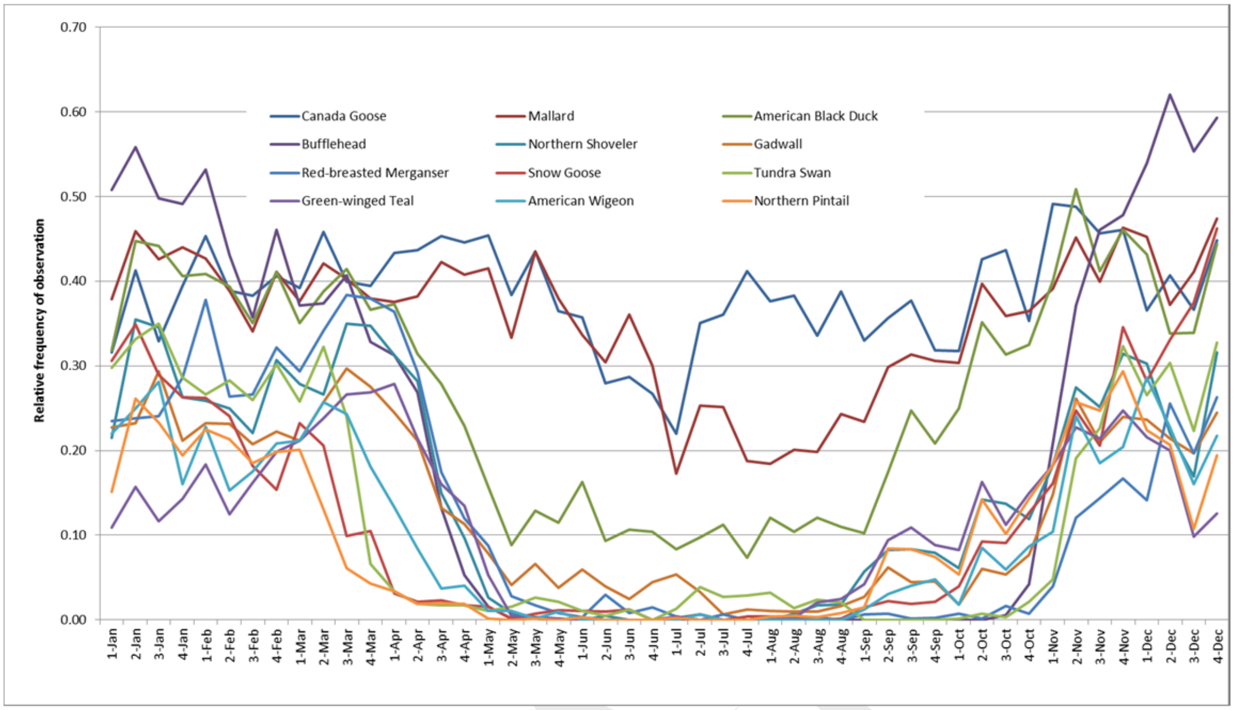
*In order of frequency of occurrence: black-and-white warbler, northern parula, Baltimore oriole, black-throated blue warbler, magnolia warbler, scarlet tanager, bobolink, black-throated green warbler, blackpoll warbler, rose-breasted grosbeak, Cape May warbler, and blue-headed vireo.

Source: eBird 2017. The online resource "eBird" is used to determine species' occurrence in areas with good coverage by birdwatchers. Records submitted to eBird are checked for errors by regional reviewers to reduce the possibility that a species is mistakenly reported.

Water Birds

A number of water birds occur at Wallops Island due to the abundance of adjacent wetlands and surface waters. The 12 most common species of native waterfowl commonly reported to eBird in Accomack County are Canada goose, mallard, American black duck, bufflehead, northern shoveler, gadwall, red-breasted merganser, snow goose, tundra swan, green-winged teal, American wigeon, and northern pintail, in that order (eBird 2017). Other common species of native waterfowl occurring in the area include blue-winged teal, ruddy duck, black and surf scoter, brant, and wood duck (NASA 2010; eBird 2017). The majority of these waterfowl commonly overwinter in areas around WFF, although species such as Canada goose, wood duck, and American black duck also are commonly found in the area during the summer. The relative frequency of observation for these species around WFF is shown in **Figure 3-5**.

Figure 3-4: Relative Frequency of Observation of 12 Most Common Species of Waterfowl in Accomack County, by Quarter Month

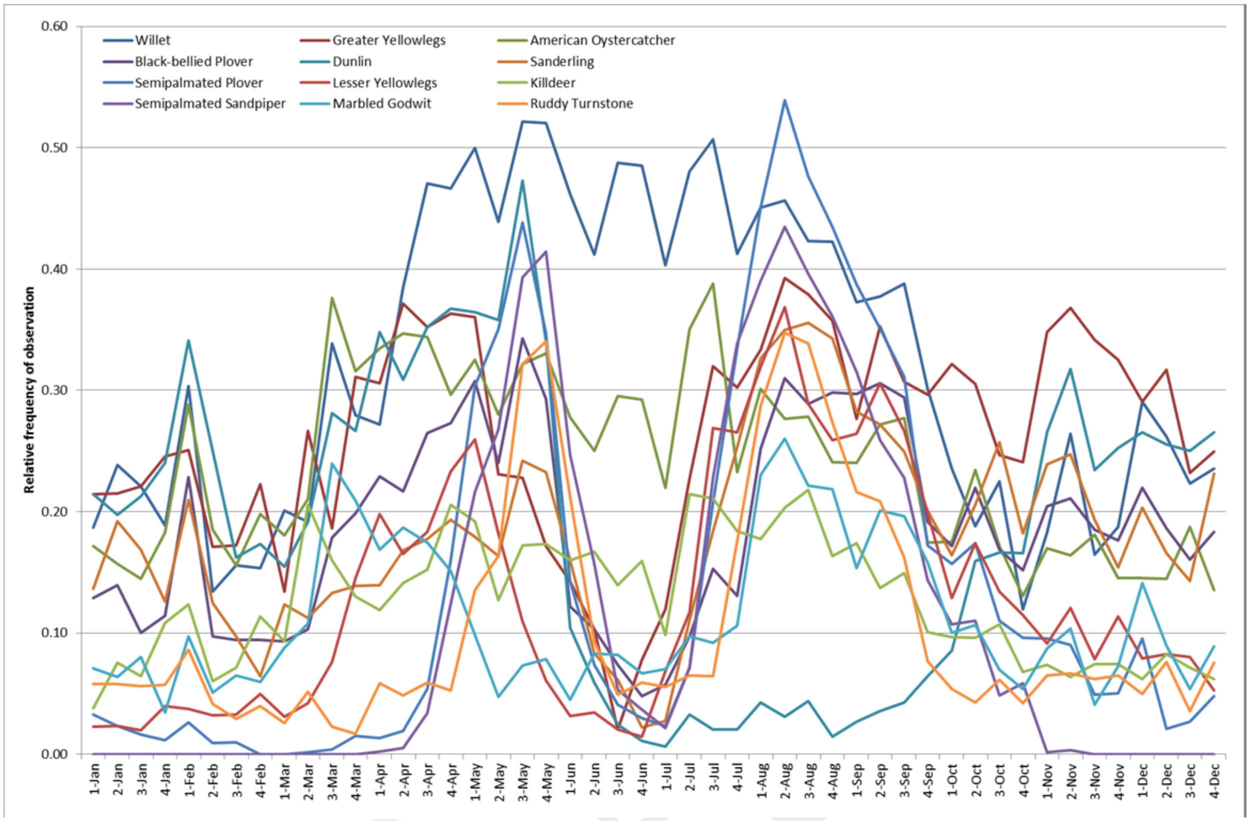


Source: eBird 2017.

Less common native waterfowl species occurring in the area include long-tailed duck, common goldeneye, canvasback, ring-necked duck, greater and lesser scaup, white-winged scoter, and hooded and common mergansers. The non-native mute swan is commonly found on the nearby Chincoteague NWR and could also occur at WFF. Other water birds regularly occurring in waters around WFF include common loon, red-throated loon, horned grebe, and pied-billed grebe (Allen 2000; Dunn and Alderfer 2011; eBird 2017).

Marshes and shorelines on Wallops Island provide high-quality habitat for a variety of other water birds, including several species of wading birds and shorebirds. The most frequently recorded species of native wading birds commonly found in Accomack County are great egret, great blue heron, snowy egret, tricolored heron, little blue heron, green heron, and black-crowned night-heron. The most frequently recorded species of shorebirds commonly found in Accomack County, and which occur or are likely to occur at WFF, are willet, greater yellowlegs, American oystercatcher, black-bellied plover, dunlin, sanderling, semi-palmated plover, lesser yellowlegs, killdeer, semipalmated sandpiper, marbled godwit, and ruddy turnstone (NASA 2010; eBird 2017). Of those, the willet, American oystercatcher, and killdeer breed in the area, while all other species are migratory. The relative frequency of observation for these species around WFF is shown in **Figure 3-5**.

Figure 3-5: Relative Frequency of Observation of 12 Most Common Species of Shorebirds in Accomack County, by Quarter Month



Source: eBird 2017.

No non-native species of shorebird have been recorded in Accomack County (eBird 2017). More than 24 other species of shorebirds could be expected to occur at WFF, although about half of these would be relatively rare. While not among the 10 most frequently reported shorebird species in the Delaware Bay/Virginia Barrier Island region, whimbrel use the area in large numbers, with an estimated 40,000 individuals passing through the area in the spring (Paxton and Wilson 2015). Other water birds common in the area include various species of gulls (e.g., herring gull, ring-billed gull, and laughing gull), Forster's tern, and double-crested cormorant (Allen 2000; NASA 2010; Dunn and Alderfer 2011; eBird 2017).

The Delaware Bay/Virginia Barrier Island region provides valuable habitat for breeding water birds. More than 20,000 colonial water bird nests of 16 different species are located within 10 miles of the alternative sites (Watts and Paxton 2014). The region supports more than half of all breeding colonial water birds in Virginia, including the entire Virginia breeding population of white ibis (two colonies; 369 pairs in 2013) and Caspian terns (two colonies; 9 pairs in 2013), and more than 75 percent of the Virginia breeding population of glossy ibis, snowy egret, tricolored heron, little blue heron, cattle egret, black-crowned night heron, herring gull, laughing gull, gull-billed tern, and black skimmer (Watts and Paxton 2014).

Shorebirds often fly as high as 3,000 feet, while ducks and other water birds near shore usually fly within 100 to 200 feet AGL, although they sometimes fly much higher. Many waterfowl often fly just above the water (Kerlinger 1995).

Bird Collisions with Communication Towers

It has been estimated that between 6.8 million and 50 million birds are killed each year in the United States and Canada by collisions with communication towers (Manville 2005; Longcore *et al.* 2012).

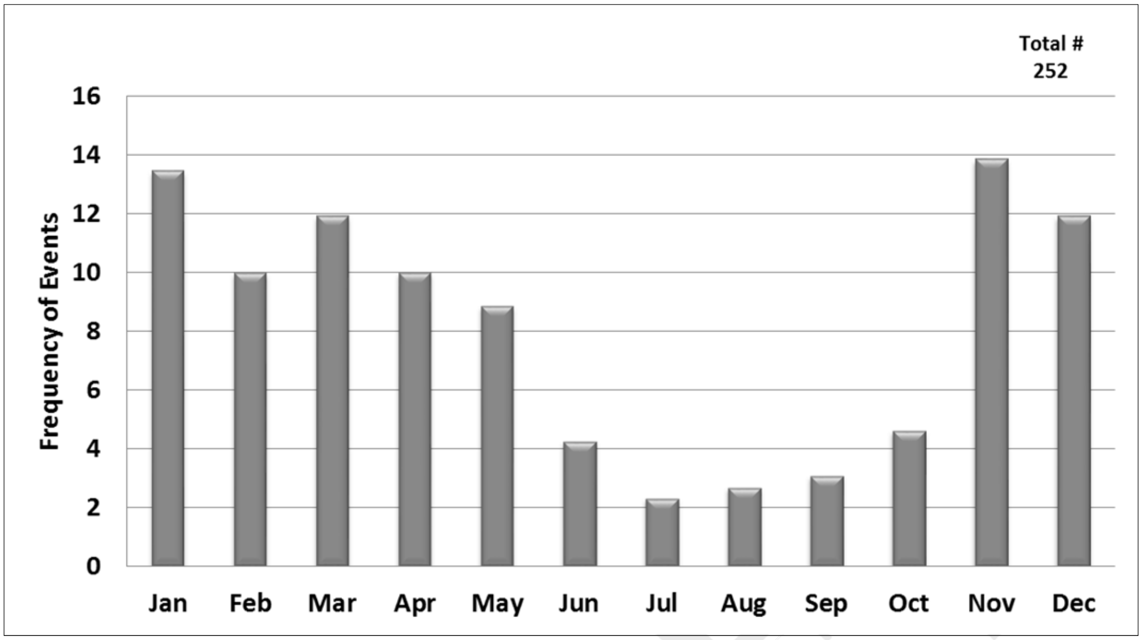
Weather conditions and lighting on structures are the two main factors affecting the likelihood that birds will collide with a structure (Kerlinger *et al.* 2010). The probability of collision is largely a function of behavior (APLIC 2012) with specific behaviors, such as migration, flushing, and aerial hunting, potentially rendering species more susceptible to collision. Collisions occur when birds flying in poor visibility conditions do not see a structure in time to avoid it. This can occur during the day when the tower is obscured by fog, or at night. Artificial lighting is also known to disorient or divert migrating or foraging birds and cause collisions with structures (Taylor and Anderson 1973; Avery *et al.* 1976; Longcore *et al.* 2008; Gehring *et al.* 2009; Kerlinger *et al.* 2010).In otherwise dark environments or when cloud base obscures moonlight, the impacts of bright lights aappear to be most severe. For example, in a study by Hüppop *et al.* (2006), 13,037 birds were recorded by thermal imaging camera over a 13 month period on a single, brightly lit unmanned offshore research platform in the North Sea. Of these, 442 (3 percent) were documented collision fatalities. Most (99 percent) of fatalities were passerines, mainly thrushes, common starling and skylark. Studies comparing lighting regimes and fatality events include Gehring *et al.* (2009), and Kerlinger *et al.* (2010). The Gehring study conducted at Michigan communication towers, and comparing red strobe, red flashing, white strobe, red strobe combined with red non-flashing and steady red burning lights found that there were fewer Neotropical migrating songbird fatalities with red flashing lighting. This study did not include flashing white lights. Kerlinger et al. (2010) compared 30 continental USA wind turbines with differing lighting regimes. They found that installations with flashing red FAA lighting do not attract nocturnally migrating birds. They also found that there were no impacts on birds from unlit turbines.

Weather and Seasonality

Most mass mortality events of migrant bird collisions with communication towers are weather-related (Taylor and Anderson 1974; Newton 2007a). Prevailing weather conditions on nights of large kills are characterized by overcast skies, often with precipitation; winds favorable for migration; and, in the fall, with the passage of cold fronts (Kale *et al.* 1969; Carter III and Parnell 1976, 1978; Avery *et al.* 1977; Erickson *et al.* 2005). Data also show that many bird collisions occur throughout the migration seasons under clear skies, particularly in the spring, although affecting different ages and different species of birds (rails and fringilids) (Kale *et al.* 1969; Carter III and Parnell 1976; Avery *et al.* 1977). Reasons for these differences between seasons and species are largely unexplained, although discussion surrounding this topic infers migratory strategy in the spring is more direct and completed more rapidly. More birds are attracted to lighted towers on overcast nights, and most appear to avoid towers of any lighting type on clear nights (Avery *et al.* 1976). Other consistent patterns related to collision events with towers include: mortality occurring during south and north winds (as opposed to east or west winds), but with north winds resulting in higher mortality; high mortality usually during the passage of cold fronts; and, in general, the highest mortality in the fall during overcast skies (Crawford 1981). Younger birds possibly collide more frequently than older birds, which could render fall migrants more susceptible to collision (Kelly 1999).

Instrument Flight Rules (IFR) are a set of FAA regulations for civil aviation aircraft. IFR conditions are met when cloud ceilings are below 1,000 feet and/or visibilities are less than 3 statute miles. For WFF, an IFR event is recorded when there are at least 3 hourly observations of IFR conditions within a 5-hour period as recorded in Meteorological Terminal Aviation Routine (METAR) reports (i.e., routine weather reports provided at fixed intervals) (Thomas, pers. comm., August 27, 2014). **Figure 3-5** illustrates the monthly frequency of IFR events at WFF occurring between 1997 and 2012 Approximately 9 and 3 percent of all the annual IFR conditions at WFF occur during May and September, respectively, which correlate to the peak spring and fall bird migration months.

Figure 3-5: Monthly Frequency of IFR Events at WFF from 1997 to 2012



Source: Thomas, pers. comm., August 27, 2014

Tower Height, Tower Lighting, and Guy Wires

The height of a tower, the presence of associated guy wires, and a tower's lighting regime can affect the severity of the hazard posed to birds (Taylor and Anderson 1973; Kemper 1996; Crawford and Engstrom 2001; Longcore *et al.* 2008). A significant decrease in mortality is associated with reduced tower height (Crawford and Engstrom 2001). Towers taller than 450 feet are generally recommended to be sited away from coastal zones, bird staging areas, colonial nesting sites, and WHSRN sites (FCC 2012). Guyed towers cause higher mortality than non-guyed towers (Gehring *et al.* 2011; Dickey *et al.* 2012; Gehring and Walter 2012). One study showed 70 times as many collisions at tall, guyed towers than on non-guyed, medium-height towers (Gehring *et al.* 2011). Tall, guyed towers lit with steady-burning lights have the highest fatality rates (Carter III and Parnell 1976, 1978; Erickson *et al.* 2005). Fewer bird fatalities have been documented at towers equipped with only red or white flashing lights as compared to towers with non-flashing, steady-burning lights (Carter III and Parnell 1976, 1978; Gehring *et al.* 2009, 2011). Extinguishing steady-burning, red tower lights have been determined to reduce avian collisions with towers by 70 percent (Kemper 1996; Gehring and Walter 2012).

Species Most Susceptible to Collisions

Nearly all species of migratory land birds have been documented to collide with communication towers along their migratory path (Shire *et al.* 2000 and Longcore *et al.*, 2012 in Paxton and Wilson 2015), with collision numbers usually correlated with species abundance (Kemper 1996). Night migrating songbirds, such as warblers, thrushes, vireos, tanagers, cuckoos, and sparrows, appear to be most affected, with percent species composition in fatality data for these groups ranging from 69 percent to 97.4 percent (Taylor and Anderson 1974; Carter III and Parnell 1976, 1978; Crawford and Engstrom 2001; Gehring *et al.* 2011; Longcore *et al.* 2013). Smaller numbers of waterfowl, shorebirds, and other species have been documented to collide with towers (Brewer and Ellis 1958; Carter III and Parnell 1976, 1978; Avery *et al.* 1977; Crawford and Engstrom 2001; Erickson *et al.* 2005; Gehring *et al.* 2009, 2011; Buchanan 2011; Longcore *et al.* 2013).

Between 1949 and 1999, 121 reports were written documenting 545,250 bird mortalities at communication towers (Shire 2000). Forty-seven of the reported studies, the longest of which was conducted intermittently over a period of 39 years, presented species-specific information from lit towers.

Steady burning lights are no longer recommended under FAA and USFWS guidelines. Nevertheless, species composition and collision susceptibility presented in this study lend some insight into relative vulnerability of birds to collision mortality. These studies documented 184,797 birds of 230 different species, including 10 on the Partners in Flight Extremely High Priority list (Shire 2000). The majority of bird mortalities documented in these studies were neotropical migratory songbirds. However, 1,452 deaths occurred among 54 species of water birds and raptors. Among those mortalities, the most commonly documented species (other than passerines) were sora (657), Virginia rail (144), pied-billed grebe (123), yellow rail (67), and ring-necked duck (61) (Shire 2000).

Rails and fringillids are frequently documented to collide with towers, and appear to collide with towers in all weather conditions. Neotropical nocturnal migrants and diurnal migrant warblers experience increased mortality in periods of overcast skies and also have the highest documented collision rates (Avery *et al.* 1977; Crawford and Engstrom 2001; Gehring *et al.* 2011). Of these species, red-eyed vireo, grey catbird, Nashville warbler, blackpoll warbler, mourning dove, and ovenbird have the highest mortality rates from collisions with towers (Crawford and Engstrom 2001; Gehring *et al.* 2009, 2011). Other species identified as “super colliders” (i.e., species that collide most frequently with buildings and towers) are bay-breasted warbler and black-throated blue warbler (Arnold and Zink 2011). The same study identified horned lark, cliff swallow, American robin, and common grackle as “super avoiders” (i.e., species that collide least frequently with buildings and towers). Overall, neotropical nocturnal migrants represented 97.4 percent of tower fatalities, consisting of Parulidae (58.4 percent), Vireonidae (13.4 percent), Turdidae (7.7 percent), and Emberizidae (5.8 percent) (Longcore *et al.* 2013). Most of these fatalities resulted from collisions involving attraction to lighting.

Breeding birds that nest in elevated areas, such as trees or poles, have increased daily exposure to collision as compared to ground-nesting birds (APLIC 2012). Such birds include osprey, bald eagle, a variety of other raptors, and many woodpeckers, doves, and songbirds. In addition, birds traveling between breeding, feeding, and roosting sites, especially over water and particularly in flocks, have increased risk of collision (APLIC 2012). Such species include ducks, geese, swans, herons, egrets, rails, shorebirds, gulls, and terns. Flocking birds are generally susceptible to collisions, with some shorebird species even colliding with each other (Buchanan 2011).

Electromagnetic Impacts

Studies of the effects of electromagnetic fields produced by communications towers on breeding and foraging birds have been determined to be inconclusive (Bhattacharya and Roy 2013). Therefore, such effects are not discussed further in this analysis.

3.2.1.3. Environmental Consequences

No Action Alternative

Under the No Action Alternative, the proposed instrumentation tower would not be built and existing conditions at Wallops Island would continue. This would have no effect on avifauna (common bird species) at or in the vicinity of Wallops Island.

Alternative 1 (Preferred Alternative): Building X-015 Site

The proposed relocation of the telemetry dish would have no short-term or long-term impacts on avifauna, as the telemetry dish would be installed on existing infrastructure in a previously developed portion of the WFF Mainland.

Construction and operation of the proposed instrumentation tower could result in the further loss or fragmentation of habitat available at and in the vicinity of Alternative 1. However, the site of the tower proposed under Alternative 1 and the quantity of habitat potentially available in that location is small in the context of habitat provided in areas on and near Wallops Island. Furthermore, the alternative site is previously disturbed, periodically maintained (e.g., via trimming and mowing of vegetation), and located adjacent to existing development on Wallops Island. Thus, available habitat on the site is of low quality, and any fragmentation or loss of such habitat resulting from the construction and operation of the proposed tower under Alternative 1 would be negligible.

Based on information detailed above, the construction and operation of the proposed instrumentation tower under Alternative 1 would pose a moderate risk of collision to some species, and low risk of collision to other species occurring at or in the vicinity of Wallops Island. The Risk Level Category for potential collision with the proposed tower, generalized by families of birds occurring at and in the vicinity of Wallops Island, is presented in **Table 3-2** and combines quantitative and qualitative assessment. Total body counts reveal little about relative mortality risk for each species because they are potentially confounded by variation in population size. The range for this is 40,000 to 220 million (Arnold and Zink 2011) and by potential range overlap with monitored collision sites. To estimate relative vulnerabilities among species, Arnold and Zink (2011) forced regression coefficients for population size and site overlap to their theoretical values of +1.0 [16] and calculated residuals for each species: relative vulnerability = log10(m+1) – Y – [log10(N+1) – X1] - [log10(S+1) – X2], where Y is mean log10 mortalities (towers: 1.698), X1 is mean log10 population size (towers: 6.618), and X2 is mean log10 collision sites (1.539; towers only). These residuals represent relative collision vulnerability, which varied enormously among species. Species that would potentially have a higher-than-average collision rate with the proposed tower would include those belonging to the following species groups: Troglodytidae (wrens), Tyrannidae (tyrant flycatchers), Emberizidae (New World sparrows), Cardinalidae (buntings, cardinals and allies), Vireonidae (vireos) and Parulidae (New World warblers). Individuals belonging to the Hirundinidae (swallows and martins), Strigidae (owls), Picidae (woodpeckers), Fringillidae (finches, siskins and allies), Icteridae (blackbirds and allies), Accipitridae (hawks, eagles, and kites) and Turdidae (thrushes, bluebirds and allies) species groups would have a lower risk of collision with the proposed tower, although individuals of those groups have also been documented to collide with towers (Arnold and Zink 2011) (see **Table C-3** in **Appendix C**). Waterfowl, shorebirds, and other bird species would also have the potential to collide with the proposed tower and its associated guy wires, particularly in consideration of the proposed tower's proximity to areas within and adjacent to Wallops Island that provide habitat for such birds.

To varying degrees, the risk of collision potentially posed by the proposed tower would be reduced with appropriate mitigation. As described in **Section 2.2.3**, the USAF would incorporate proactive measures to minimize effects to avian species. This would include meeting FAA standards for lighting and marking, during both construction and operation (FAA 2016), among other measures as identified in **Section 2.2.3.2**.

While such measures would minimize the risk of collision to birds, such risk would not be eliminated altogether. Continued research and monitoring of bird collisions and mortality at the site of the proposed tower is recommended, and, as described in **Section 2.2.3**, would include allowing access to the proposed tower site by USFWS personnel, researchers, and/or other visitors with a pertinent interest in the interaction of birds or other wildlife with the proposed tower. In addition, the USAF is preparing and would implement an avifauna and protected avian species monitoring and mitigation plan in consultation with interested stakeholders. A copy of the draft monitoring and mitigation plan is included in **Appendix C** of this EA. With implementation of these mitigation measures, impacts on avifauna would be less than significant.

Alternative 1 would be in accordance with the Final Rule authorizing take of birds protected by the Migratory Bird Treaty Act by DoD agencies during military readiness activities dated February 28, 2007. In accordance with the Final Rule, the USAF has assessed the effects of the Proposed Action on migratory birds in accordance with NEPA and would develop and implement a monitoring and mitigation plan as described above.

Alternative 2: Building X-079 Site

Impacts on avifauna resulting from Alternative 2 would be similar to those described for Alternative 1, as both sites are ecologically similar and located in proximity to one another. The implementation of

Alternative 2 would be in accordance with the Final Rule authorizing take of birds protected by the Migratory Bird Treaty Act by DoD agencies during military readiness activities dated February 28, 2007, for the same reasons described for Alternative 1.

Table 3-2: Risk Level Category for Potential Collision with the Proposed Tower, Generalized by Bird Family

Bird Family	Risk Level Category
Anatidae (Ducks, Geese, and Waterfowl)	Low-Moderate
Odontophoridae (New World Quail)	Low
Phasianidae (Pheasants, Grouse, and Allies)	Low
Gaviidae (Loons)	Low
Podicipedidae (Grebes)	Low
Sulidae (Boobies and Gannets)	Low
Phalacrocoracidae (Cormorants)	Low
Pelecanidae (Pelicans)	Low-Moderate
Ardeidae (Herons, Egrets, and Bitterns)	Low-Moderate
Threskiornithidae (Ibises and Spoonbills)	Low
Cathartidae (New World Vultures)	Low
Pandionidae (Osprey) & Accipitridae (Hawks, Eagles, and Kites)	Low-Moderate
Rallidae (Rails, Gallinules, and Coots)	Moderate
Gruidae (Cranes)	Low
Recurvirostridae (Stilts and Avocets)	Low
Charadriidae (Plovers)	Moderate
Scolopacidae (Sandpipers and Allies)	Low-Moderate
Stercorariidae (Skuas and Jaegers)	Low
Laridae (Gulls, Terns, and Skimmers)	Low
Columbidae (Pigeons and Doves)	Low
Cuculidae (Cuckoos)	Low
Tytonidae (Barn Owls)	Low
Strigidae (Owls)	Low
Caprimulgidae (Nightjars and Allies)	Low
Apodidae (Swifts)	Low
Alcedinidae (Kingfishers)	Low
Picidae (Woodpeckers)	Low
Falconidae (Falcons and Caracaras)	Low
Tyrannidae (Tyrant Flycatchers)	Low-Moderate
Vireonidae (Vireos)	Low-Moderate
Corvidae (Crows and Jays)	Low
Alaudidae (Larks)	Low
Hirundinidae (Swallows)	Low
Paridae (Chickadees, and Titmice)	Low
Sittidae (Nuthatches)	Low
Certhiidae (Treecreepers)	Low
Troglodytidae (Wrens)	Low

Bird Family	Risk Level Category
Polioptilidae (Gnatcatchers)	Low
Regulidae (Kinglets)	Low
Turdidae (Thrushes and Allies)	Low
Mimidae (Mockingbirds and Thrashers)	Low-Moderate
Sturnidae (Starlings)	Low
Motacillidae (Pipits)	Low
American Pipit	Low
Bombycillidae (Waxwings)	Low
Calcariidae (Longspurs and Snow Buntings)	Low
Parulidae (New World Warblers)	Low-Moderate
Emberizidae (New World Sparrows)	Low
Cardinalidae (Cardinals and Allies)	Low
Icteridae (Troupials and Allies)	Low
Fringillidae (Finches and Allies)	Low
Passeridae (Old World Sparrows)	Low

Sources: Brewer and Ellis 1958; Taylor and Anderson 1974; Carter III and Parnell 1976, 1978; Avery *et al.* 1977; Shire *et al.* 2000; Crawford and Engstrom 2001; Erickson *et al.* 2005; Gehring *et al.* 2009, 2011; Buchanan 2011; Longcore *et al.* 2013.

3.2.2 SPECIAL STATUS SPECIES

3.2.2.1. Regulatory Context

Special status species include any species that is listed or proposed for listing as threatened or endangered by the USFWS under the provisions of the ESA; special status bird species protected by the Bald and Golden Eagle Protection Act (BGEPA); and species listed as threatened or endangered by the Virginia Department of Game and Island Fisheries (VDGIF). Avifauna (common bird species) is discussed in **Section 3.2.1**. Scientific names of special status species discussed in the following analysis, including those that have been documented or could potentially occur at WFF, are presented in **Tables C-1** and **C-2** in **Appendix C**.

Section 7 of the ESA requires federal agencies to evaluate the effects of their proposed actions on federal-listed species and consult with either the USFWS or National Marine Fisheries Service if the agency determines that its action "may affect" an individual or critical habitat of a federal-listed species. In addition, the 1988 amendment to the Fish and Wildlife Conservation Act (Public Law 100-653, Title VIII), which is administered by the USFWS, mandates identification of BCC. The Act requires the USFWS to "…identify species, subspecies, and populations of all migratory non-game birds that, without additional conservation actions, are likely to become candidates for listing under the Endangered Species Act of 1973."

3.2.2.2. Affected Environment

Birds

Six species of federal- and state-listed threatened and endangered birds have the potential to occur on Wallops Island **(**VDGIF 2016; USFWS 2017a). These species are listed in **Table 3-3**. Two federal-listed threatened bird species, the piping plover and the rufa subspecies of the red knot, occur on beaches near the alternative sites. Although the federal-listed endangered roseate tern has been recorded at the nearby Chincoteague NWR (eBird 2017), this species has not been documented at WFF (NASA 2010; eBird 2017, NASA 2016a).

Table 3-3: Federal- and State--listed Threatened and Endangered Birds Documented at Wallops Island

Common Name	Status[1]
Bald Eagle	BGEPA
Gull-billed Tern	ST
Peregrine Falcon	ST
Piping Plover	FT and ST
Red Knot	FT and ST
Wilson's Plover	SE

Note:
1. BGEPA= Bald and Golden Eagle Protection Act; FE=Federal-listed Endangered; FT=Federal-listed Threatened; SE=State Endangered; ST=State Threatened
Sources: VDGIF 2016; USFWS 2017a; NASA 2016a.

State-listed birds occurring in Accomack County (eBird 2017) and documented at WFF include Wilson's plover, gull-billed tern, peregrine falcon. Wilson's plover occurs in the area in low densities, and its entire Virginia breeding population occurs in the area (Watts 2006). Gull-billed terns would be expected to use the beach and mudflat near WFF from the spring through the fall; individuals were observed on August 3, 2009 flying south of the project site in an easterly direction (NASA 2010). Peregrine falcons occur in the WFF area year-round, although there is a peak in their numbers during fall migration, in particular late September and early October (NASA 2010; eBird 2017).

Nine BCC breeding land birds and 10 BCC wintering land birds are believed to use the Delmarva Peninsula and Virginia Barrier Island region (Paxton and Wilson 2015). BCC that may occur on or within the vicinity of WFF include the following (species are listed in taxonomic order) (USFWS 2008a; NASA 2016a):

- American Bittern
- American Oystercatcher
- Bald Eagle
- Black Rail*
- Black Skimmer
- Blue-winged Warbler
- Brown-headed Nuthatch
- Buff-breasted Sandpiper (nb)**
- Cerulean Warbler*
- Golden-winged Warbler*
- Gull-billed Tern
- Horned Grebe (nb)
- Hudsonian Godwit (nb)
- Kentucky Warbler
- Least Bittern
- Least Tern
- Lesser Yellowlegs (nb)
- Marbled Godwit (nb)
- Nelson's Sparrow
- Peregrine Falcon
- Pied-billed Grebe
- Prairie Warbler
- Purple Sandpiper* (nb)
- Red Knot (nb)
- Red-headed Woodpecker
- Red-throated Loon (nb)
- Rusty Blackbird (nb)
- Saltmarsh Sparrow
- Seaside Sparrow
- Sedge Wren
- Semipalmated Sandpiper (nb)
- Short-billed Dowitcher (nb)
- Short-eared Owl (nb)
- Snowy Egret
- Solitary Sandpiper (nb)
- Upland Sandpiper (nb)
- Whimbrel (nb)
- Eastern Whip-poor-will
- Wilson's Plover
- Wood Thrush
- Worm-eating Warbler

* Indicates that the species has not been documented at WFF, although WFF is located within the species' normal range.
** nb = non-breeding; (i.e., birds with breeding ranges that do not include WFF); birds not indicated as nb may or may not breed in the area.

Blue-winged warblers are of high conservation concern across multiple bird conservation regions, including the area around Wallops Island. These birds are sparsely distributed across the northeastern United States, but follow coastal migration routes in the spring and fall (Gil *et al.* 2001). Therefore, blue-winged warblers may represent populations of high vulnerability to a coastal hazard.

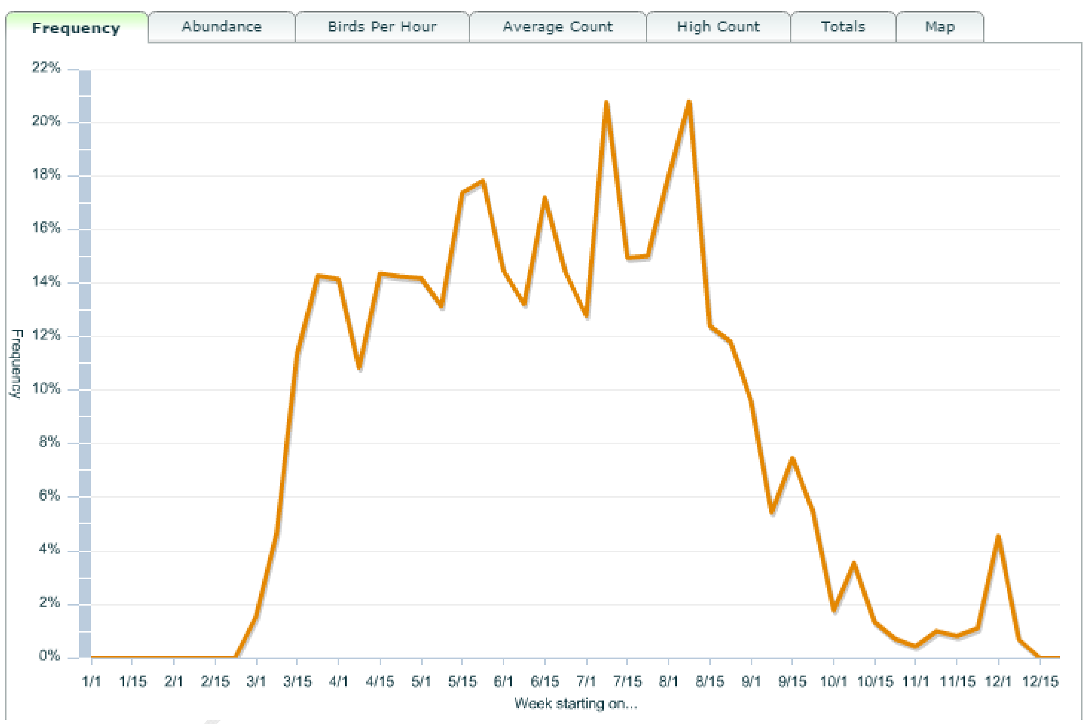
Suitable habitat for the federally threatened piping plover and red knot (rufa subspecies) occurs adjacent to the alternative sites. These species are described in additional detail below.

Piping Plover

Atlantic Coast populations of piping plover are listed as threatened under the ESA (USFWS 2017a). These small shorebirds arrive in Accomack County in the spring in early to mid-March, breed in the area, and depart by mid-August (eBird 2017). To understand the presence and numbers of piping plovers near WFF, it is useful to look at both frequency (i.e., the percentage of eBird checklists that report the species) (see **Figure 3-6**) and high count (i.e., the highest count of a species submitted on a single checklist) (see **Figure 3-7**) in Accomack County. From these figures, it is possible to estimate that piping plovers are relatively frequently encountered in the county (**Figure 3-6**) in numbers sometimes as high as 40 to 80 birds (**Figure 3-7**) in a single observation (eBird 2017), although none were recorded in a study of the marshes on the western side of mid-Wallops Island (NASA 2010).

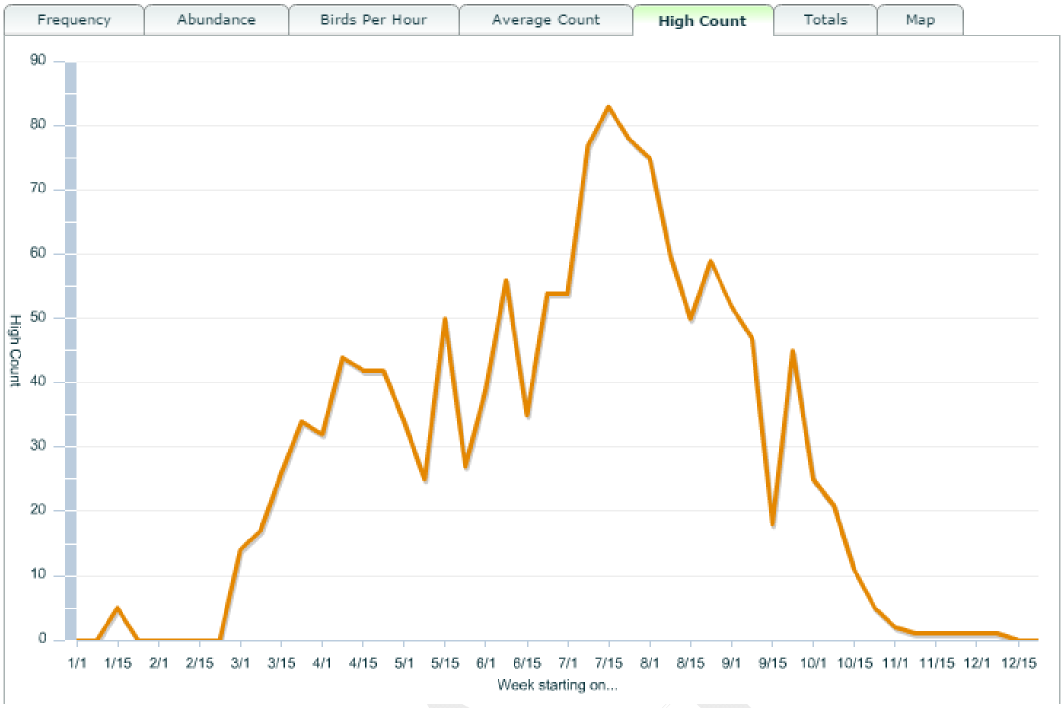
Between 1986 and 2005, Virginia supported between 84 and 127 pairs of the Atlantic Coast population of piping plovers, representing 6 to 13 percent of that population. In that 20-year period, the number of breeding piping plover pairs on Wallops Island has fluctuated between 0 and 5, with a mean of approximately 2 pairs per year (Boettcher *et al.* 2007). More recent numbers for piping plover nesting observations are discussed below.

Figure 3-6: Percentage of eBird Checklists Reporting Piping Plovers in Accomack County



Source: eBird 2017.

Figure 3-7: High Counts of Piping Plovers in Accomack County on eBird Checklists



Source: eBird 2017.

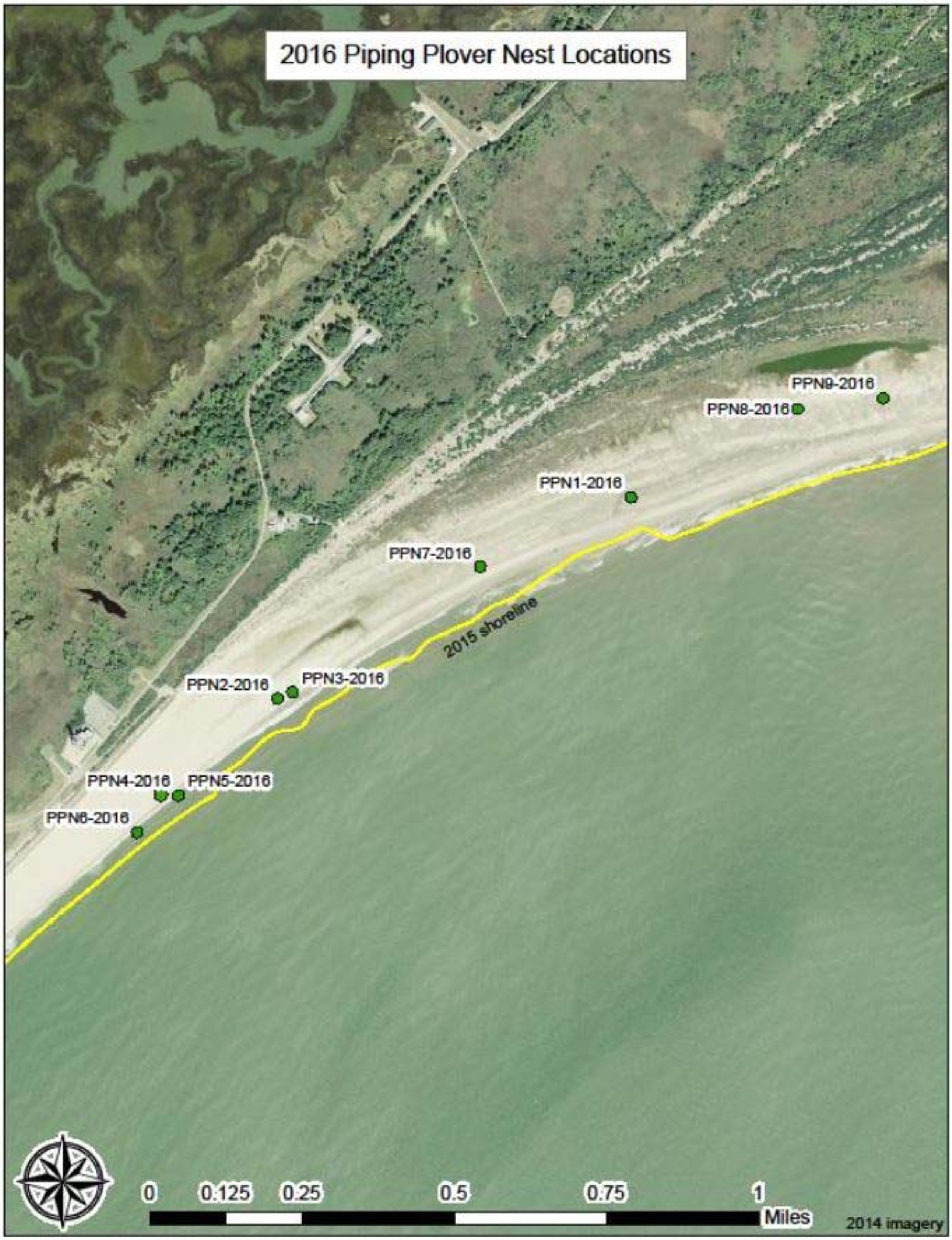
As part of the Terms and Conditions of the USFWS Biological Opinion regarding ongoing operations on Wallops Island, NASA has prepared a Protected Species Monitoring Plan and annually reports monitoring results back to USFWS. In accordance with the Plan, NASA annually conducts piping plover surveys three to four times weekly from March to September, or when the last chick fledges. From March 2016 to September2016, nine nests were found on the piping plover nesting area shown on **Figure 3-8** (NASA 2016b). Nest success during 2016 ranged from 75 percent (with three of four chicks fledging from one nest) to 0 percent (with none of four chicks fledging due to predation). No nests failed as a result of overwash from ocean waves. Overall, five of the nests had a 0 percent success rate, while the other four nests had at least a 50 percent success rate. Nest failure and success is summarized in **Table 3-4**.

Table 3-4: 2016 Piping Plover Nesting Results at Wallops Island

Nest	Number of Eggs	Number of Eggs Hatched	Number of Chicks Fledged	Success Rate (percent)[1]
1	4	3	0	0
2	4	4	2	50
3	4	4	3	75
4	4	4	0	0
5	4	4	2	50
6	4	4	0	0
7	3	3	2	67
8	4	0	0	0
9	3	0	0	0
Totals	**34**	**26**	**9**	**26**

Note:
1. Number of chicks fledged relative to number of eggs laid.
Source: NASA 2016b

2399 **Figure 3-8: Locations of Piping Plover Nests on Wallops Island in 2016**



Source: NASA 2016b, unpublished data.

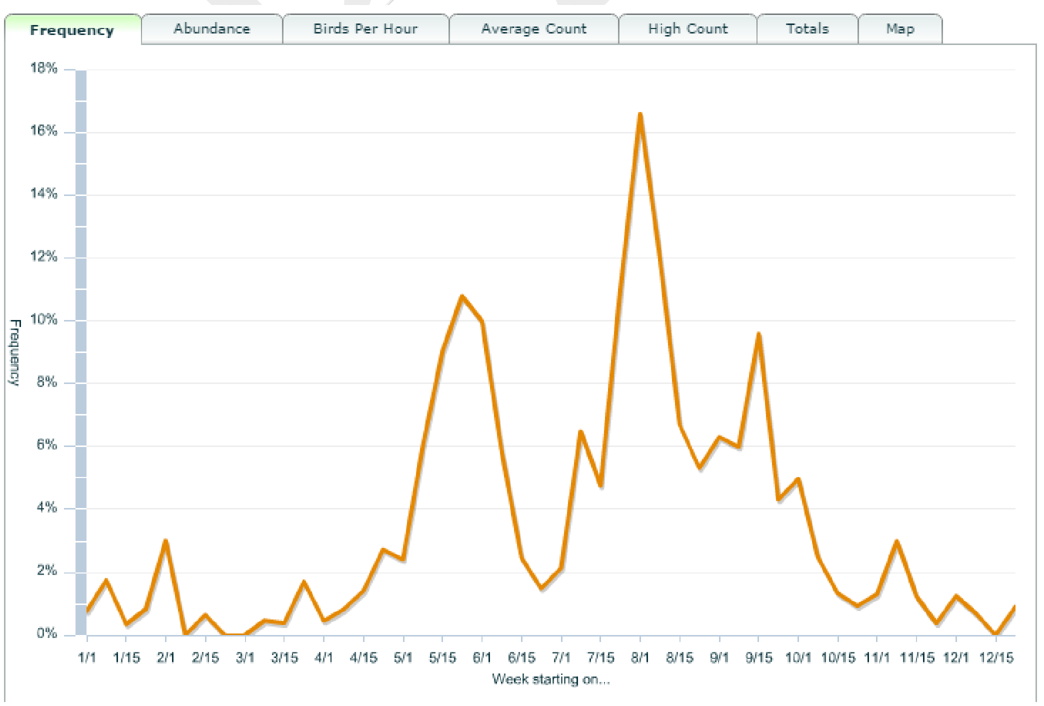
Although comparatively fewer shorebird species' mortalities have been reported at communication towers (which could be interpreted as these species being at lower collision risk), little is known about piping plover migration behavior, flight altitude, or habitat use, all of which are factors in weighing collision risk (USFWS 1996). Flocking shorebirds have been identified as being more prone to collision (Buchanan 2011). As such, piping plover are anticipated to collide with structures (Hatch and Brault 2007). The majority of Atlantic Coast piping plover migratory movements is thought to take place along a narrow flight corridor including the outer beaches of the coastline, with rare offshore and inland observations (USFWS 1996).

Red Knot

The rufa subspecies of red knot is listed as threatened under the ESA. These medium-size arctic-breeding shorebirds may be present year-round in Accomack County, although peak numbers occur during spring migration in May and again during fall migration between August and September (eBird 2017). Beaches of the Virginia Barrier Islands support a large portion of the overall population of red knots that stage on the Atlantic Coast, although this proportion has declined from 32 percent between 2007 and 2010 to 17 percent between 2011 and 2014 (Paxton and Wilson 2015). A larger proportion of red knots would likely pass WFF while migrating north in the spring (Paxton and Wilson 2015). This species was documented during fall migration (NASA 2010).

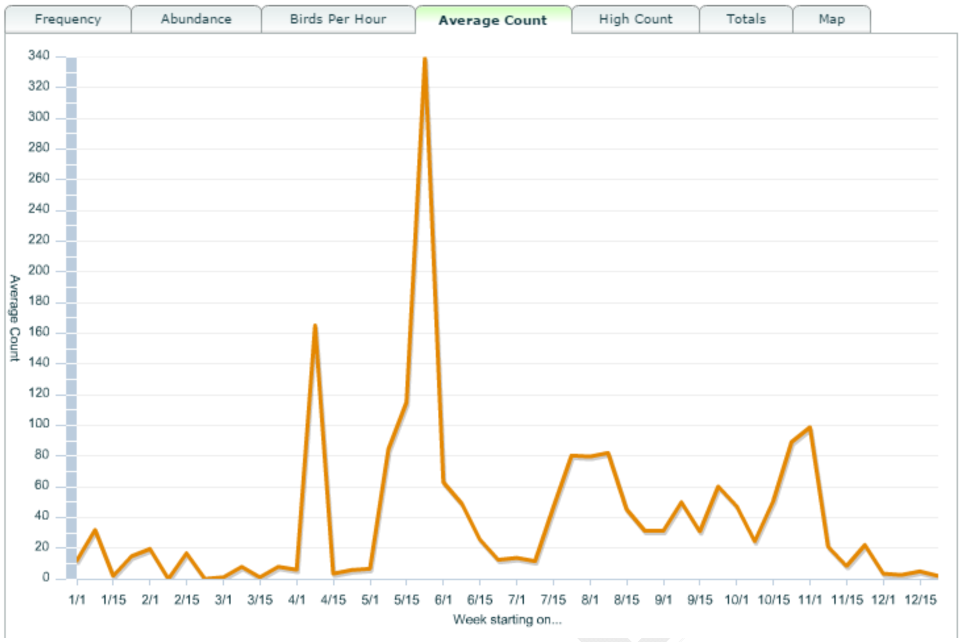
To understand the presence and numbers of red knots near WFF, it is useful to look at both frequency (i.e., the percentage of eBird checklists that report the species) and average count (i.e., the average count of a species submitted on all checklists) in Accomack County (see **Figure 3-9** and **Figure 3-10**, respectively). High count data for red knots is more difficult to visualize than average count data due to some extremely large counts from Chincoteague NWR in the early 1980s (eBird 2017). From these data, it is possible to estimate that red knots are encountered at variable frequencies in the county (**Figure 3-9**), but with more frequent sightings in spring and fall. Data from eBird indicates that numbers of red knots drop in the winter, with average counts fewer than 20 birds from December through April, but between 40 and greater than 300 individuals during the rest of the year, and peak numbers in the spring (**Figure 3-10**) (eBird 2017).

Figure 3-9: Percentage of eBird Checklists Reporting Red Knots in Accomack County



Source: eBird 2017.

Figure 3-10 : Average Counts of Red Knots in Accomack County on eBird Checklists

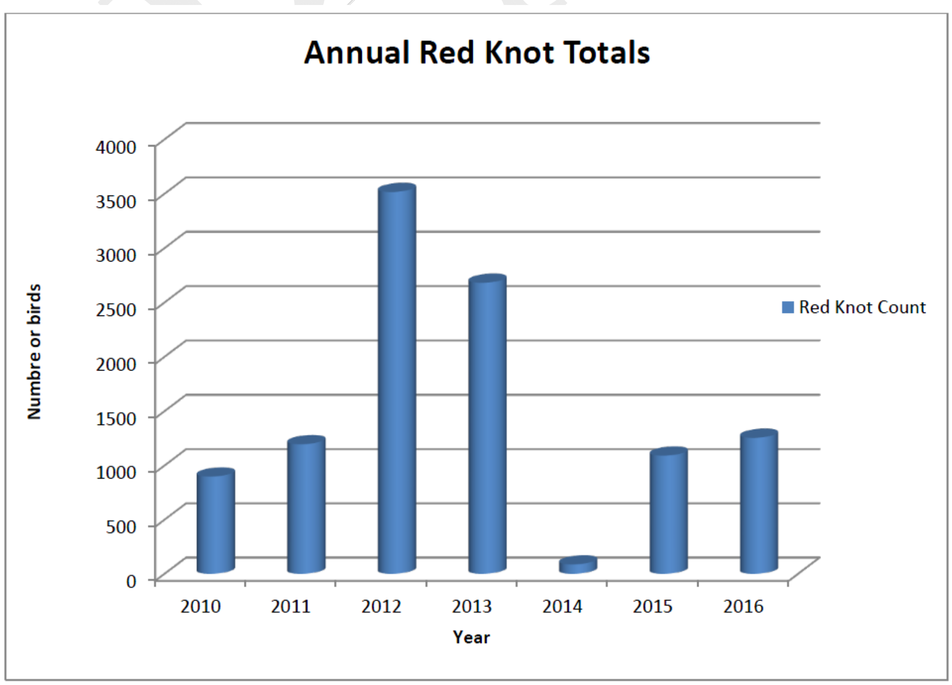


Source: eBird 2017.

In accordance with the PSMP and in conjunction with piping plover surveys, NASA conducts annual surveys for red knots. During the month of May 2012, NASA observed almost 3,500 red knots on Wallops Island. Monitoring conducted in 2012 yielded slightly more than 2,500 individuals (NASA 2016b).

Results of red knot surveys on the north end of Wallops Island from 2010 through 2016 are shown in **Figure 3-11**.

Figure 3-11: Annual Red Knot Totals



Source: NASA 2016b

Bird Species of Concern Associated with Nearby Conservation Sites

The Virginia Department of Conservation and Recreation's (VDCR) Division of Natural Heritage (DNH) program has identified five Conservation Sites at WFF: two on Wallops Island, North Wallops Island and North Assawoman/South Wallops Island; two on the Main Base, Little Mosquito Creek and Wallops Main Base Airfield Swale; and one on the Mainland and the west side of central Wallops Island, Wallops Island Causeway Marshes (Fleming 1996 in NASA 2016a).

Bird species of concern associated with two of the Conservation Sites, the 1,600-acre Wallops Island Causeway Marshes and the approximately 100-acre North Assawoman/South Wallops Island sites, could potentially be affected by the proposed tower. VDCR-DNH has assigned the Causeway Marshes site a biodiversity significance ranking of B4, representing a site of moderate significance. The natural heritage resources of concern at this site are the saltmarsh sparrow and northern harrier, which have not been observed on Wallops Island but for which suitable habitat is present. A biodiversity significance ranking of B3 has been assigned to the North Assawoman/South Wallops Island site, representing a site of high significance. Its species of concern are the piping plover, Wilson's plover, and least tern (Fleming 1996).

Terrestrial Mammals

The northern long-eared bat is a federal-listed threatened species throughout its range (80 *Federal Register* 17974), which includes Virginia and more than 30 other states in the eastern and north-central United States. This species roosts singly or in colonies underneath bark, in cavities, or in crevices of both live and dead trees during the summer months (i.e., approximately April through August) and hibernates in caves or mines during the winter. Breeding occurs prior to winter hibernation, and females give birth to a single pup the following summer. Individual bats forage three to ten feet above the ground between the understory and canopy of forested hillsides and ridges, with peak foraging activity occurring within five hours after sunset (U.S. Nuclear Regulatory Commission 2015).

White-nose syndrome, a fungal disease known to affect bats, is currently the predominant threat to the northern long-eared bat, especially throughout the northeastern United States where the species has declined by up to 99 percent from pre-white-nose syndrome levels at many hibernation sites. Impacts on winter hibernacula and loss or degradation of summer habitat are additional factors affecting the mortality of the species.

The USFWS published the final 4(d) rule for the northern long-eared bat in the *Federal Register* on January 14, 2016 (81 Federal Register 1900-1922). Under Section 4(d) of the ESA, the USFWS may issue regulations deemed "necessary and advisable to provide for the conservation of threatened species." It enables the USFWS to promulgate special rules for species listed as threatened that provide flexibility in implementing the ESA (USFWS 2017b).

The final 4(d) rule for the northern long-eared bat identifies prohibitions that focus on protecting the bat's sensitive life stages in areas affected by white-nose syndrome, which includes Accomack County. As such, the northern long-eared bat final 4(d) rule prohibits all "purposeful take" of the species, defined as the intentional destruction, harm, or disturbance of the species, except in specific situations generally related to the protection of human health and safety. Activities potentially resulting in the "incidental take" of northern long-eared bats (i.e., activities that do not intentionally target the species, such as the removal or trees potentially providing habitat to facilitate a construction project) are allowed without a permit under the final 4(d) rule except when either of the following circumstances apply (USFWS 2017c):

- When the activity occurs within 0.25 mile of a known northern long-eared bat hibernaculum, or
- When the activity involves the disturbance or destruction of a known occupied maternity roost tree, or any other tree within a 150-foot radius of a maternity roost tree, during the species' pup season from June 1 through July 31 of any year.

The northern long-eared bat final 4(d) rule established a streamlined Section 7 consultation process with regard to the species. Under the streamlined Section 7 consultation process, a federal agency may determine that a proposed activity occurring within areas affected by white-nose syndrome “may affect, but is not likely to adversely affect” the northern long-eared bat if the activity does not result in the purposeful take of the species, does not occur within 0.25 mile of a known hibernaculum, or does not affect known maternity roost trees or trees within a 150-foot radius of maternity roost trees. The agency is required to submit documentation of the proposed activity to the USFWS office with jurisdiction over the project site, but USFWS concurrence with the agency’s determination may be assumed if the USFWS does not respond within 30 days of the submission (USFWS 2017c).

The range of the northern long-eared bat includes Accomack County. During 2008 acoustic bat surveys conducted in the marshes on Wallops Island and between the island and the Mainland, 0.3 percent of the calls identified were attributed to myotids (Stantec Consulting 2008 in NASA 2016a). While northern long-eared bats were not separated from the rest of the guild, it is reasonable to assume that this species could occur in the vicinity of WFF, as suitable summer habitat is present (NASA 2016a).

Trees providing maternity roost habitat for the northern long-eared bat have not been documented on either of the alternative sites at Wallops Island. Winter hibernacula suitable for the species has not been documented at or near Wallops Island (VDGIF 2017).

Species Most Sensitive to Collisions with Towers

Collision mortality is an added burden for populations already in decline for other reasons. The Connecticut warbler falls under this category. On the “watch list” due to significant declines in population, both of these species have been identified as “super colliders” (Arnold and Zink 2011).

Species that rely on tidal salt marsh and brackish marsh habitats have a spatially restricted movement corridor. This increases the risk of collision with tall structures and could particularly impact species such as the saltmarsh sparrow, Nelson’s sparrow, and seaside sparrow, all of which are expected to be found at WFF. These species are of high conservation concern over their breeding grounds and throughout their breeding range in the Mid-Atlantic and Atlantic Forest Bird Conservation Regions (Wilson and Watts 2013). Sparrows are one of the species groups frequently found in tower collision mortality data (APLIC 2012).

The rufa subspecies of the red knot is a waterbird that is considered to have a high risk of collision and high degree of population vulnerability with resepct to communication towers.

3.2.2.3. Environmental Consequences

No Action Alternative

Under the No Action Alternative, the proposed instrumentation tower would not be built and existing conditions at Wallops Island would continue. This would have no effect on special status species at Wallops Island.

Alternative 1 (Preferred Alternative): Building X-015 Site

Birds

As discussed for avifauna in **Section 3.2.1.3**, implementation of Alternative 1 would have negligible effects on habitat loss and fragmentation for special status species, as the Alternative 1 site is relatively small in the context of available habitat on and in the vicinity of Wallops Island; previously disturbed and periodically maintained; adjacent to existing development; removed from the shoreline habitat of the majority of Wallops Island special status species; and of generally low habitat quality.

Implementation of Alternative 1 would not result in any construction in areas within known piping plover nesting or foraging habitat. Although documented piping plover collisions with fixed structures in the coastal zone are rare if not non-existent, the ability to avoid structures such as the proposed tower could be reduced in poor visibility conditions (Burger *et al.* 2011) and interaction with guy wires is possible in all weather conditions (USFWS 2008b). Months with high rates of IFR events (indicating higher chance of poor visibility) and high occurrence of piping plovers include mid-February through May when there are nine to twelve IFR events per month (**Figure 3-5**).

The proposed tower would be located outside known foraging habitat of the red knot, but collision risk during migration cannot be discounted. Although a red knot cruising altitude is between 3,300 and 9,800 feet AGL (Burger *et al.* 2011), well above the height of the proposed tower, the most serious risk would occur when northbound long-distance spring migrants make landfall. Additionally, inclement weather conditions could increase collision risk, as could flocking behavior. Interaction with guy wires would also be possible. May is the month with the highest rate of IFR events (nine) and high occurrence of red knot (**Figure 3-5**).

Based on this analysis, Alternative 1 would have no impact on habitat of the piping plover or red knot, as no such habitat is present on the alternative site. However, Alternative 1 would have the potential to adversely affect individual piping plovers and red knots while in flight as a result of possible collision with the proposed tower and associated guy wires.

Generally, Alternative 1 would pose risks of collision to special status species of birds similar to those described for common bird species in **Section 3.2.1.3**. Risks would vary from low to high depending on the species. Additional risks would include additional exposure (i.e., the relative level a population is expected to overlap with the alternative site) to land birds, and population vulnerability. Exposure/collision risk and population risk for special status birds are summarized in **Table 3-5**.

Table 3-5: Risks from the Proposed Action to Special Status Birds Documented on Wallops Island

Common Name	Population Exposure[1]	Population Vulnerability[2]	Collision Risk[3]	Population Risk[4]
American Bittern			Medium	Low
American Oystercatcher			High	Medium
Bald Eagle			Low	Low
Black Skimmer			High	Medium
Blue-winged Warbler	High	High		
Brown-headed Nuthatch	Low	Low		
Buff-breasted Sandpiper (nb)[5]			Low	Low
Cerulean Warbler	High	Low		
Eastern Whip-poor-will	High	Low		
Gull-billed Tern			Medium	Low
Horned Grebe (nb)			Medium	Low
Hudsonian Godwit (nb)			Low	Low
Kentucky Warbler	High	Moderate-High		
Least Bittern			High	Medium
Least Tern			Medium	Medium
Lesser Yellowlegs (nb)			Medium	Low
Marbled Godwit (nb)			Medium	High
Nelson's Sparrow	High	Low		
Peregrine Falcon			Low	Medium
Pied-billed Grebe			High	Low
Piping Plover			Medium	High
Prairie Warbler	High	Low		
Red Knot (nb)			High	High
Red-headed Woodpecker	High	Low		
Red-throated Loon (nb)			Low	Medium
Rusty Blackbird (nb)	High	Low		
Saltmarsh Sparrow	High	Low		
Seaside Sparrow	High	Low		
Sedge Wren	High	Low		
Semipalmated Sandpiper (nb)			High	Low

Common Name	Population Exposure[1]	Population Vulnerability[2]	Collision Risk[3]	Population Risk[4]
Short-billed Dowitcher (nb)			High	High
Short-eared Owl (nb)			Low	Low
Snowy Egret			High	Low
Solitary Sandpiper (nb)			Low	Low
Upland Sandpiper (nb)			Low	Low
Whimbrel (nb)			High	High
Wilson's Plover			Low	Low
Wood Thrush	High	High		
Worm-eating Warbler	High	Moderate-High		

Notes:
1. Population exposure refers to the relative level a population is expected to overlap with the proposed sites.
2. Population vulnerability refers to the level in which a population may respond negatively to a demographic disturbance.
3. Collision risk based on assessment of wing/body morphology, flight characteristics, flocking habits, nocturnal movements, habitat use, and population exposed to hazard.
4. Population risk based on assessment proportion of population exposed to hazard.
5. nb = non-breeding

Source: Paxton and Wilson 2015.

To varying degrees, the risk of collision potentially posed by the proposed tower would be reduced with appropriate mitigation. As described in **Section 2.2.3**, the USAF would incorporate proactive measures to minimize effects to avian species, including special status bird species. This would include meeting FAA standards for lighting and marking, during both construction and operation (FAA 2016), among other measures as identified in **Section 2.2.3.2**.

While such measures would minimize the risk of collision to special status bird species, such risk would not be eliminated altogether. Continued research and monitoring of bird collisions and mortality at the site of the proposed tower is recommended. As described in **Section 2.2.3.2**, such research and monitoring could include allowing access to the proposed tower site by USFWS personnel, researchers, and/or other visitors with a pertinent interest in the interaction of birds or other wildlife with the proposed tower. In addition, the USAF is preparing and would implement an avifauna and protected avian species monitoring and mitigation plan in consultation with interested stakeholders. A copy of the draft monitoring and mitigation plan is included in **Appendix C**. With implementation of these mitigation and monitoring measures, impacts on special status species of birds would be less than significant.

The USAF has consulted with the USFWS in accordance with Section 7 of the ESA to determine effects on federal-listed species of birds potentially resulting from the Proposed Action. In an email dated April 11, 2017 the USFWS concurred with the USAF's determination that the Proposed Action may affect, but is not likely to adversely affect rufa red knots and piping plovers occurring at Wallops Island. Copies of correspondence relevant to this consultation are included in **Appendix A.**

Terrestrial Mammals

None of the activities included in Alternative 1 involve the purposeful take of individual northern long-eared bats. However, construction activities and the presence of associated cranes or other equipment have the potential to disorient individual northern long-eared bats during the project's construction phase, adversely affecting their navigation, flight, and/or feeding patterns. Similarly, individual northern long-eared bats could be affected by the presence of the tower structure and associated guy wires during the operational phase of Alternative 1.

The construction and operation of the proposed tower would not involve the disturbance or removal of known maternity roost trees or trees within 150 feet of known maternity roost trees, nor would it disturb or destroy winter hibernacula or trees within 0.25 mile of winter hibernacula. To minimize adverse impacts on the northern long-eared bat during the construction or periodic maintenance of the proposed tower, the USAF would adhere to the following avoidance and minimization measures:

- To the greatest extent possible, trees on the Alternative 1 site potentially providing habitat for the northern long-eared bat would not be removed between June 1 and July 31 of any year.
- Should the USAF determine that the removal of trees three inches diameter at breast height (DBH) or greater is required between June 1 and July 31, it would either:

  1. Conduct a bat emergence survey (one surveyor per 10 trees) one to two days prior to the scheduled tree removal; or

  2. Conduct a presence/absence survey of the affected area, employing a qualified bat surveyor.

All survey results would be provided to the USFWS. If the removal of maternal roost trees occupied by northern long-eared bats is planned between June 1 and July 31, additional consultation with the USFWS would be required.

While components of the Proposed Action could result in incidental take of individual northern long-eared bats, particularly from individuals colliding with the tower during its operational phase, such effects are anticipated to remain minimal and would not threaten the continued propagation of the species. Energy emitted by equipment mounted on the tower is not anticipated to adversely affect individual northern long-eared bats flying near the tower. Based on the information presented in **Section 3.2.2.2,** *Terrestrial Mammals*, the presence and operation of communication towers is not a primary influence on the mortality of northern long-eared bats. The relocation of the telemetry dish would have no impacts on the northern long-eared bat, as the dish would be installed on existing infrastructure elsewhere at WFF. For these reasons, short- and long-term impacts on the northern long-eared bat resulting from Alternative 1 would be negligible.

The USAF has consulted with the USFWS in accordance with Section 7 of the ESA to determine effects on the northern long-eared bat potentially resulting from the Proposed Action. In an email dated April 11, 2017 the USFWS concurred with the USAF's determination that the Proposed Action may affect, but is not likely to adversely affect, northern long-eared bats occurring at Wallops Island. Copies of correspondence relevant to this consultation are included in **Appendix A.**

Alternative 2: Building X-079 Site

Impacts on special status bird species and the northern long-eared bat resulting from Alternative 2 would be similar to those described for the Preferred Alternative, as the alternative sites are ecologically similar and located in proximity to one another.

3.3 SOCIAL ENVIRONMENT

This section describes resources of the social environment that could be affected by the alternatives considered. Social resources discussed in this section include health and safety, cultural resources, and visual quality and aesthetics.

3.3.1 HEALTH AND SAFETY

Health and safety refers to polices, programs, and practices are intended to protect workers and ensure that conditions in the workplace are not harmful to their health and well-being.

3.3.1.1. Regulatory Context

The Occupational Safety and Health Act of 1970 (OSH Act) requires public- and private-sector employers to provide safe workplaces for their employees. OSHA was established by the OSH Act and is the primary federal agency for the establishment and enforcement of standards to ensure safe and healthful conditions for workers in the United States. Workplace safety and health standards established by OSHA are generally administered through federal and state laws and implemented in the health and safety guidelines of government agencies and private companies.

Requirements of the OSH Act are administered by NASA in NASA Procedural Requirement 8715.1A, *NASA Occupational Safety and Health Programs* and by the USAF in Air Force Instruction 91-203, *Air Force Consolidated Safety Instruction* dated 15 June 2013 (incorporating Change 1, October 26, 2016).

3.3.1.2. Affected Environment

Human health and safety issues at WFF encompass workers' health and safety during operational, construction, and maintenance activities; public safety during those same activities; requirements for proper handling and storage of hazardous and potentially explosive substances, and establishment of safety buffers around facilities where such substances are stored or used; and terrestrial and aerial clearance requirements for aircraft and spacecraft operations. With sufficient planning and foresight, safety and accident hazards can generally be identified and minimized or eliminated, and physical safety requirements can be incorporated into the siting and design of facilities.

The WFF Safety Office plans, develops, and provides functional management of policies and procedures for safety and establishes and approves safety precautions for the protection of the public, NASA personnel, contractors, and civilians. The Safety Office's Ground Safety Group plans, develops, and implements facility programs and controls for the safety of personnel, protection of property, and reliable operations of facilities. Day-to-day institutional operations and maintenance activities conducted at WFF are performed in accordance with applicable NASA institutional safety and mission assurance programs and controls. Safety controls are established to minimize the potential hazards associated with institutional and workplace activities.

Construction, demolition, and facility improvement projects are ongoing activities at WFF. All contractors performing construction activities are required to submit and abide by a health and safety plan and are responsible for following applicable OSHA regulations. All construction activities must be conducted in a manner that does not pose any risk to workers, personnel, or bystanders. Industrial hygiene programs address exposure to hazardous materials, use of personal protective equipment, and use and availability of Material Safety Data Sheets.

Three local emergency medical service facilities are located in the vicinity of WFF. WFF has its own health unit with a full-time nursing staff and a full-time physician to provide first aid and immediate assistance to patients in emergency situations. The WFF health unit operates daily from 8:00 a.m. to 4:30 p.m. After-hours emergency medical care is provided by Emergency Medical Services staff of the WFF Fire Department. The Chincoteague Community Health Center and the Chincoteague Island Medical Center, both located on Chincoteague Island, and the Atlantic Community Health Center in Oak Hall, Virginia, also provide emergency assistance, and are all located within close proximity to WFF.

Neither of the alternative sites are located within clearance zones or overlay districts associated with the WFF airfield on Main Base, nor are the sites located with buffer zones associated with facilities on Wallops Island where hazardous substances are used or stored (NASA 2008). Remediation of hazardous wastes that were formerly present within the boundaries of the Alternative 1 site has been completed, and those areas have been granted closure/NFA by applicable regulatory organizations (see **Section 3.1.6.2**). No hazardous substances exceeding applicable regulatory thresholds that could potentially endanger the health of workers building the proposed tower are known to occur on the Alternative 2 site (see **Section 3.1.6.2**) (Miller, pers. comm., April 12, 2017).

3.3.1.3. Environmental Consequences

No Action Alternative

Under the No Action Alternative, the proposed tower would not be built and existing conditions on Wallops Island would continue. This would have no impact on health and safety at WFF.

Alternative 1 (Preferred Alternative): Building X-015 Site

Implementation of Alternative 1 would have no adverse impacts on health and safety at or in the vicinity of Wallops Island. During the proposed tower's construction phase, worker safety practices would be in accordance with relevant regulations established by the USAF, Navy, NASA, OSHA, and other federal and state agencies. The construction site would be fenced and only accessible to workers and other persons with a need to be there. Thus, any risks to the safety of workers and passers-by would be minimized and no unusual risks would be created.

Through adherence to applicable safety practices, it is anticipated that any injuries to workers during the construction of the proposed tower, if any were to occur, would remain minor and would be within the treatment capabilities of WFF's health unit or health care facilities in the vicinity of WFF. As such, short-term impacts on nearby medical facilities resulting from Alternative 1 would be negligible or non-existent.

The proposed tower would not penetrate clearance zones associated with the WFF airfield on Main Base, and its operation would not require the establishment of new hazardous substance or explosive buffer zones on Wallops Island. Similarly, equipment on the proposed tower would not emit energy that would be harmful to the health of people working nearby, nor would the tower's operation generate hazardous substances that could adversely affect human health. The installation and removal of equipment on the tower, and the periodic maintenance of such equipment, the tower itself, its associated ground-level support equipment, and the guy wires, would be conducted in accordance with all applicable USAF, Navy, NASA, federal, and state health and safety regulations. For these reasons, the Proposed Action would have no long-term impacts on health and safety at Wallops Island.

Alternative 2: Building X-079 Site

Short-term and long-term impacts resulting from Alternative 2 would be similar to the Preferred Alternative, with one exception: guy wires associated with the tower would cross Seawall Road along the eastern side of the Alternative 2 site between the tower itself and one or more guy wire anchor points located east of Seawall Road (see **Figure 2-2**). The lowest of the guy wires would be mounted at an elevation sufficient to allow traffic to pass freely below, and Seawall Road would remain an active roadway. However, while the risk to vehicles and passerby posed by the presence of the guy wires over the road would be manageable, it would nonetheless remain marginal. Therefore, Alternative 2 would have negligible impacts on health and safety in the long term.

3.3.2 CULTURAL RESOURCES

Cultural resources are defined as prehistoric or historic sites, buildings, structures, objects, or other physical evidence of human activity that are considered important to a culture or community for scientific, traditional, or religious reasons.

3.3.2.1. Regulatory Context

The NHPA of 1966, as amended, outlines federal policy to protect historic properties and promote historic preservation in cooperation with other nations, tribal governments, states, and local governments. Section 106 of the NHPA and its implementing regulations require federal agencies to consider the effects of their proposed actions on historic properties before undertaking a project. Under Section 106, federal agencies are responsible for delineating the Area of Potential Effects (APE) in which impacts from a proposed action may occur; identifying historic properties present within the APE; assessing the potential effects of the undertaking on those historic properties; and considering ways to avoid, minimize, and mitigate any adverse effects. Federal agencies are further required to initiate consultation with the SHPO for actions that may impact historic properties; VDHR serves as the SHPO for the Commonwealth of Virginia.

3.3.2.2. Affected Environment

Archaeological and Architectural Resources

In December 2014, NASA, VDHR, and the Advisory Council on Historic Preservation, in consultation with Native American tribes, executed a Programmatic Agreement (PA) for the management of facilities, infrastructure, and sites at WFF (NASA 2014b). The PA sets forth a streamlined process for NASA's compliance with Section 106 of the NHPA when agreed-upon criteria are met and procedures in the PA are followed. Appendix G of the PA defines activities occurring at WFF with limited potential to affect historic resources including launch/flight operations, new construction that does not directly impact or alter identified archaeological sites, and ground disturbance in areas having low archaeological sensitivity as identified in a cultural resources assessment prepared for WFF in 2003 (NASA 2003).

In consultation with VDHR, the direct APE for the analysis of physical impacts on historic properties potentially resulting from the Proposed Action was defined as the tower footprint and any associated cable runs and equipment shelters. A three-mile radius around the proposed tower, extended to include the Assateague Beach Coast Guard Station, was defined as the indirect APE for assessing visual impacts on nearby historic properties potentially resulting from the Proposed Action. The indirect APE is shown on **Figure 3-12**.

No architectural resources or archaeological sites have been documented within the direct APE of the action alternatives (NASA 2016c). Both alternative sites are located in areas identified in the 2003 cultural resources assessment as having low archaeological sensitivity.

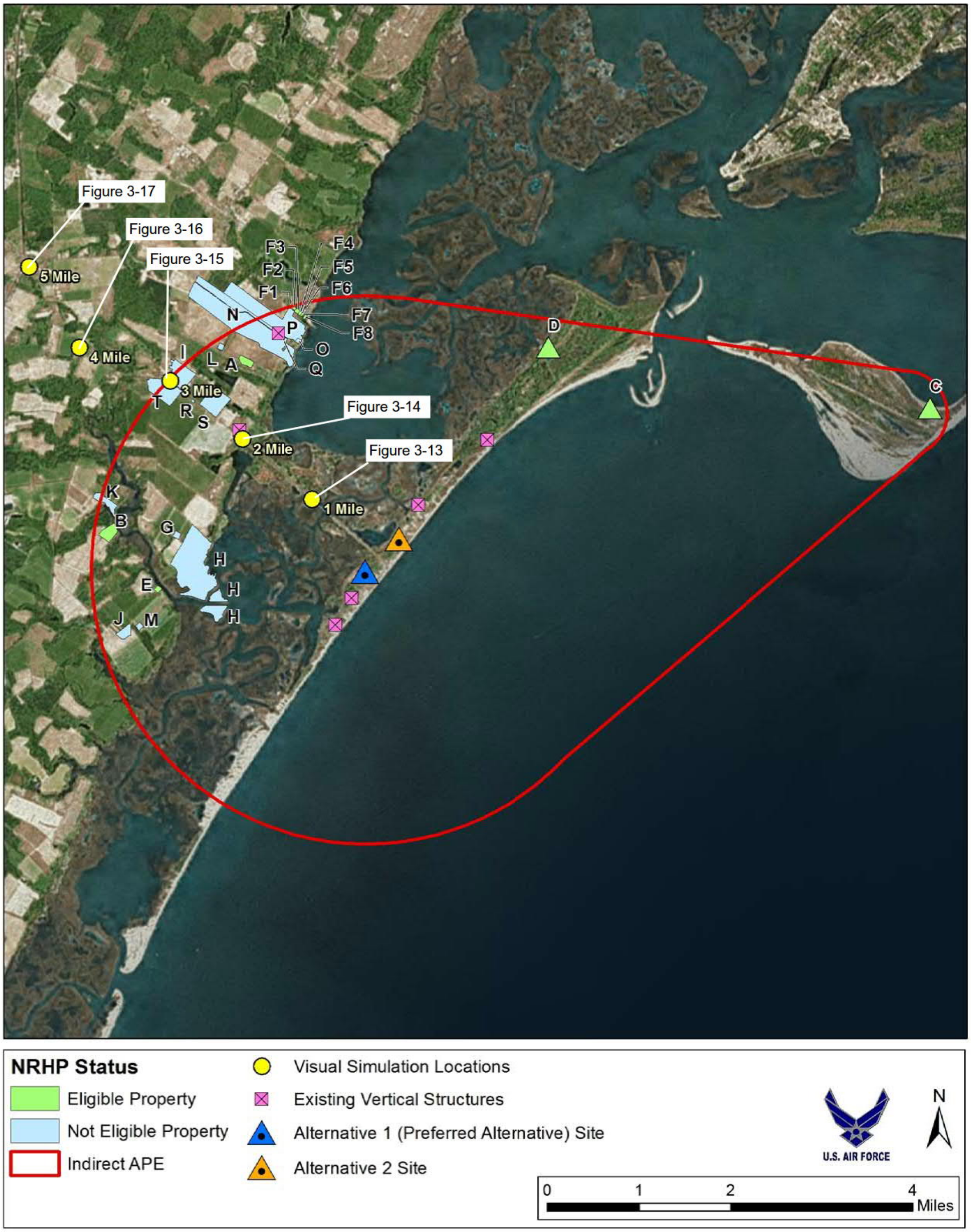
Twenty-seven architectural resources, 50 years and older, within the indirect APE were surveyed in a cultural resources assessment prepared by NASA in 2016 (NASA 2016c) to assess effects potentially resulting from Alternative 1. Sixteen properties included in the 2016 assessment had not been previously evaluated. Properties evaluated in the 2016 assessment are summarized in **Table 3-6**. Map symbols included in the first column of **Table 3-6** correspond to the locations of 27 of the 28 resources shown on **Figure 3-12**[6].

Within the indirect APE, two properties were previously listed in the NRHP and Virginia Landmarks Registry (VLR), and two had been previously identified as eligible for listing in the NRHP. Two properties that had not been previously surveyed, consisting of one individual historic property and one historic district comprising eight architectural resources, were recommended as eligible for listing in the NRHP and VLR by the 2016 assessment (NASA 2016c).

With the exception of the Wallops Beach Life Saving Station and Observation Tower, none of the NRHP-listed, eligible, and recommended eligible properties evaluated in the assessment are located on Wallops Island. All of the NRHP-listed, eligible, and recommended eligible properties are located more than two miles from the alternative sites. The remaining 14 resources evaluated in the 2016 assessment, all of which had not been previously evaluated, were determined not eligible for listing in the NRHP. No further cultural resource investigations with respect to the Proposed Action were recommended by the 2016 assessment. VDHR concurrence with these findings is pending.

[6] Note that the NRHP-listed Assateague Lighthouse is located outside the indirect APE, approximately 8.4 miles northeast of the action alternatives and is not shown on **Figure 3-12**.

Figure 3-12: Indirect APE of the Alternative 1 Site and Associated Architectural Resources



Sources: Spatial Data courtesy of NASA (2016); Esri (2016) Disclaimer: No warranty is made by AECOM as to the accuracy, reliability, or completeness of these data for individual use or aggregate use with other data. This map is a "living document", in that it is intended to change as new data become available and is incorporated into the GIS database.

Table 3-6: Summary of Properties Evaluated in the 2016 Cultural Resources Assessment

Map Symbol	VDHR No.	Name	Property Type	NRHP Status
A	001-0052	Mount Wharton	Residential, 1772 Dwelling	**NRHP Eligible, SHPO Opinion 2008**
B	001-0050	Wharton Place	Residential, 1797 Dwelling	**NRHP-Listed 1972, VLR Listed 1972**
C	001-0172	Assateague Beach Coast Guard Station	Military/Defense, 1922 Dwelling	**NRHP-Listed 2015, VLR Listed 1973**
(not shown on **Figure 3-12**)	001-0078	Assateague Lighthouse	Government, 1867 Lighthouse	**NRHP-Listed 1973, VLR Listed 1973**
D	001-0027-0100/ 001-0027-0101	Wallops Beach Life Saving Station and Observation Tower	Military/Defense, 1936 Dwelling/Tower	**NRHP Eligible, SHPO Opinion 2005**
E	Not Applicable (NA)	31545 Point Breeze Lane	Residential, Circa 1890 Dwelling	**Recommended NRHP and VLR Eligible**
F1	NA	Wisharts Point Historic District	Residential, 1900 Dwelling	**Recommended NRHP and VLR Eligible**
F2			Residential, 1920 Dwelling	
F3			Residential, 1920 Dwelling	
F4			Residential, 1920 Dwelling	
F5			Residential, 1920 Dwelling	
F6			Residential, 1900 Dwelling	
F7			Residential, 1920 Dwelling	
F8			Residential, 1900 Dwelling	
G	NA	NA	Residential, 1900 Dwelling	Not Eligible
H	NA	NA	Residential, 1920 Dwelling	Not Eligible
I	NA	NA	Residential, 1920 Dwelling	Not Eligible
J	NA	NA	Residential, 1920 Dwelling	Not Eligible
K	NA	NA	Residential, 1920 Dwelling	Not Eligible
L	NA	NA	Residential, 1900 Dwelling	Not Eligible
M	NA	NA	Residential, 1920 Dwelling	Not Eligible
N	NA	NA	Residential, 1900 Dwelling	Not Eligible
O	NA	NA	Residential, 1900 Dwelling	Not Eligible
P	NA	NA	Residential, 1910 Dwelling	Not Eligible
Q	NA	NA	Residential, 1918 Dwelling	Not Eligible
R	NA	NA	Residential, 1930 Dwelling	Not Eligible
S	NA	NA	Residential, 1768 Dwelling	Not Eligible
T	NA	NA	Residential, 1930 Dwelling	Not Eligible

Source: NASA 2016c.

Traditional Cultural Resources

No traditional cultural resources have been documented or are otherwise known to exist on Wallops Island. As part of the public scoping process for this EA, the USAF sent letters to the Pocomoke Indian Nation, Catawba Indian Nation, and Pamunkey Indian Tribe requesting information on any potential tribal interest that might be affected by the Proposed Action. Copies of these letters are included in **Appendix A**.

In its response dated March 8, 2016, the Catawba Nation stated that it has no immediate concerns with regard to traditional cultural properties, sacred sites or Native American archaeological sites within the boundaries of the proposed project areas. In addition, the Catawba Nation requested that it be notified if Native American artifacts and/or human remains are located during ground-disturbing activities associated with the Proposed Action. A copy of the Catawba Nation's response is included in **Appendix A**.

To date, no responses from the Pocomoke Indian Nation and the Pamunkey Indian Tribe have been received.

3.3.2.3. Environmental Consequences

No Action Alternative

Under the No Action Alternative, the proposed instrumentation tower would not be built and existing conditions at Wallops Island would continue. This would have no effect on cultural resources.

Alternative 1 (Preferred Alternative): Building X-015 Site

All ground disturbance associated with Alternative 1 would occur within areas modeled as having low sensitivity for prehistoric and historic archaeological sites. As such, it is anticipated that no archeological resources would be encountered. Ground disturbance associated with Alternative 1 would be conducted in accordance with the terms of the 2014 PA described in **Section 3.3.2.2**.

In the event that previously unknown archaeological artifacts or human remains are encountered during ground disturbing activities associated with Alternative 1, the USAF's contractor would be required to halt work and immediately contact WFF's Historic Preservation Officer. The WFF Historic Preservation Officer would, in accordance with the 2014 PA, consult with VDHR to: 1) determine the significance of the resource, 2) evaluate the effects of the undertaking on the resource, and 3) identify the appropriate avoidance or mitigation measures.

The 2016 cultural resources assessment noted that the proposed tower would have the potential to be visible from the six listed or eligible properties and the one eligible historic district evaluated in the assessment (NASA 2016c). These properties are summarized in **Table 3-7.**

Table 3-7: Listed or Eligible Properties and Historic District from Which the Preferred Alternative would be Visible

Map Symbol[1]	VDHR No.	Name	Property Type	NRHP Status
A	001-0052	Mount Wharton	Residential, 1772 Dwelling	**NRHP Eligible, SHPO Opinion 2008**
B	001-0050	Wharton Place	Residential, 1797 Dwelling	**NRHP-Listed 1972, VLR Listed 1972**
C	001-0172	Assateague Beach Coast Guard Station	Military/Defense, 1922 Dwelling	**NRHP-Listed 2015, VLR Listed 1973**
(not shown on **Figure 3-12**)	001-0078	Assateague Lighthouse	Government, 1867 Lighthouse	**NRHP-Listed 1973, VLR Listed 1973**
D	001-0027-0100/ 001-0027-0101	Wallops Beach Life Saving Station and Observation Tower	Military/Defense, 1936 Dwelling/Tower	**NRHP Eligible, SHPO Opinion 2005**
E	NA	31545 Point Breeze Lane	Residential, Circa 1890 Dwelling	**Recommended NRHP and VLR Eligible**
F1	NA	Wisharts Point Historic District	Residential, 1900 Dwelling	**Recommended NRHP and VLR Eligible**
F2			Residential, 1920 Dwelling	
F3			Residential, 1920 Dwelling	
F4			Residential, 1920 Dwelling	
F5			Residential, 1920 Dwelling	
F6			Residential, 1900 Dwelling	
F7			Residential, 1920 Dwelling	
F8			Residential, 1900 Dwelling	

Note:
1. Symbols correspond to locations shown on **Figure 3-12**.
Source: NASA 2016c.

Figure 3-13 through **Figure 3-17** were included in the 2016 assessment and present simulations of how the proposed tower would potentially appear at various distances from the Alternative 1 site. These figures are keyed to the locations indicated in the callouts on **Figure 3-12**. The 2016 assessment determined that Alternative 1 would not adversely affect the six NRHP-listed or eligible historic properties and one NRHP-eligible historic district listed in **Table 3-7**.

The relocation of the telemetry dish included in Alternative 1 would have no indirect effects on the viewsheds of surrounding listed or eligible properties or districts, as the dish would be installed on existing infrastructure in a previously developed area of the installation. Its appearance would be consistent with other facilities and equipment that support the missions of WFF and its tenants.

No traditional cultural resources have been documented or are otherwise known to exist on Wallops Island. Thus, it is anticipated that Alternative 1 would have no effects on traditional cultural resources.

The USAF is currently consulting with the VDHR in accordance with Section 106 of the NHPA. The preparation of a Phase II analysis by the USAF and NASA to further assess the eligibility of the Wisharts Point Historic District is pending.

The USAF and NASA have determined that the Proposed Action would not adversely affect NRHP-listed or eligible properties within the indirect APE. Concurrence with this determination by the VDHR is pending. Copies of correspondence relevant to Section 106 consultation for the Proposed Action are included in **Appendix A**.

Figure 3-13: Photo-simulation of Alternative 1 from 1 Mile

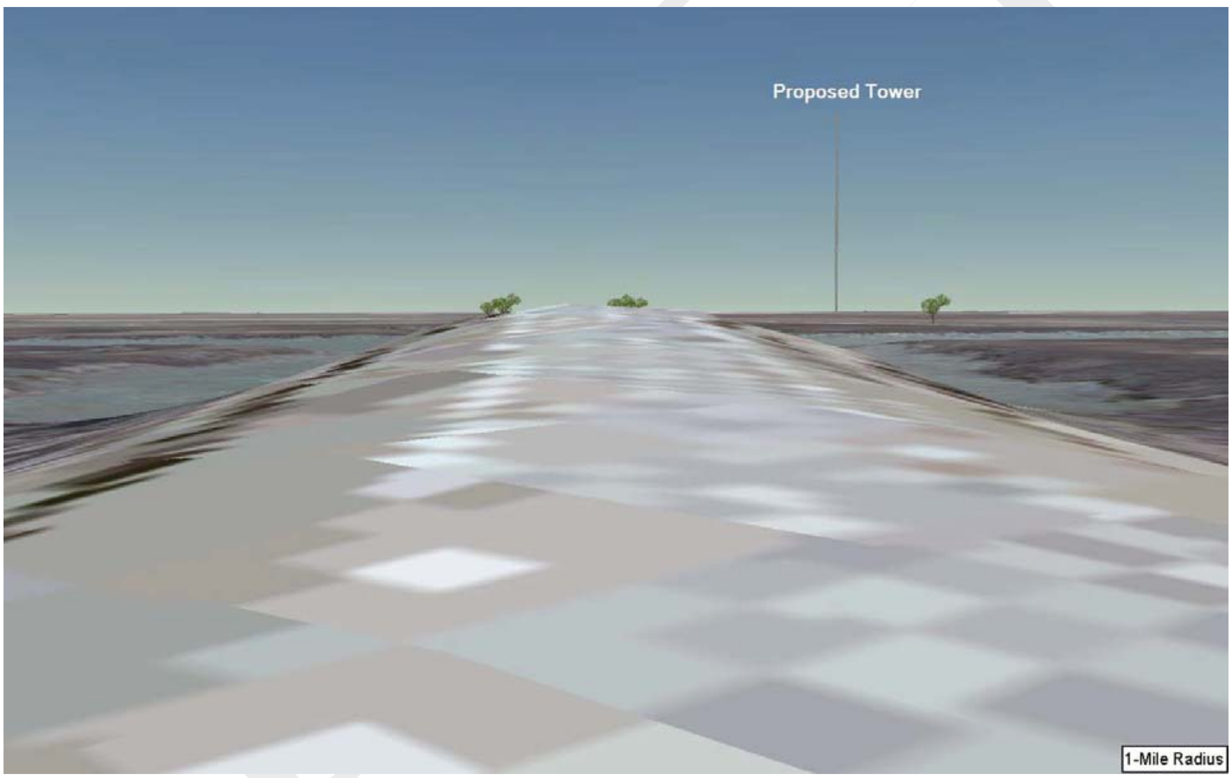


Figure 3-14: Photo-simulation of Alternative 1 from 2 Miles

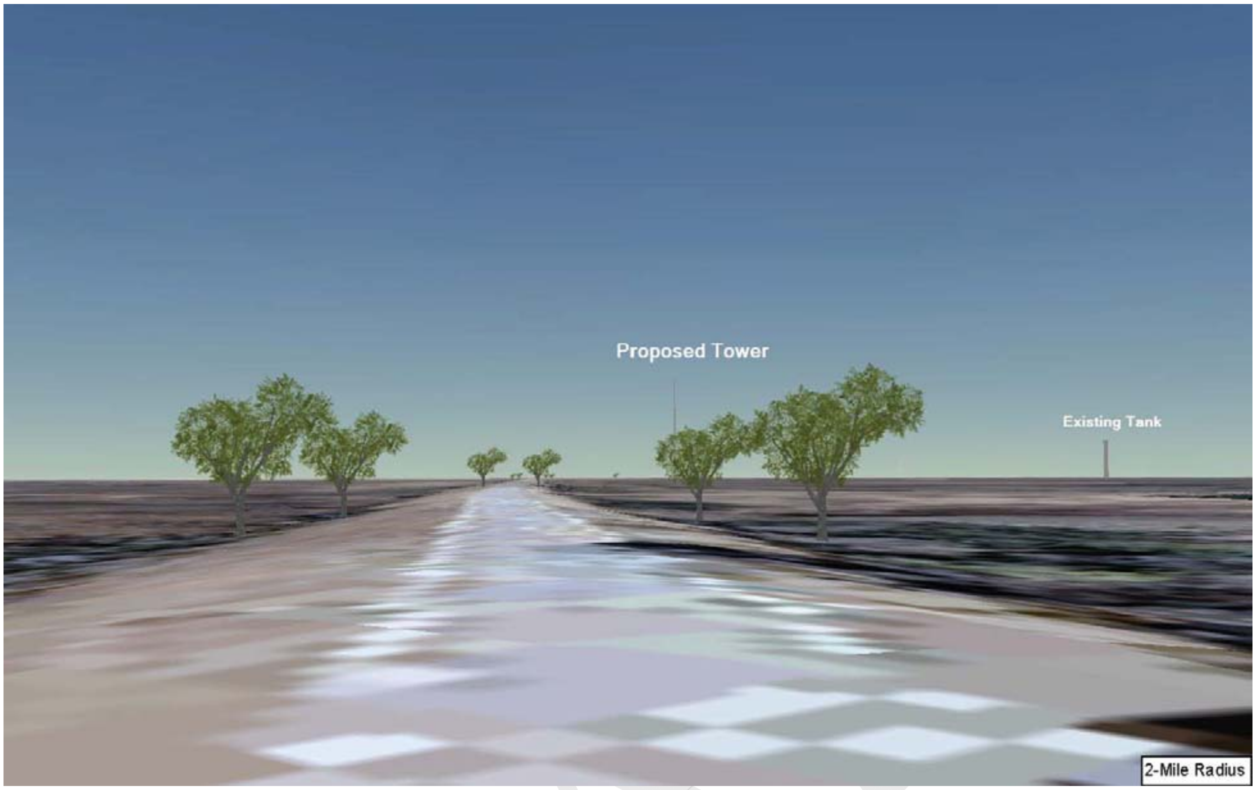


Figure 3-15: Photo-simulation of Alternative 1 from 3 Miles

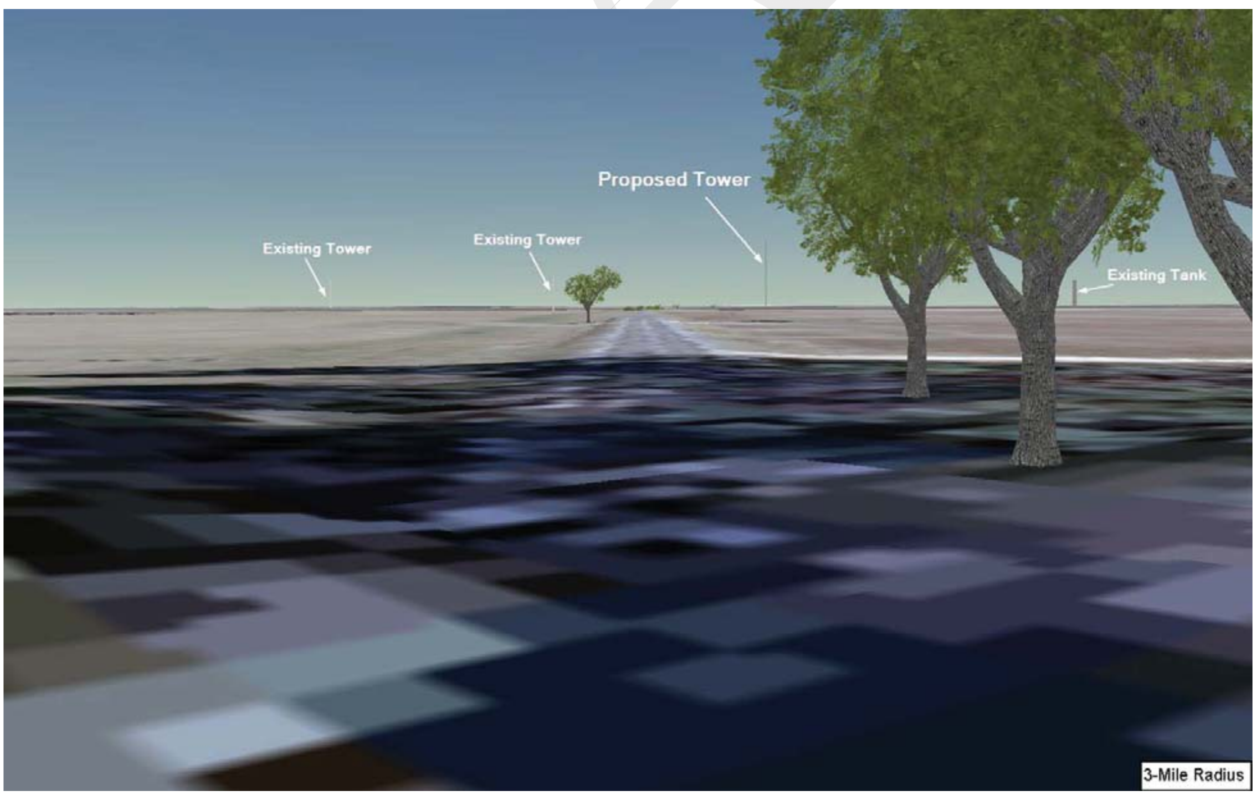


Figure 3-16: Photo-simulation of Alternative 1 from 4 Miles

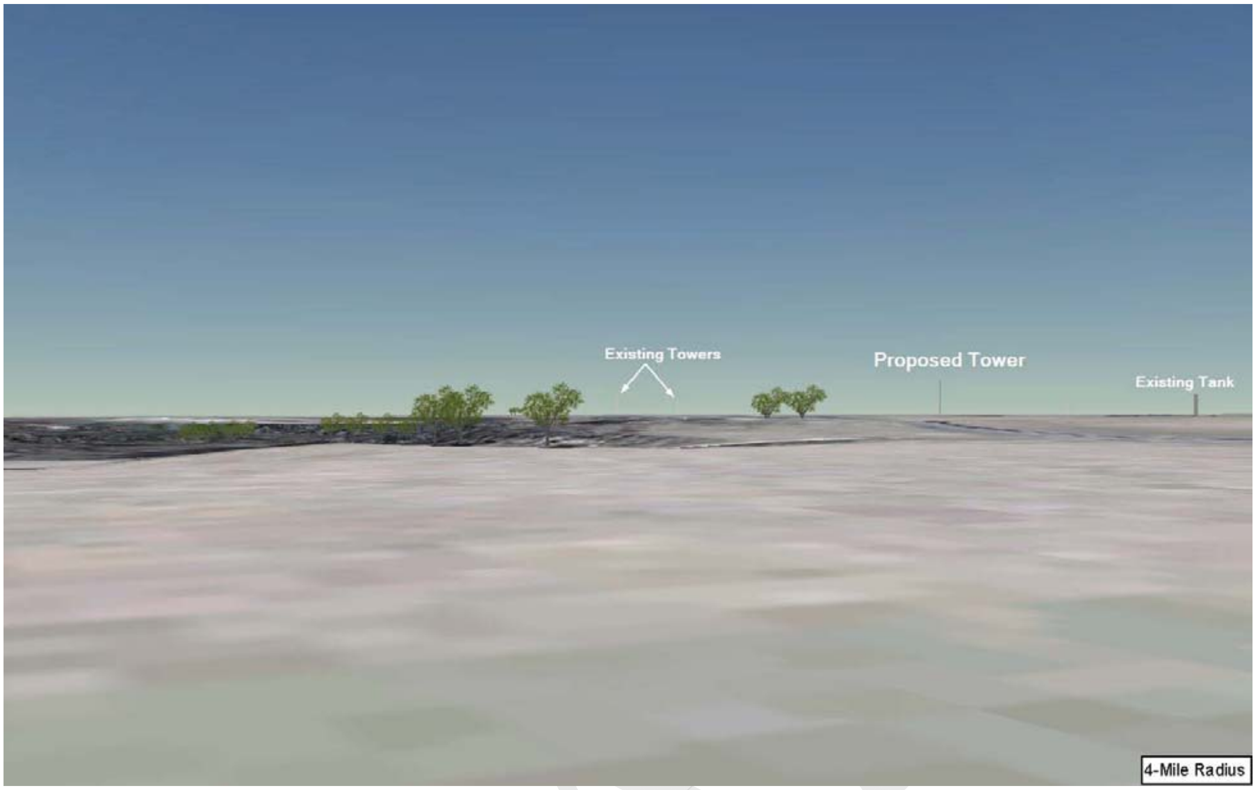
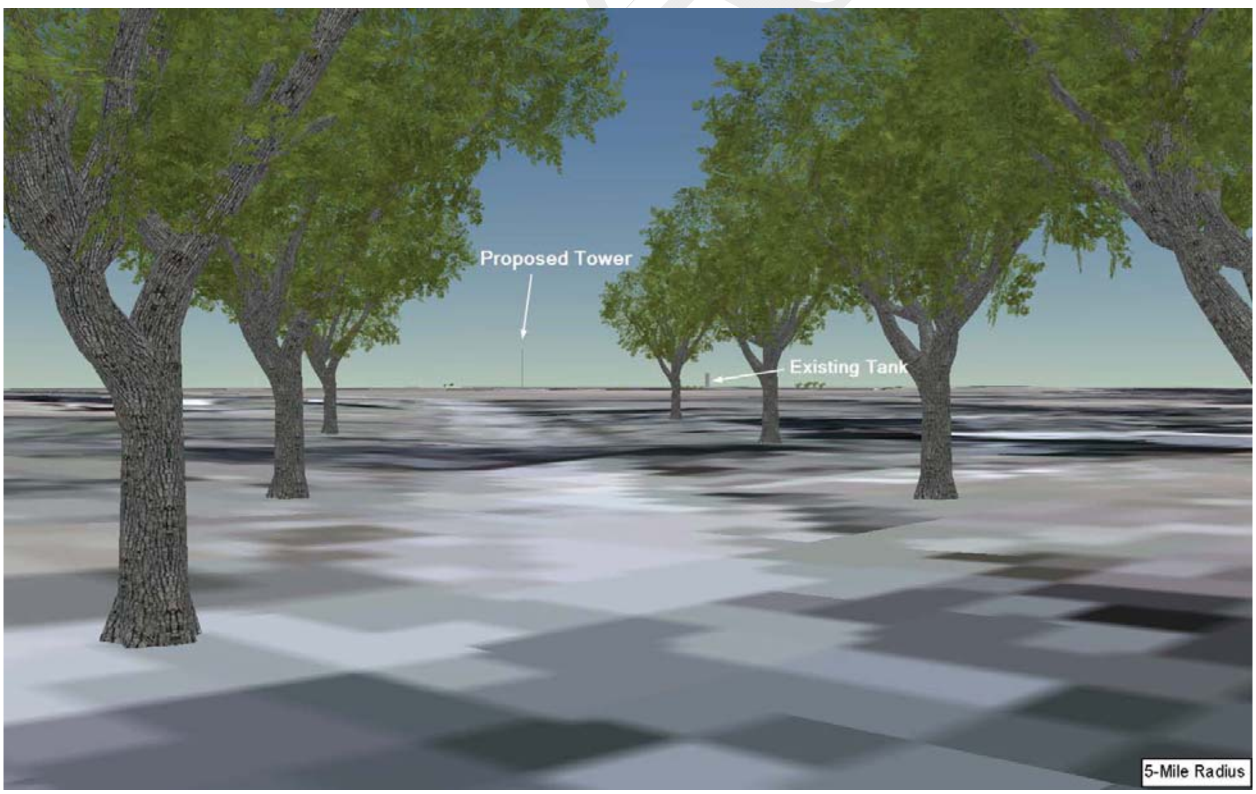


Figure 3-17: Photo-simulation of Alternative 1 from 5 Miles



Alternative 2: Building X-079 Site

Similar to the Preferred Alternative, all ground disturbances resulting from Alternative 2 would occur within areas modeled in the 2003 WFF cultural resources assessment as having low sensitivity for prehistoric and historic archaeological sites. As such, it is anticipated that no archeological resources would be encountered. Ground disturbance associated with Alternative 2 would be conducted in accordance with the terms of the 2014 PA described in **Section 3.3.2.2**. In the event that previously unknown archaeological artifacts or human remains are identified during the construction of the Proposed Action, the USAF's contractor would be required to halt work and immediately contact WFF's Historic Preservation Officer.

Although the 2016 assessment only evaluated effects on historic properties within the indirect APE for the Preferred Alternative, it is anticipated that effects from a tower built on the Alternative 2 site would be similar to those described for the Preferred Alternative based on the proximity of the sites to each other and their similar topography and elevation. Thus, Alternative 2, although potentially visible from the six NRHP-listed or eligible properties and one NRHP-eligible historic district summarized in **Table 3-7**, would have no adverse effects on those properties or district. Concurrence with this determination by VDHR is pending. Copies of correspondence relevant to Section 106 consultation for the Proposed Action are included in **Appendix A**.

No effects on traditional cultural resources resulting from the implementation of Alternative 2 are anticipated.

3.3.3 VISUAL QUALITY AND AESTHETICS

3.3.3.1. Regulatory Context

NEPA requires the consideration of visual resources when analyzing the potential effects of a federal proposed action. The affected environment for visual resources and aesthetics includes areas on and outside Wallops Island and WFF from which the proposed tower would potentially be visible.

3.3.3.2. Affected Environment

The visual environment of Virginia's and Maryland's Eastern Shore in the vicinity of WFF is characterized by predominantly rural, low density development that includes agricultural lands, wooded areas, small towns, scattered commercial and light industrial uses, and single family residences. Buildings and structures are generally low in height, with the exception of some light industrial facilities and agricultural-related structures, such as silos. Concentrations of development are infrequent and are generally located along U.S. Highway 13, which is the primary north-to-south highway along the Eastern Shore in Maryland and Virginia.

Fifteen free-standing or guyed towers registered with the FCC ranging in height from approximately 193 to 500 feet are located in Accomack County, Virginia (FCC 2016). Five of these towers exceed 330 feet, with three located within a 10-mile radius of Wallops Island. These include a guyed tower 500 feet in height located approximately 7.5 miles northeast on Chincoteague Island, a 330-foot guyed tower located approximately 7.6 miles to the southwest near Metompkin, and a 476-foot guyed tower located approximately five miles to the west in Mappsville (FCC 2016). In addition, 12 communication towers exceeding 100 feet in height are located at WFF; of these, one is 200 feet tall, and two exceed 300 feet in height (NASA 2017).

Visual characteristics at Wallops Island consist of relatively low-rise administrative, maintenance, and warehouse-type facilities ranging in height from approximately one to three stories, as well as a number of elevated structures substantially greater in height. Such taller structures include water tanks, communications towers, and rocket launch pad gantries. Two such structures, an existing 335-foot tall, free-standing communications tower and a 300-foot tall water tower, are located near the alternative sites. **Figure 3-18** illustrates variations in height among structures on Wallops Island and the island's overall visual character, as viewed from the south.

Figure 3-18: Variations in Structure Heights and Overall Visual Character of Wallops Island

As shown in **Figure 3-13** through **Figure 3-17,** a number of the taller structures on Wallops Island are visible at varying distances as an observer approaches Wallops Island from the northwest. Existing elevated structures are distributed across the island, thereby avoiding concentrations of visual “clutter” in any particular area. Generally, the visual environment of Wallops Island is characterized by administrative and light-industrial buildings and structures that support the operations of NASA and its tenants and whose appearance corresponds to their functionality and use. No pristine or particularly unique vistas or viewsheds have been documented at Wallops Island.

3.3.3.3. Environmental Consequences

No Action Alternative

Under the No Action Alternative, the proposed instrumentation tower would not be built and existing conditions at Wallops Island would continue. This would have no impact on visual quality and aesthetics at or in the vicinity of Wallops Island.

Alternative 1 (Preferred Alternative): Building X-015 Site

During construction, the appearance of the Alternative 1 site would be characterized by construction vehicles and equipment, areas of cleared vegetation and disturbed soils, and temporary fencing to restrict access to the site by unauthorized personnel. The number, type, and size of vehicles and equipment on the site would vary throughout the project’s construction phase, as would the size and number of areas where vegetation and soils would be disturbed. Due to the relatively flat topography on Wallops Island, the appearance of conditions on the site would be limited to observers adjacent to or in the immediate vicinity of the site. Generally, the appearance of the site during the construction phase would be similar to that of other construction projects and similar activities occurring with relative frequency on Wallops Island. Such conditions would not be particularly unusual to personnel and other observers who work at or frequently visit the island. Following the completion of construction, construction-related vehicles and equipment would be removed and areas disturbed during construction would be restored to pre-construction conditions. Thus, Alternative 1 would have negligible short-term impacts on visual quality and aesthetics on Wallops Island.

Once complete, the proposed tower would be the tallest structure visible in comparison to other nearby towers and elevated structures on Wallops Island. A conceptual rendering of the proposed tower on the Alternative 1 site, as viewed from the south, is shown in **Figure 3-19**. In addition, it is likely that the proposed tower would be visible from several miles away (see **Figure 3-13** through **Figure 3-17**). However, the tower would be located in an area of Wallops Island that has been previously developed with other, similar vertical tower structures. The appearance of the proposed tower would be consistent with these other vertical structures on Wallops Island that support the missions of NASA and its partner organizations, and would not contribute to the degradation of an otherwise undisturbed visual landscape. It is likely that the structure of the proposed tower would be virtually indistinguishable at night (although pilot illumination and/or obstruction lighting would be visible). Illumination would be limited to the minimum amount required by the FAA (see **Section 2.2.3.2**).

The proposed relocation of the telemetry dish would have no impacts on the visual quality and aesthetics of WFF, as the dish would be installed on existing infrastructure in a previously developed area of the installation. Its appearance would be consistent with other facilities and equipment that support the missions of WFF and its tenants.

For these reasons, short- and long-term impacts on visual quality and aesthetics on and in the vicinity of Wallops Island resulting from Alternative 1 would be minor.

Figure 3-19: Conceptual Rendering of Proposed Tower on Alternative 1 (Preferred Alternative) Site

Alternative 2: Building X-079 Site

A conceptual rendering of the proposed tower on the Alternative 2 site, as viewed from the south, is shown on **Figure 3-20**. Due to the proximity of the Alternative 2 site to that of Alternative 1, impacts on visual quality and aesthetics resulting from Alternative 2 would be similar to those described for Alternative 1.

Figure 3-20: Conceptual Rendering of Proposed Tower on Alternative 2 Site

3.4 CUMULATIVE EFFECTS

3.4.1 DEFINITION OF CUMULATIVE EFFECTS

The CEQ defines cumulative effects as the "impact on the environment which results from the incremental impact of the action(s) 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" (40 CFR §1508.7). The key function of a cumulative effects analysis is to determine whether other actions are inducing additive stressors on the same resources that may be affected by the Proposed Action under consideration.

The first step in assessing cumulative effects involves defining the scope of the other actions and their interrelationship with the Proposed Action. The scope must consider both geographic and temporal overlaps among the Proposed Action and other actions, as well as the nature of interactions among them.

3.4.2 SCOPE OF THE CUMULATIVE EFFECTS ANALYSIS

The scope of this cumulative effects analysis was defined by four key factors: 1) the relevant cumulative issues (i.e., technical resource areas of potential effect) related to the Proposed Action under consideration in this EA; 2) the geographical boundary (i.e., Region of Influence [ROI]) within which additive effects would be reasonably expected; 3) the temporal boundary during which such effects would be expected to occur; and 4) other actions that could interact with the same resources affected by the Proposed Action. For the cumulative effects analysis conducted for this EA, the ROI is defined as a 10-mile radius around the sites of Alternatives 1 and 2 on Wallops Island, as this is the maximum area within which impacts resulting from the Proposed Action would be reasonably anticipated to have the potential to contribute to cumulative impacts, particularly on avian species, resulting from other similar federal or non-federal actions.

Consistent with CEQ's guidance entitled *Considering Cumulative Effects under the National Environmental Policy Act* (CEQ 1997), the scope of the cumulative effects analysis should be related to the magnitude of the environmental effects of the Proposed Action. Proposed actions of limited scope and impact typically do not require as comprehensive a cumulative effects analysis as proposed actions that have environmental impacts over a large area. Therefore, similar to the methodology employed for deciding those resources to be considered in detail in the **Sections 3.1** through **3.3** of this EA, only those resource areas upon which the Proposed Action would cause measurable effects are considered in detail in this analysis. In consideration of this EA's preceding analyses of potential effects on physical, biological, and social resources, the USAF has determined that the relevant issues to be assessed in this cumulative effects analysis are those that have been addressed in **Sections 3.1** through **3.3** of this EA.

3.4.3 PAST, PRESENT, AND FUTURE ACTIONS

Past and present actions have been incorporated into the discussion of the affected environment for each resource addressed in **Sections 3.1** through **3.3** and, therefore, have been previously considered in the analysis of impacts presented in this EA.

The proposed tower is currently the tallest structure planned for construction and operation on and in the vicinity of Wallops Island, including WFF as a whole. As discussed in **Sections 3.1** through **3.3**, adverse short-term and long-term impacts on resources resulting from the construction and operation of the proposed tower would generally be minor, negligible, or non-existent. Adherence to applicable mitigation and minimization measures would further minimize such impacts. Therefore, with the exception of biological resources (discussed below), the proposed tower would not have the potential to contribute to significant cumulative impacts on resources analyzed in this EA...

The proposed tower would, individually, result in moderate, less-than-significant effects on birds, including both common (i.e., non-protected) and special status bird species. As described in **Section 3.2**, the operation of the proposed tower could have moderately adverse impacts on some birds, although the severity of such impacts would likely vary and would be influenced by a number of factors and characteristics particular to each bird species. Ultimately, it is anticipated that the presence of the proposed instrumentation tower would contribute to increased mortality of birds occurring in the vicinity of Wallops Island as a result of collisions with the tower or its associated guy wires. However, adherence to mitigation measures incorporated into the Proposed Action, including the Avian Monitoring and Mitigation Plan (to be included in **Appendix C** of this EA when available), would minimize impacts on birds resulting from the presence of the proposed tower to the extent possible. As previously noted, the USFWS concurred with the USAF's determination that the proposed tower may affect, but is not likely to adversely affect, protected species occurring in the vicinity of Wallops Island.

Therefore, it is unlikely that the proposed tower would inhibit the continued propagation of special status avian species, nor is it anticipated that the continued propagation of common bird species would be adversely impacted by the proposed tower. For these reasons, impacts on birds resulting from the operation of the proposed instrumentation tower would be, individually, less than significant..

No other towers or vertical structures (i.e., above 199 feet) are currently planned in the ROI. As such, no reasonably foreseeable future actions are proposed that would contribute to additional cumulative effects. As noted above, the conclusions reached for the Proposed Action concerning potential for significant effects, including the concurrence of no adverse effect by the USFWS, include consideration of existing towers and other vertical obstructions already extant in the ROI. Therefore, the Proposed Action, when considered in conjunction with other past, present, and reasonably foreseeable future actions, would not result in significant cumulative effects.

Should other structures, currently unplanned, be constructed in the ROI in the future, additional cumulative effects on avian species could occur. Thus, such currently unforeseen Federal and/or non-Federal actions could similarly contribute to the increased mortality of birds occurring near such structures. As with the proposed tower, the severity of such increases in mortality potentially resulting from future structures would vary and would be contingent on factors such as the height, bulk, density, and operational characteristics of any such structures, as well as the behavior and characteristics of birds interacting with them. The specific effects of each such future tower would need to be carefully evaluated during its planning and review process, as coordinated by the FCC, FAA, or other applicable Federal agencies.

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4 MITIGATION AND MINIMIZATION MEASURES

This section summarizes applicable mitigation and minimization measures that have been incorporated into the Proposed Action and would be adhered to during the construction and/or operation of the proposed instrumentation tower under either action alternative. Project-specific mitigation and minimization measures applicable to common and special-status avian species that are included in the Proposed Action are summarized in **Section 2.2.3** and the Draft Monitoring and Mitigation Plan included in Appendix C of this EA.

- Because construction of the Proposed Action would disturb more than 10,000 square feet of land, the construction contractor would be required to prepare an erosion and sediment control plan in accordance with the Virginia Erosion and Sediment Control Regulations (4 VAC 50-30). If, as the design of the project is finalized, it is determined that one acre or more of land would be disturbed during the construction of the proposed tower, the construction contractor also would be required to obtain a Construction General Permit in accordance with 9 VAC 25-880. Acquisition of the permit would require the preparation of a SWPPP. The WFF SEED Team would review and approve applicable construction and development plans involving land disturbance and would conduct periodic inspections and any necessary enforcement in accordance with the terms of the erosion and sediment control and/or stormwater management plans. Compliance with the requirements set forth in the erosion and sediment control plan, the General Permit, the SWPPP, and oversight from the WFF SEED Team would minimize impacts resulting from construction-related soil erosion and stormwater runoff.

- To minimize emissions of criteria pollutants and GHG during construction activities, the USAF would implement measures such as prohibiting the idling of construction vehicles and equipment for extended periods, and requiring contractors to maintain exhaust systems on construction vehicles and equipment in optimal condition.

- All fuel and oil storage during the operations would comply with VDEQ regulations. If greater than 55 gallons of fuel would be stored on the project site in portable or temporary AST, the following conditions would apply:
  - WFF Facilities Management Division would be notified of the AST;
  - a spill prevention plan would be prepared by the construction contractor; and
  - the AST would be registered with VDEQ if on-site for more than 120 days.

  Inspections of all fuel storage containers would be conducted in accordance with applicable regulations. All fuel storage containers and fuel handling activities would also comply with the requirements of the WFF ICP. Any spills would be reported immediately to the WFF Fire Department at 757-824-1333.

- Following the completion of construction activities, any disturbed areas of the project site not built on or otherwise developed would be returned to a pre-construction condition. As necessary, clean fill soils would be imported to the site if existing soils are determined to be inadequate to support the construction of the proposed tower.

- The USAF's construction contractor would implement and adhere to site-specific BMPs for vehicle and equipment fueling and maintenance as well as spill prevention and control measures in accordance with established NASA requirements. Adherence to such BMPs would ensure that the potential for inadvertent spills of petroleum products during construction activities would be eliminated or remain minimal.

- The extent of impacts on wetlands would be determined during the formal engineering design of the proposed tower. In the event that disturbance of wetlands is required, the USAF would obtain applicable permits from the USACE and other federal and state regulatory agencies; the extent of impacts on wetlands would be reflected in the permit application(s). Adherence to avoidance, compensation, and/or mitigation measures specified in applicable federal and/or state permit(s) during and following the project's construction phase would ensure that impacts on wetlands remain minimal.

- In the event that previously unknown archaeological artifacts or human remains are identified during the construction of the Proposed Action, the USAF's contractor would be required to halt work and immediately contact WFF's Historic Preservation Officer, who would consult with the VDHR to: 1) determine the significance of the resource; 2) evaluate the effects of the undertaking on the resource; and 3) identify the appropriate avoidance or mitigation measures.

- To prevent the accidental introduction of *Phragmites* to the project site during construction of the tower, all tracked equipment involved in earth work would be inspected and cleaned to remove any rhizomes and seeds prior to arrival on the project site. If possible, earth disturbing activities in areas where *Phragmites* is present would be conducted last, or the equipment would be cleaned prior to use on any portion of the site that is known to be free of *Phragmites*. Construction equipment would be cleaned by using physical means and hand tools, such as brushes, brooms, rakes, or shovels, on all track and bucket/blade components to adequately remove all visible dirt and plant debris. If water should be used, the water/slurry would be contained so as to restrict introduction of *Phragmites* rhizomes and seeds into the project site as well as to prevent off-site introduction during debris disposal. Construction vehicle and equipment rinse-out areas would be located in upland areas, and runoff would be contained to minimize or eliminate impacts (NASA 2014a).

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6 AGENCIES AND PERSONS CONSULTED

The following agencies, organizations, and individuals will be notified of the availability of the Draft EA for public and agency review.

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Ms. Kim Damon-Randall	National Marine Fisheries Service, Protected Resources Division
Mr. Charles Bryant	National Oceanic and Atmospheric Administration, Wallops Command and Data Acquisition Station
Mr. Albert McMath	National Oceanic and Atmospheric Administration, Wallops Command and Data Acquisition Station
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LT Joshua Zirbes	U.S. Coast Guard, Sector Field Office Eastern Shore
Mr. Brady Scheib	U.S. Coast Guard, Sector Field Office Eastern Shore
Ms. Barbara Rudnick	EPA, Office of Environmental Programs
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Ms. Lorraine Fechtig	Eastern Shore of Virginia Bird Club
Mr. Victor Klein	Eastern Shore of Virginia Bird Club
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Dr. Birge Reichard	Eastern Shor Master Naturalists
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Mr. Peter Bale	Interested party
Ms. Joelle Buffa	Interested party
Mr. Jay Ford	Interested party
Mr. Randy Fox	Interested party
Ms. Jean Hungiville	Interested party
Ms. Amber Parker	Interested party
Ms. Kathy Phillips	Interested party
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Mr. Denard Spady	Interested party
State Elected Officials	
Senator Lynwood Lewis, Jr.	Virginia Senate
Delegate Robert Bloxom, Jr.	Virginia House of Delegates, District 100

7 PREPARERS AND CONTRIBUTORS

Persons involved in the preparation and review of this EA are listed below.

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[TBD]

URS and Normandeau Associates, Inc.

Name	Education	Role	Years of Experience	Professional Disciplines/Background
		URS		
Scott McClelland, PG	MS, Geology, University of South Carolina, 1987 BA, Geology, Colgate University, 1985	Vice President/ Corporate Sponsor	30	Environmental restoration and compliance; 15+ years of serving as responsible corporate representative for similar contracts
Varna Boyd, RPA	MA, Anthropology, College of William and Mary, 1988 BA, Prehistory, Mary Washington College, 1982	Project Manager	37	Cultural Resources Management; NEPA and NHPA compliance; overall project management
Janet Frey, PG	BA, Geology, Thiel College, 1982	Deputy Project Manager	28	NEPA and environmental planning/permitting/compliance technical lead; EBS technical reviewer
Brian W. Boose, CEP	BS, Biological Sciences/Ecology, University of California, Davis, 1990	Senior NEPA Advisor; Senior QA/QC Reviewer	28	NEPA; experienced in all technical resource area analyses and in conducting cumulative impact analyses
Jennifer Warf	MS, Environmental Studies, University of Charleston, 2003 BA, Zoology, Miami University, 1999	Senior Natural Resources and NEPA Author and Reviewer	16	NEPA; natural resources management, biological resources, wetlands, and water resources impact analyses; environmental permitting

Name	Education	Role	Years of Experience	Professional Disciplines/Background
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Lorin Farris	MA, Historic Preservation, Goucher College, 2012 BA, History, Longwood University, 2001	Cultural Resources Author	13	NHPA; cultural resources analysis
Lynne McMullen	BA, Geography, University of Mary Washington, 2002	Senior Hazardous Materials and Wastes Analyst	15	Environmental compliance, permitting, and due diligence; EBS lead and senior analyst
Brad Borowy	BS, Environmental Science, University of Maryland Baltimore County, 2011 AS, Chemistry, Harford Community College, 2009	Hazardous Materials and Wastes Analyst	5	Environmental investigations and compliance; EBS contributor and analyst
Craig Carver	Master of Urban and Regional Planning (MURP), Virginia Commonwealth University, 2009 BA, Music, Virginia Commonwealth University, 1998	Affected Environment; Environmental Consequences; Document Technical Review	7	NEPA; experienced in general analyses of all technical resource areas
Joseph R. Lemen	MS, Biology, Missouri State University, 2015 BS, Environmental Sciences, University of Texas, 2009	Affected Environment; Environmental Consequences; GIS Mapping & Analysis	8	NEPA; GIS analysis; environmental permitting; endangered species analytical support
Michael Busam	BS, Environmental Science and Policy, University of Maryland College Park, 2014	Technical Editing; Readability Review	1	NEPA; Wildlife Ecology
		Normandeau Associates, Inc.		
Julia Robinson Willmott	RAM London; MA equivalent	Avifauna; Special Status Species Analysis	25	Ornithology; endangered species; NEPA; conservation planning
Adam Kent	MS, Natural Resource Conservation, University of Florida, 1995 BS, History, University of Florida, 1991	Avifauna; Special Status Species Analysis	16	Ornithology; endangered species; NEPA; conservation planning

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Appendix A – IICEP Correspondence

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Appendix A Contents

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Section 7 Consultation Documentation

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Subject: Online Project Review Request, Tower Project at Wallops Island

Date: Tuesday, April 11, 2017 at 2:14:41 PM Eastern Daylight Time

From: Nystrom, Sarah

To: Miller, Shari A. (WFF-2500), Bundick, Joshua A. (WFF-2000), Mitchell, Joel T. (WFF-2500), Meyer, T J (WFF-2500), melanie.anderson@navy.mil, kristina.deer@us.af.mil, Bonsteel, Michael Carroll (WFF-200.C)[LJT AND ASSOCIATES, INC.]

We have reviewed the project package received on March 3, 2017 for the referenced project. The following comments are provided under provisions of the Endangered Species Act of 1973 (16 U.S.C. 1531-1544, 87 Stat. 884), as amended, and Bald and Golden Eagle Protection Act (16 U.S.C. 668-668c, 54 Stat. 250), as amended.

We concur with the determinations provided in the Species Conclusion Table dated March 2, 2017 and have no further comments. Please provide the draft monitoring plan for review prior to implementation. Should project plans change or if additional information on the distribution of listed species or critical habitat becomes available, this determination may be reconsidered. If you have any questions, please contact me at (804) 824-2413, or via email at Sarah_Nystrom@fws.gov.

Thanks!

Sarah

--

Sarah Nystrom
Fish and Wildlife Biologist
Virginia Field Office - Ecological Services
6669 Short Lane
Gloucester, Virginia 23061
(804) 824-2413

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National Aeronautics and
Space Administration

Goddard Space Flight Center
Wallops Flight Facility
Wallops Island, VA 23337

Reply to Attn of: 250.W

March 3, 2017

U.S. Fish and Wildlife Service
Virginia Field Office
6669 Short Lane
Gloucester, Virginia 23061

Re: Online Project Review Request, Tower Project at Wallops Island, Accomack County, Virginia, Consultation Tracking Number: 05E2VA00-2017-SLI-1157

We have reviewed the referenced project using the Virginia Field Office's online project review process and have followed all guidance and instructions in completing the review. We completed our review on February 1, 2017, and are submitting our project review package in accordance with the instructions for further review.

Our proposed action consists of authorizing the U.S. Air Force to install a guyed, multi-use instrumentation tower of approximately 750 feet in height on mid-Wallops Island, between Buildings X-030 and X-015. The tower and associated infrastructure would be sited in a previously developed area, the project site having been configured to avoid permanent impacts to jurisdictional wetlands.

The tower would be a typical 3-sided lattice structure, approximately 44 inches per side, and constructed of galvanized steel. Steel guy wires would be installed along three radii from the tower at angles of 120 degrees from each other. Guys would be required approximately every 80 feet of tower height and would tie into two or three anchor points positioned in line with each of the three radii. Therefore, each of the three guy radii would contain approximately 10 individual guys.

The tower would be lit in accordance with Federal Aviation Administration (FAA) guidelines. However, to minimize the collision risk to nocturnally-active avian species, the tower's lighting scheme would be consistent with the September 14, 2000, *Service Guidance on the Siting, Construction, Operation and Decommissioning of Communications Towers*, as well as a FAA-commissioned study (**Patterson, 2012**) which verified the visibility of more bird-friendly tower lighting configurations (i.e., flashing lights versus steady-burning fixtures) to pilots. Likewise, the guy wires would include visual aerial markers (**Avian Power Line Interaction Committee, 2012**) to reduce the potential for diurnal avian collisions. Associated support structures would use down-shielded, motion-sensitive lighting, comprised of either amber light-emitting diode (LED) or low-pressure sodium lamps.

All structural components of the tower would be pile-supported. Piles could be driven or cast in place. Based upon previous projects on Wallops Island, it is expected that piles would need to be installed to approximately 100 feet depth.

In addition to the tower itself, two small (approximately 10 foot by 20 foot) enclosures would be installed at the base of the tower to house electronics and tower-related appurtenances. Required utility services include electricity and communication, both of which would be tied-in from adjacent existing locations. To provide back-up electricity, a propane-fueled generator (and associated fuel tank) would be installed adjacent to the electronics enclosure. In order to mitigate the potential for flooding during storm events, the enclosure and all supporting equipment would be elevated on piles to at least 11 feet above mean sea level.

The construction phase of the proposed project would likely occur between August 2017 and March 2018. While erecting the tower would require approximately 30 days, other activities, including pile driving and electronics outfitting, would take the majority of the overall installation time. Once installed, the tower is expected to have a lifespan of at least twenty years. Regular maintenance of the tower would be required, and would include tensioning the guy wires, replacing electronics, and trimming vegetation. The location of the project and the action area are identified on the enclosed maps Enclosures 1 and 2).

As the project sponsor, the Air Force is serving as the lead agency for this Endangered Species Act (ESA) consultation with the U.S. Fish and Wildlife Service. NASA and the U.S. Naval Air Warfare Center Aircraft Division would undertake actions connected to the Tower Project and are also participating in this ESA consultation. The effects of their actions are considered in all project-related environmental documentation. As such, please include all three action agencies in future correspondence regarding the Tower Project.

This project review demonstrates all three agencies compliance with the Endangered Species Act (Enclosure 3). The enclosed project review package provides information about the species, critical habitat, and bald eagles considered in our review, the species conclusions table identifies our initial determinations for the resources that may be affected by the project, and the Measures to Mitigate Adverse Effects will be part of the proposed action. The Air Force, NASA, and the Navy, are seeking your agency's concurrence on our determination that the proposed Tower Project "may affect but is not likely to adversely affect" red knot (*Calidris canutus rufa)*, piping plover (*Charadrius melodus)*, and northern long eared bat *(Myotis septentrionalis)*.

Thank you for the consideration of our request. If you have questions or require additional information, please contact me at (757) 824-2327 or Shari.A.Miller@nasa.gov.

Sincerely,

Shari A. Miller

Shari A. Miller
Lead, Environmental Planning

3 Enclosures:

1. Aerial view map depicting proposed action site
2. Conceptual rendering of proposed action
3. Project Review Package

cc:
200/Mr. J. Bundick
250/Mr. T. Meyer
250/Mr. J. Mitchell
NAWCAD/Ms. M. Anderson
USAF/Ms. K. Deer

Literature Cited

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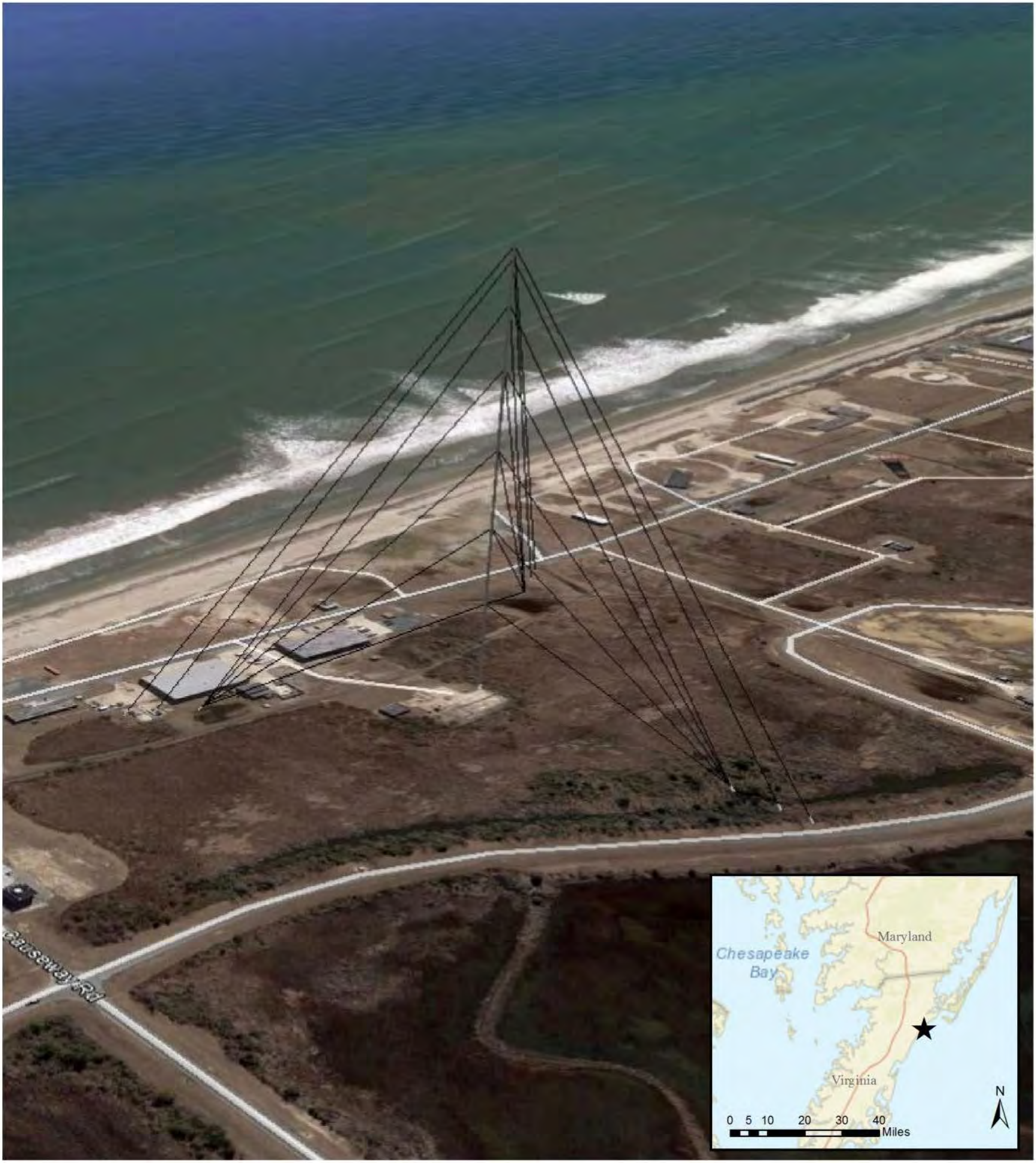
Patterson Jr, J. W. (2012). *Evaluation of New Obstruction Lighting Techniques to Reduce Avian Fatalities*. No. DOT/FAA/TC-TN12/9. 64 pp.



Conceptual Rendering of the X-015 Tower Location (Proposed Action)

U.S. AIR FORCE

Enclosure 1

0 12.5 25 50 75 100 Yards

N

Sources: Spatial Data courtesy of NASA (2016); Esri (2016); Google (2016) Disclaimer: No warranty is made by AECOM as to the accuracy, reliability, or completeness of these data for individual use or aggregate use with other data. This map is a "living document", in that it is intended to change as new data become available and is incorporated into the GIS database.

X-015 Site (Proposed Action)
X-015 Study Area
X-079 Site (Action Alternative)
X-079 Study Area

U.S. AIR FORCE

0 100 200 400 Yards

N

Enclosure 2

Sources: Spatial Data courtesy of NASA (2016); Esri (2016) Disclaimer: No warranty is made by AECOM as to the accuracy, reliability, or completeness of these data for individual use or aggregate use with other data. This map is a "living document", in that it is intended to change as new data become available and is incorporated into the GIS database.

Enclosure 3: Species Conclusions Table

Project Name: Tower Project at Wallops Island

Date: March 2, 2017

Species / Resource Name	Conclusion	ESA Section 7 / Eagle Act Determination	Notes / Documentation
Flowering Plants			
Seabeach amaranth *Amaranthus pumilus*	Species not present No suitable habitat present	No effect	No documented occurrences on Wallops Island (NASA 2016); closest documented occurrence has been at Assateague Island (USFWS 2012), north of the action area.
Avifauna			
Bald eagle *Haliaeetus leucocephalus*	Unlikely to disturb nesting bald eagles Does not intersect with bald eagle concentration area	No Eagle Act permit required	Two active nest exists on Wallops Island, north of the action area (B. Watts, personal communication, 2016).
Piping plover *Charadrius melodus*	Species present Suitable habitat present	Not likely to adversely affect	Piping plovers regularly nest and forage on Wallops, Assateague, Assawoman Island beaches (NASA 2016; USFWS 2012). Under the proposed action, no construction is planned for areas within known piping plover nesting or foraging habitat. However, collision-induced avian mortality (primarily night-migrating passerines) at tall, guyed communication towers has been observed at multiple sites across the U.S. (Longcore et al. 2013). Although comparatively fewer shorebird species mortalities have been reported at communication towers (which could be interpreted as these species being at lower collision risk), little is known about piping plover migration behavior, flight altitude or habitat use (all of which are factors in weighing collision

			risk) within the Atlantic Coast breeding range (USFWS 1996). The majority of Atlantic Coast piping plover migratory movements are thought to take place along a narrow flight corridor including the outer beaches of the coastline, with rare offshore and inland observations (USFWS 1996). Citing a personal communication with A. Hecht, Burger et al. (2011) state that plover visual acuity and maneuverability are known to be good, including night vision (Staine and Burger 1994), suggesting that plovers may be able to identify and avoid structures in their flight paths. USFWS (2008) also indicate that piping plover collisions with fixed structures in the coastal zone, including lighthouses, are rare, if not non-existent in the literature. However, the ability to avoid structures (such as the proposed tower), even if normally good, could be reduced in poor visibility conditions (Burger et al. 2011). In consideration of these facts, it is possible, but extremely unlikely, that migrating plovers would interact with the tower or its guy wires, once erected.
Red knot *Calidris canutus rufa*	Species present Suitable habitat present	Not likely to adversely affect	Red knots regularly forage on Wallops, Assateague, and Assawoman Island beaches during northerly spring migration (NASA 2016). Similar to the discussion regarding piping plovers, the proposed tower would be located outside known foraging habitat (i.e., outside the intertidal zone; Cohen et al. 2010). However, the collision risk during migration cannot be discounted. Citing a personal communication with C. Minton, Burger et al.

			(2011) indicate a red knot cruising altitude of between 1,000 and 3,000 meters above ground level, well above the height of the proposed tower; however, the authors also suggest that the most serious risk comes when northbound long-distance migrants make landfall, movement patterns about which little information exists. Additionally, although visual acuity and maneuverability of red knots are known to be good (L. Niles, personal communication, as cited in Burger et al. 2011; Cohen et al. 2011), inclement weather conditions could increase collision risk. Therefore, because Wallops Island is a known stopover site for northerly migrating red knots, the proposed tower site could present a collision risk for those individuals, whereas those that stop over elsewhere (e.g., Delaware Bay; Karpanty et al. 2011), could be at relatively less risk. Based upon a personal communication with C. Minton, Burger et al (2011) also suggest that southbound (fall) migrants are at comparatively less risk due to their farther offshore flight paths. In consideration of these facts, it is possible, but extremely unlikely, that migrating red knots would interact with the tower or its guy wires, once erected.
Roseate tern *Sterna d. dougallii*	Species not present	No effect	Individuals are rarely observed along the U.S. coast south of New Jersey; may transit through oceanic areas east of the action area during seasonal migration (Nisbet 1984).

Mammals			
Northern Long-Eared Bat *Myotis septentrionalis*	Suitable habitat present	Not likely to adversely affect	Relying upon the findings of the 1/5/2016 Programmatic Biological Opinion on Final 4(d) Rule for the Northern Long-Eared Bat and Activities Excepted from Take Prohibitions (USFWS 2016a) and 6/22/2016 Revised Biological Opinion on Wallops Flight Facility Proposed and Ongoing Operations and Shoreline Restoration/Infrastructure Protection Program (USFWS 2016b) to fulfill our project-specific Section 7 responsibilities.
Herpetofauna			
Atlantic green sea turtle *Chelonia mydas*	Species not present Suitable habitat present	No effect	Action Area is outside sea turtle nesting habitat.
Hawksbill sea turtle *Eretmochelys imbricate*	Species not present No suitable habitat present	No effect	Action Area is outside sea turtle nesting habitat.
Kemp's ridley sea turtle *Lepidechelys kempi*	Species not present Suitable habitat present	No effect	Action Area is outside sea turtle nesting habitat.
Leatherback sea turtle *Dermochelys coriaces*	Species not present Suitable habitat present	No effect	Action Area is outside sea turtle nesting habitat.
Loggerhead sea turtle *Caretta caretta*	Species present Suitable habitat present	No effect	Action Area is outside sea turtle nesting habitat.

Literature Cited

Burger, J., Gordon, C., Lawrence, J., Newman, J., Forcey, G., & Vlietstra, L. (2011). Risk evaluation for federally listed (roseate tern, piping plover) or candidate (red knot) bird species in offshore waters: A first step for managing the potential impacts of wind facility development on the Atlantic Outer Continental Shelf. *Renewable Energy*, *36*(1), 338-351.

Cohen, J. B., Karpanty, S. M., Fraser, J. D., & Truitt, B. R. (2010). The effect of benthic prey abundance and size on red knot (*Calidris canutus*) distribution at an alternative migratory stopover site on the US Atlantic Coast. *Journal of Ornithology*, *151*(2), 355-364.

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Karpanty, S. M., Cohen, J., Fraser, J. D., & Berkson, J. (2011). Sufficiency of horseshoe crab eggs for red knots during spring migration stopover in Delaware Bay USA. *The Journal of Wildlife Management*, *75*(5), 984-994.

Longcore, T., Rich, C., Mineau, P., MacDonald, B., Bert, D. G., Sullivan, L. M., ... & Drake, D. (2013). Avian mortality at communication towers in the United States and Canada: which species, how many, and where? *Biological Conservation*, *158*, 410-419.

NASA. (2016). Wallops Island Protected Species Monitoring Report. December.

Nisbet, I. C. (1984). Migration and winter quarters of North American Roseate Terns as shown by banding recoveries. *Journal of Field Ornithology*, 1-17.

Staine, K. J., & Burger, J. (1994). Nocturnal foraging behavior of breeding Piping Plovers (*Charadrius melodus*) in New Jersey. *The Auk*, 579-587.

USFWS (U.S. Fish and Wildlife Service). (1996). Piping plover (*Charadrius melodus*), Atlantic Coast Population, Revised Recovery Plan. 258 pp. Hadley, Massachusetts.

USFWS. (2008). Final Biological Opinion, Cape Wind Associates, LLC, Wind Energy Project, Nantucket Sound, Massachusetts Formal Consultation # 08-F-0323. November 21. 78 pp. New England Field Office.

USFWS. (2012). *Chincoteague National Wildlife Refuge 2012 Beach Habitat Management Report*.

USFWS. (2016a). Programmatic Biological Opinion on Final 4(d) Rule for the Northern Long-Eared Bat and Activities Excepted from Take Prohibitions. January 5. 103 pp. U.S. Fish and Wildlife Service Regions 2, 3, 4, 5, and 6.

USFWS. (2016b). Revised Biological Opinion on Wallops Flight Facility Proposed and Ongoing Operations and Shoreline Restoration/Infrastructure Protection Program, Accomack County, VA, Project #2015-F-3317. June 22. 103 pp. U.S. Fish and Wildlife Service Regions 2, 3, 4, 5, and 6.

United States Department of the Interior

FISH AND WILDLIFE SERVICE
Virginia Ecological Services Field Office
6669 SHORT LANE
GLOUCESTER, VA 23061
PHONE: (804)693-6694 FAX: (804)693-9032
URL: www.fws.gov/northeast/virginiafield/

Consultation Code: 05E2VA00-2017-SLI-1157 January 12, 2017
Event Code: 05E2VA00-2017-E-01702
Project Name: Tower Project

Subject: List of threatened and endangered species that may occur in your proposed project location, and/or may be affected by your proposed project

To Whom It May Concern:

The enclosed species list identifies threatened, endangered, proposed and candidate species, as well as proposed and final designated critical habitat, that may occur within the boundary of your proposed project and/or may be affected by your proposed project. The species list fulfills the requirements of the U.S. Fish and Wildlife Service (Service) under section 7(c) of the Endangered Species Act (Act) of 1973, as amended (16 U.S.C. 1531 *et seq.*). Any activity proposed on National Wildlife Refuge lands must undergo a 'Compatibility Determination' conducted by the Refuge. Please contact the individual Refuges to discuss any questions or concerns.

New information based on updated surveys, changes in the abundance and distribution of species, changed habitat conditions, or other factors could change this list. Please feel free to contact us if you need more current information or assistance regarding the potential impacts to federally proposed, listed, and candidate species and federally designated and proposed critical habitat. Please note that under 50 CFR 402.12(e) of the regulations implementing section 7 of the Act, the accuracy of this species list should be verified after 90 days. This verification can be completed formally or informally as desired. The Service recommends that verification be completed by visiting the ECOS-IPaC website at regular intervals during project planning and implementation for updates to species lists and information. An updated list may be requested through the ECOS-IPaC system by completing the same process used to receive the enclosed list.

The purpose of the Act is to provide a means whereby threatened and endangered species and the ecosystems upon which they depend may be conserved. Under sections 7(a)(1) and 7(a)(2) of the Act and its implementing regulations (50 CFR 402 *et seq.*), Federal agencies are required to utilize their authorities to carry out programs for the conservation of threatened and endangered species and to determine whether projects may affect threatened and endangered species and/or designated critical habitat.

A Biological Assessment is required for construction projects (or other undertakings having similar physical impacts) that are major Federal actions significantly affecting the quality of the human environment as defined in the National Environmental Policy Act (42 U.S.C. 4332(2)(c)). For projects other than major construction activities, the Service suggests that a biological evaluation similar to a Biological Assessment be prepared to determine whether the project may affect listed or proposed species and/or designated or proposed critical habitat. Recommended contents of a Biological Assessment are described at 50 CFR 402.12.

If a Federal agency determines, based on the Biological Assessment or biological evaluation, that listed species and/or designated critical habitat may be affected by the proposed project, the agency is required to consult with the Service pursuant to 50 CFR 402. In addition, the Service recommends that candidate species, proposed species and proposed critical habitat be addressed within the consultation. More information on the regulations and procedures for section 7 consultation, including the role of permit or license applicants, can be found in the "Endangered Species Consultation Handbook" at:

http://www.fws.gov/endangered/esa-library/pdf/TOC-GLOS.PDF

Please be aware that bald and golden eagles are protected under the Bald and Golden Eagle Protection Act (16 U.S.C. 668 *et seq.*), and projects affecting these species may require development of an eagle conservation plan (http://www.fws.gov/windenergy/eagle_guidance.html). Additionally, wind energy projects should follow the wind energy guidelines (http://www.fws.gov/windenergy/) for minimizing impacts to migratory birds and bats.

Guidance for minimizing impacts to migratory birds for projects including communications towers (e.g., cellular, digital television, radio, and emergency broadcast) can be found at: http://www.fws.gov/migratorybirds/CurrentBirdIssues/Hazards/towers/towers.htm; http://www.towerkill.com; and http://www.fws.gov/migratorybirds/CurrentBirdIssues/Hazards/towers/comtow.html.

We appreciate your concern for threatened and endangered species. The Service encourages Federal agencies to include conservation of threatened and endangered species into their project planning to further the purposes of the Act. Please include the Consultation Tracking Number in the header of this letter with any request for consultation or correspondence about your project that you submit to our office.

Attachment

United States Department of Interior
Fish and Wildlife Service

Project name: Tower Project

Official Species List

Provided by:

Virginia Ecological Services Field Office
6669 SHORT LANE
GLOUCESTER, VA 23061
(804) 693-6694
http://www.fws.gov/northeast/virginiafield/

Consultation Code: 05E2VA00-2017-SLI-1157
Event Code: 05E2VA00-2017-E-01702

Project Type: COMMUNICATIONS TOWER

Project Name: Tower Project
Project Description: Construction of a 750-foot guyed instrumentation tower and auxiliary structures on Wallops Island beginning summer 2017.

Please Note: The FWS office may have modified the Project Name and/or Project Description, so it may be different from what was submitted in your previous request. If the Consultation Code matches, the FWS considers this to be the same project. Contact the office in the 'Provided by' section of your previous Official Species list if you have any questions or concerns.

Project Location Map:

Project Coordinates: MULTIPOLYGON (((-75.47976703394484 37.844597150754, -75.47851602443792 37.84366504948299, -75.47837959597796 37.84349390458593, -75.47826995470214 37.8432797259433, -75.47824141264888 37.84305090960962, -75.4782738691579 37.842788771221194, -75.47834338726275 37.842655491917284, -75.4785203449509 37.84249070488882, -75.48205573220659 37.840009159442346, -75.4824055880928 37.83970725317847, -75.48383858599902 37.84088180681751, -75.48523484195636 37.841949182072135, -75.48448993025622 37.8425388878283, -75.48360861393158 37.842964604055155, -75.48319443218637 37.84308792442036, -75.4815187649441 37.84344534027337, -75.48106881714848 37.843618878324605, -75.4803771481801 37.84407956616671, -75.47976703394484 37.844597150754)))

Project Counties: Accomack, VA

Endangered Species Act Species List

There are a total of 9 threatened or endangered species on your species list. Species on this list should be considered in an effects analysis for your project and could include species that exist in another geographic area. For example, certain fish may appear on the species list because a project could affect downstream species. Critical habitats listed under the **Has Critical Habitat** column may or may not lie within your project area. See the **Critical habitats within your project area** section further below for critical habitat that lies within your project. Please contact the designated FWS office if you have questions.

Birds	**Status**	**Has Critical Habitat**	**Condition(s)**
Piping Plover *(Charadrius melodus)* Population: except Great Lakes watershed	Threatened	Final designated	
Red Knot *(Calidris canutus rufa)* Population: Wherever found	Threatened		
Roseate tern *(Sterna dougallii dougallii)* Population: northeast U.S. nesting pop.	Endangered		
Flowering Plants			
Seabeach amaranth *(Amaranthus pumilus)* Population: Wherever found	Threatened		
Mammals			
Northern long-eared Bat *(Myotis septentrionalis)* Population: Wherever found	Threatened		
Reptiles			
Hawksbill sea turtle *(Eretmochelys imbricata)*	Endangered	Final designated	

Population: Wherever found			
Kemp's Ridley sea turtle *(Lepidochelys kempii)* Population: Wherever found	Endangered		
Leatherback sea turtle *(Dermochelys coriacea)* Population: Wherever found	Endangered	Final designated	
Loggerhead sea turtle *(Caretta caretta)* Population: Northwest Atlantic Ocean DPS	Threatened	Final designated	

Critical habitats that lie within your project area

There are no critical habitats within your project area.

Appendix A: FWS National Wildlife Refuges and Fish Hatcheries

There are no refuges or fish hatcheries within your project area.

Background and Basis for Determination

The presence of the proposed instrumentation tower and its associated guy wires would present a collision risk to birds and bats flying in the vicinity of Wallops Island. Substantial numbers of migratory and resident birds are present on Wallops Island throughout the year due to its coastal location and its proximity to the Atlantic Flyway, a major migratory bird corridor along the East Coast of the United States. In addition, two Federal-listed threatened bird species, the piping plover (*Charadrius melodus*) and the rufa subspecies of the red knot (*Calidris canutus rufa*), have been documented at WFF. Although not documented at WFF, the range of the Federal-listed threatened northern long-eared bat (*Myotis septentrionalis*) includes Accomack County; thus, it is reasonable to assume this listed bat species could occur at or in the vicinity of Wallops Island during non-hibernating summer months (i.e., approximately April to August).

Mitigation Measures Included in the Proposed Action

The USAF and NASA have determined the potential for impacts on bird and bat species from the Proposed Action (see Species Conclusion Table). These data have been used by the USAF and NASA in early project planning to identify specific mitigation measures to reduce the potential impacts of the Proposed Action to these species.

These measures, which have been proactively incorporated into the Proposed Action under either build Alternative, are based on these data, other available research, best management practices (BMPs), and current WFF policies. The USAF and NASA consulted several sources to develop the details of these mitigation measures, including the USFWS Tower Guidelines (USFWS 2016); consultation with the Federal Communications Commission (FCC); and Michigan State University's Fewer Lights Safer Flights program (Michigan State University 2016).

The USFWS Tower Guidelines identify 12 BMPs to be considered and used, where possible, in tower design and construction. Based on the analysis conducted by the USAF and NASA, the following eight BMPs from the USFWS Tower Guidelines would be included as part of the Proposed Action:

- ***Guideline #1:*** If constructing multiple towers, providers should consider the cumulative impacts of all of those towers to migratory birds and threatened and endangered species, as well as the impact of each individual tower. ***Compliance:*** This proposed instrumentation tower is the only tower being considered for construction on Wallops Island at this time.

- ***Guideline #2:*** If taller (i.e., greater than 199 feet above ground level [AGL]) towers requiring lights for aviation safety must be constructed, the minimum amount of pilot warning and obstruction avoidance lighting required by the Federal Aviation Administration (FAA) should be used. ***Compliance:*** The proposed tower would use the minimum amount of pilot warning and obstruction avoidance lighting required by the FAA; the number and configuration of such lighting would be determined as project planning and design continues.

- ***Guideline #3:*** Tower designs using guy wires for support that are proposed to be located in known raptor or water bird concentration areas or daily movement routes, or in major diurnal migratory bird movement routes or stopover sites, should have daytime visual markers on the wires to prevent collisions by these diurnally moving species. ***Compliance:*** The proposed tower would include daytime visual markers. Current plans include either orange-ball or yellow-spiral type diverters on the outer-most guy wires.

- ***Guideline #4:*** Towers and appendant facilities should be sited, designed, and constructed so as to avoid or minimize habitat loss within and adjacent to the tower footprint. ***Compliance:*** The proposed tower would be located near existing infrastructure. The tower base and support building, under the Preferred Action Alternative, would be located in an area currently maintained as mowed lawn. Guy anchor points have been sited so as to avoid impacts on wetlands.

- ***Guideline #5:*** In order to reduce the number of towers needed in the future, providers should be encouraged to design new towers structurally and electrically to accommodate the applicant/licensee's antennas and comparable antennas for at least two additional users (minimum of three users for each tower structure), unless this design would require the addition of lights or guy wires to an otherwise un-lighted and/or un-guyed tower. ***Compliance:*** The proposed tower would provide sufficient space for the USAF, NASA, and NASC equipment, as this is a joint project, consolidating equipment onto a single tower; there would be additional space potentially available to support other tower users.
- ***Guideline #6:*** Security lighting for on-ground facilities and equipment should be down-shielded to keep light within the boundaries of the tower site. ***Compliance:*** All exterior lighting would be down-shielded and activated by motion sensors to reduce lighting to the maximum extent possible.
- ***Guideline #7:*** If a tower is constructed or proposed for construction, service personnel or researchers from the Communication Tower Working Group should be allowed access to the site to conduct studies. ***Compliance:*** Should the Communication Tower Working Group require access to the tower, the Group must coordinate with NASA (the landowner) to obtain access, following all required safety and security protocols. In addition, in consultation with interested stakeholders, the USAF and NASA would prepare, implement, and monitor a project-specific mitigation plan. The USAF and NASA have engaged a recognized expert in avian migration and communication tower impact concerns to assist in preparing and implementing this post-construction monitoring plan. At a minimum, this monitoring plan would include systematic, frequent mortality searches during the both shorebird and songbird migration periods. This plan is being developed as part of the NEPA process and will be provided once completed. The information obtained through this monitoring effort would be provided to wildlife management agencies, academic institutions, and conservation organizations.
- ***Guideline #8:*** Towers no longer in use or determined to be obsolete should be removed within 12 months of cessation of use. ***Compliance:*** End-of-life instructions for this proposed tower would include removal of the entire tower structure within 12 months of cessation of use. All DoD projects are required to plan for and document required system disposal activities that would be implemented at the end of a project’s life.

Section 106 Consultation Documentation

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Catawba Indian Nation
Tribal Historic Preservation Office
1536 Tom Steven Road
Rock Hill, South Carolina 29730

Office 803-328-2427
Fax 803-328-5791

March 8, 2016

Attention: Shari Miller
NASA Goddard Space Flight Center
Wallops Flight Facility
Wallops Island, VA 23337

Re. THPO #	TCNS #	Project Description
2016-517-1		Proposed construction and operation of an instrumented tower on Wallops Island, VA

Ms. Miller,

The Catawba have no immediate concerns with regard to traditional cultural properties, sacred sites or Native American archaeological sites within the boundaries of the proposed project areas. **However, the Catawba are to be notified if Native American artifacts and / or human remains are located during the ground disturbance phase of this project.**

If you have questions please contact Caitlin Totherow at 803-328-2427 ext. 226, or e-mail caitlinh@ccppcrafts.com.

Sincerely,

Caitlin Totherow for

Wenonah G. Haire
Tribal Historic Preservation Officer

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DEPARTMENT OF THE AIR FORCE
AIR FORCE CIVIL ENGINEER CENTER
JOINT BASE SAN ANTONIO LACKLAND TEXAS

March 01, 2017

MEMORANDUM FOR: Ms. Amanda Lee
Virginia Department of Historic Resources
280 I Kensington A venue
Richmond, VA 23221

SUBJECT: Air Force Tower Construction Project on Wallops Island, VA

In November, 2015, Virginia Department of Historic Resources (DHR) responded to the National Aeronautics and Space Administration (NASA) regarding the proposed tower construction project, DHR File No. 2014-0946. The Air Force has taken over as the lead federal agency for this project and is preparing an Environmental Assessment (EA) in accordance with the National Environmental Policy Act (NEPA). In response to the 2015 DHR letter attached, NASA contracted with URS Group, Inc to review the proposed 750-feet tall tower and identify the affect to historic properties within the Area of Potential Effects (APE).

The Wallops Island Tower Cultural Resources Analysis is attached for your review. The analysis concludes that there is no potential to affect historic archaeological sites and that there would be no effect on historic properties. The Air Force would like to respectfully request that you review this letter and the attached files to determine if any further action is needed to comply with Section 106 of the Historic Preservation Act.

We respectfully request your review and comment within 30 days from receiving this letter. Please provide any comments to me at michael.ackerman.2@us.af.mil (210) 925-2741, or Mr. Mark Kinkade at mark.kinkade.1@us.af.mil.

Sincerely,

Michael Ackerman
Air Force Civil Engineering Center
NEPA Division (AFCEC/CZN)

Attachments:
1. DHR Letter (November 10, 2015)
2. Wallops Island Tower Cultural Resources Analysis

COMMONWEALTH of VIRGINIA

Department of Historic Resources

Molly Joseph Ward
Secretary of Natural Resources

2801 Kensington Avenue, Richmond, Virginia 23221

Julie V. Langan
Director

Tel: (804) 367-2323
Fax: (804) 367-2391
www.dhr.virginia.gov

November 10, 2015

Mr. Randall Stanley
Facility Historic Preservation Officer
National Aeronautics and Space Administration
Goddard Space Flight Center
Wallops Flight Facility
Wallops Island, VA 23337

Re: Area of Potential Effects Definition, Instrumented Tower, National Aeronautics and Space Administration, Goddard Space Flight Center, Wallops Flight Facility
Accomack County
DHR File No. 2014-0946

Dear Mr. Stanley,

The Virginia Department of Historic Resources (DHR) received information regarding the above referenced project for our review and comment pursuant to Section 106 of the National Historic Preservation Act of 1966, as amended and the *Programmatic Agreement Among the National Aeronautics and Space Administration, the Virginia State Historic Preservation Office, and the Advisory Council on Historic Preservation Regarding the Management of Facilities, Infrastructure, and Sites at the National Aeronautics and Space Administration's Wallops Flight Facility, Wallops Island, Accomack County, Virginia.*

DHR understands that the U.S. Air Force is proposing to construct an instrumented tower at NASA Wallops Flight Facility in Accomack County (Undertaking). The proposed tower will be approximately 750-feet tall and anchored by three sets of guy wires aligned at 120 degree increments around the tower base. The tower will likely be painted dark gray and will be illuminated following Federal Aviation Administration guidelines. NASA is serving as the lead Federal agency as the proposed project would be located on NASA property.

At this stage of the review process, NASA has developed an Area of Potential Effects (APE) for indirect effects. The proposed APE for indirect effects is a 3-mile radius around the proposed tower. The 3-mile radius is based on photo simulations developed using bare-earth

Digital Elevation Model with a 6-foot high observation point and run at 1-mile radii from the proposed tower location; 30-feet tall trees were included in the simulations for scale. A number of other existing towers and water tanks within the proposed APE for indirect effects were also included in the photo simulations.

Additional information is needed to aid DHR is its review of the proposed Undertaking.

- **DHR Project Review Application Form**: Please complete and submit a DHR Project Review Application Form.
- **APE for direct effects**: You note in your submission that "the Undertaking does not occur within an area identified as having a moderate or high probability for archaeological resources nor does it occur within the boundary of a previously recorded archaeological site; as such, no archaeological investigations are warranted within the direct APE."
  - Please provide an APE for direct effects, so we may better understand the proposed site location and ground disturbance.
  - Please clearly identify the APE for direct effects and the APE for indirect effects on Figure 1.
- APE for indirect effects: You note that "the photo simulations show that the tower's apparent height rapidly reduces by the 3-mile radius and is similar to those of other existing towers and tanks in the vicinity.
  - Did you run 3.5-, 4-, 4.5-, or 5-mile radius photo simulations to verify that the tower would not be visible at those locations? If not, please do so.
  - The photo simulations (Figures 2-6) provided illustrate the visibility of the proposed tower and existing towers and tanks. Unfortunately, the figures are not keyed to Figure 1, which is the proposed APE for indirect effects. Please key Figures 2-6 to Figure 1. Also update Figures 2-6 with captions so that they are easily understood in terms of distance and direction from or towards the proposed tower location.
  - Not knowing the exact locations of Figures 2-6, were all of the photo simulations run in each of the cardinal directions from the proposed tower location and at set 1-mile, 2-mile, and 3-mile radii? If not, please do so.

Please send the additional information to my attention and reference DHR File No. 2014-0946 in correspondence associated with this project. DHR looks forward to receiving the additional information and consulting with NASA on this project.

Sincerely,

M. Amanda Lee

M. Amanda Lee, Historic Preservationist
Division of Review and Compliance

Administrative Services	Eastern Region Office	Western Region Office	Northern Region Office
10 Courthouse Ave.	2801 Kensington Avenue	962 Kime Lane	5357 Main Street / PO Box 519
Petersburg, VA 23803	Richmond, VA 23221	Salem, VA 24153	Stephens City, VA 22655
Tel: (804) 862-6408	Tel: (804) 367-2323	Tel: (540) 387-5443	Tel: (540) 868-7029
Fax: (804) 862-6196	Fax: (804) 367-2391	Fax: (540) 387-5446	Fax: (540) 868-7033

Project Review Application Form

This application must be completed for all projects that will be federally funded, licensed, or permitted, or that are subject to state review. Please allow 30 days from receipt for the review of a project. All information must be completed before review of a project can begin and incomplete forms will be returned for completion.

I. GENERAL PROJECT INFORMATION

1. **Has this project been previously reviewed by DHR?** **YES** X **NO** ___ **DHR File #** 2014-0946
2. **Project Name** **NASA Wallops Flight Facility Communications Tower**
3. **Project Location** **Wallops Island** (City) ___ (Town) **Accomack County** (County)

	City	Town	County
3. Project Location	Wallops Island		Accomack County

4. **Specify Federal and State agencies involved in project (providing funding, assistance, license or permit). Refer to the list of agencies and abbreviations in the instructions.**

Lead Federal Agency **NASA**

Other Federal Agency **DOD**

State Agency **DHR**

5. **Lead Agency Contact Information**

Contact Person **Randall Stanley, Facility Historic Preservation Officer**

Mailing Address **NASA / WFF FMB, Code 228, Building N-161, Room 132, Wallops Island, VA 23337**

Phone Number **757-824-1309** **Fax Number** **757-824-1831**

Email Address **Randall.M.Stanley@nasa.gov**

6. **Applicant Contact Information**

Contact Person **Same as Lead Agency**

Mailing Address

Phone Number **Fax Number**

Email Address

II. PROJECT LOCATION AND DESCRIPTION

7. **USGS Quadrangle Name** **Wallops Island (See attached USGS Topographic Map)**
8. **Number of acres included in the project** **N/A**

MAIL COMPLETED FORM AND ATTACHMENTS TO:
Virginia Department of Historic Resources
Attention: Project Review
2801 Kensington Avenue, Richmond, VA 23221
www.dhr.virginia.gov

9. Have any architectural or archaeological surveys of the area been conducted? **YES_X_ NO___**

If yes, list author, title, and date of report here. Indicate if a copy is on file at DHR.

URS, Wallops Island Tower Cultural Resources Analysis, March 31, 2016 - Scott Seibel, RPA, Archaeology Program Manager and Lorin Farris, MA, Architectural Historian (A copy is not on file at DHR but is attached to this application).

The following surveys have been conducted by URS for the Wallops Flight Facility and are on file at DHR:
-Integrated Cultural Resource Management Plan (ICRMP), 2006
-Site-Wide Environmental Assessment, 2005
-Historic Resources Survey and Eligibility Report, 2004
-Phase I Archaeological Survey of the DD(x) Wetlands Mitigation Project Area, 2004
-Cultural Resources Assessment, NASA, 2003

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10. Are any structures 50 years old or older within or adjacent to the project area? **YES_X_ NO___**

If yes, give date(s) of construction and provide photographs.

For this project, twenty-one properties were surveyed that were constructed between 1768 and 1965. Photographs of these properties are in the report.

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11. Does the project involve the rehabilitation, alteration, removal, or demolition of any structure, building, designed site (e.g. park, cemetery), or district that is 50 years or older? If *yes*, this must be explained fully in the project description. **YES___ NO_X_**

12. Does the project involve any ground disturbance (e.g. excavating for footings, installing sewer or water lines or utilities, grading roads, etc.)? If *yes*, this must be explained fully in the project description. **YES_X_ NO___**

13. DESCRIPTION: Attach a complete description of the project. Refer to the instructions for the required information.

The Department of Defense (DOD) is proposing to construct an instrumented tower at NASA Wallops Flight Facility in Accomack County, Virginia (Undertaking). As the proposed tower would be located on NASA property, NASA is serving as the lead Federal agency for this Undertaking on behalf of the U.S. Air Force. The tower is not subject to Federal Communications Commission licensing and, as such, is not covered under the September 2004, Nationwide Programmatic Agreement for Review Effects on Historic Properties for Certain Undertakings Approved by the Federal Communications Commission.

The tower as proposed would be approximately 750-feet tall, may be painted dark gray, and anchored by three sets of guy wires aligned at 120 degree increments around the tower base. At night, the tower would be illuminated following Federal Aviation Administration guidelines; it should be noted that the proposed tower would be located within the Wallops Flight Facility restricted airspace.

In a letter dated January 14, 2016, the Virginia Department of Historic Resources (DHR) recommended a 3-mile radius indirect (visual) APE around the proposed tower with an extension (DHR File No. 2014-

0946) to include the Assateague Beach Coast Guard Station, also known as the Assateague Beach Life-Saving Station. The direct APE consists of the tower footprint and any cable runs and equipment shelters.

To the best of my knowledge, I have accurately described the proposed project and its likely impacts.

March 1, 2017

Signature of Applicant/Agent | Date

MAIL COMPLETED FORM AND ATTACHMENTS TO:
Virginia Department of Historic Resources
Attention: Project Review
2801 Kensington Avenue, Richmond, VA 23221
www.dhr.virginia.gov

The following information must be attached to this form:

X Completed DHR Archives search
X USGS map with APE shown
X Complete project description
X Any required photographs and plans

____ No historic properties affected ______ No adverse effect
____ Additional information is needed in order to complete our review.
____ We have previously reviewed this project. A copy of our correspondence is attached.
Comments: ____
____
____
____

Signature______________________________ Date ______________

Phone number ______________ DHR File # ________________
This Space For Department Of Historic Resources Use Only

MAIL COMPLETED FORM AND ATTACHMENTS TO:
Virginia Department of Historic Resources
Attention: Project Review
2801 Kensington Avenue, Richmond, VA 23221
www.dhr.virginia.gov

Cultural Resource Assessment for Air Force Tower Construction on Wallops Island

Background

LJT & Associates, Inc. (LJT) is assisting the Department of Defense (DOD) with the siting of a proposed communications tower at National Aeronautics and Space Administration (NASA) Wallops Flight Facility in Accomack County, Virginia (Undertaking). NASA is the lead Federal agency for this Undertaking on behalf of the U.S. Air Force. The proposed communications tower would be up to 750-feet tall, may be painted dark gray, and would be anchored by three sets of guy wires aligned at 120 degree increments around the tower center point. The tower would be illuminated following Federal Aviation Administration guidelines. Figures 1 through 8 provide information about the proposed communications tower APE, the location of all the properties surveyed on the aerial map, and simulations showing the visibility of the tower from different mile markers. LJT contracted with URS Group, Inc. (URS) to review the potential for the proposed project to affect historic properties within the direct and indirect Area of Potential Effects (APE) (Figures 1 and 2). In a letter dated January 14, 2016, the Virginia Department of Historic Resources (DHR) recommended a 3-mile radius indirect (visual) APE around the proposed tower with an extension (DHR File No. 2014-0946) to include the Assateague Beach Coast Guard Station, also known as the Assateague Beach Life-Saving Station. The direct APE consists of the tower footprint and any cable runs and equipment shelters. Figure 8 shows a representative view of the tower.

Visual APE

Twenty-eight (28) properties were identified to be surveyed that were 50 years and older. All but one property, the Assateague Lighthouse, are located within the indirect APE. An analysis was conducted on the Assateague Lighthouse but was not surveyed during the site visit. Three of the twenty-eight properties were previously listed in the National Register of Historic Places (NRHP) within the indirect APE: Wharton Place (DHR ID 001-0052); Assateague Beach Coast Guard Station (DHR ID 001-0172); and the Assateague Lighthouse (DHR ID 001-0078). Due to deteriorated conditions of the access road, the Assateague Beach Coast Guard Station could not be surveyed during the site visit but an analysis was completed by utilizing aerial imagery and information from the Virginia Cultural Resources Information System (VCRIS). Also, two historic properties were previously determined eligible for the NRHP within the indirect APE: Mount Wharton (DHR ID 001-0052); and the Wallops Beach Life Saving Station and Observation Tower (DHR ID 001-0027-0100/001-0027-0101). The remaining 23 resources had not been previously evaluated. Of these 23 resources, URS recommends that one individual historic resource and one historic district, consisting of eight historic resources, are eligible for the NRHP and the Virginia Landmarks Registry (VLR). The recommended, eligible individual historic resource and historic district are both within the indirect APE. The other 14 resources are recommended not eligible for the NRHP or the VLR. Table 1 includes a brief overview of the assessed properties. After Table 1 are architectural descriptions and condition assessments of the historic properties, and photographs of these properties are in Figures 9 through 24. Also, Figures 25 through 27 provide photographs and brief condition assessments of the 14 resources not eligible for the NRHP or the VLR.

Table 1. Indirect APE – Properties Surveyed

VDHR No.	Name	Address	Property Type	NRHP Status
001-0052	Mount Wharton	32339 Mt. Wharton Road	Residential, 1772 Dwelling	NRHP Eligible, SHPO Opinion 2008
001-0050	Wharton Place	13485 Wharton Drive	Residential, 1797 Dwelling	NRHP Listed 1972, VLR Listed 1972
001-0172	Assateague Beach Coast Guard Station	Beach Road on Fisherman's Point, Assateague Island	Military/Defense, 1922 Dwelling	NRHP Listed 2015, VLR Listed 1973
001-0078	Assateague Lighthouse	8250 Beach Road, southern end of Assateague Island	Government, 1867 Lighthouse	NRHP Listed 1973, VLR Listed 1973
001-0027-0100/ 001-0027-0101	Wallops Beach Life Saving Station and Observation Tower	North end of Wallops Island	Military/Defense, 1936 Dwelling/Tower	NRHP Eligible, SHPO Opinion 2005
NA	31545 Point Breeze Lane	31545 Point Breeze Lane	Residential, Circa 1890 Dwelling	URS Recommends NRHP and VLR Eligible
NA	Wisharts Point Historic District	33260 Wisharts Point Road	Residential, 1900 Dwelling	URS Recommends NRHP and VLR Eligible
		33288 Wisharts Point Road	Residential, 1920 Dwelling	
		33298 Wisharts Point Road	Residential, 1920 Dwelling	
		33322 Wisharts Point Road	Residential, 1920 Dwelling	
		33332 Wisharts Point Road	Residential, 1920 Dwelling	
		33340 Wisharts Point Road	Residential, 1900 Dwelling	
		33348 Wisharts Point Road	Residential, 1920 Dwelling	
		33362 Wisharts Point Road	Residential, 1900 Dwelling	
NA	NA	13454 Arbuckle Neck Road	Residential, 1900 Dwelling	Not Eligible
NA	NA	Arbuckle Neck Road (56-A-51)	Residential, 1910 Dwelling	Not Eligible
NA	NA	12001 Atlantic Road	Residential, 1918 Dwelling	Not Eligible
NA	NA	31263 Mappsville Road	Residential, 1930 Dwelling	Not Eligible
NA	NA	13149 Metompkin Road	Residential, 1768 Dwelling	Not Eligible
NA	NA	32307 Mt. Wharton Road	Residential, 1930 Dwelling	Not Eligible
NA	NA	31172 Piece Taylor Road	Residential, 1920 Dwelling	Not Eligible
NA	NA	32468 Taylor Farm Road	Residential, 1920 Dwelling	Not Eligible
NA	NA	33241 Taylor Farm Road	Residential, 1900 Dwelling	Not Eligible
NA	NA	33219 Taylor Farm Road	Residential, 1908 Dwelling	Not Eligible

VDHR No.	Name	Address	Property Type	NRHP Status
NA	NA	33190 Taylor Farm Road	Residential, 1957 Dwelling	Not Eligible
NA	NA	32168 Wallops Island Road	Residential, 1918 Dwelling	Not Eligible
NA	NA	32145 Wallops Island Road	Residential, 1955 Dwelling	Not Eligible
NA	NA	31494 Wallops Island Road	Commercial, 1965 Building	Not Eligible

32339 Mt. Wharton Road – NRHP Eligible

The residence at 32339 Mt. Wharton Road (DHR ID 001-0052), historically known as Mount Wharton, was built in circa 1772 (Figure 9). The house is located within the indirect APE. The VCRIS database indicates that a portion of the house was believed built by George Thomas prior to his death in 1772. The house sits on top of a hill overlooking Bogues Bay, Wallops Island, with the ocean beyond. This one-and-one-half-story, Colonial-style, side-gable roof building rests on a brick foundation. The building is five bays in width, one bay in depth, is approximately 25x50 feet and has a cellar. It has a rectangular, center hall interior plan. The building is wood framed and clad with wood clapboard. The roof is clad in asphalt shingles and both slopes of the roof have five, gable dormer windows. The house has two interior end brick chimneys covered in stucco. The main entrance is centered on the façade but is not visible and is sheltered by a front-gable portico supported by four wood-posts with wood balustrade.

In a 1940 Historic American Building Survey (HABS), two historic photographs show the main entrance did not have a portico and the main entrance had a wood paneled door with transom. Fenestration consists of wood-frame, nine-over-nine, double-hung sash windows on the first story, and the roof's dormer windows have wood-frame, six-over-six, double-hung sash windows. A hyphen connects the main house at the southwest (side) elevation to a small, one-story gable-roofed framed wing, both constructed circa 1827. The hyphen's rear elevation has a one-story, shed roof addition that was constructed prior to 1963 based on the historic aerials. The property has a small cemetery with early 19th century graves, and four other unidentified buildings.

In 2008, the property was evaluated as locally significant under Criterion C for architecture with a period of significance of 1772-1827. The house is in very good condition and maintains sufficient aspects of integrity to convey its historic architectural character. The Colonial-style building with its center hall interior plan, interior end chimneys, symmetrical fenestration, and dormer windows signifies the adaption of historic building trends of the region found in Virginia houses of the period. The house is a well-maintained example of Colonial-style architecture from the Eastern Shore Peninsula region. Therefore, the house was recommended as NRHP eligible under Criterion C at the local level on January 24, 2008. The DHR Board of Historic Resources concurred with this opinion on March 20, 2008.

The historic property located at 32339 Mt. Wharton Road continues to be NRHP eligible under Criterion C for architecture. The property is 2.6 miles northwest from the proposed project area and does not directly face towards the tower's project area. There are trees and vegetation overgrowth acting as a visual buffer to the southeast of the property line (Figure 10). The project area is not visible from 32339 Mt. Wharton. In addition, there is a 300-feet tall water tower next to the project site that is not visible from 32339 Mt. Wharton Road. Although the communications tower would be over twice the height of the water tower, and while the project may have an effect on the historic property, the effect would not be adverse.

<u>13485 Wharton Drive – NRHP and VLR Listed</u>

The residence located at 13485 Wharton Drive (DHR ID 001-0050), historically known as Wharton Place, was built in 1797 (Figure 11). The house is located within the indirect APE. The house and its immediate grounds are surrounded by broad, flat fields and pine-woods, and just to the north are the marshes of Assawoman Creek. On the west side of the house is a formal flower garden with boxwood borders, and the east side has a formal garden that leads to the family cemetery.

This two-story, Federal-style, hipped-roof building sits on a raised brick basement story and is constructed of brick. The roof is clad with asphalt shingles. Projecting from the roof are two interior brick chimneys and a widow's walk. Surrounding the roof's base is a deep cornice with pairs of brackets. The building is five bays in width, four bays in depth, is approximately 46x46 feet, and has a square plan. The symmetrical east and west façades have centered, double wood doors with panels, topped by semicircular fanlights, and feature open pediments supported on half-round pilasters. Presently, the windows are in the process of being restored. However, recent photographs show the basement story has awning-covered, wood-frame, three-light, windows. The first story has wood-frame, nine-over-six, double-hung window sashes, and the second story has wood-frame, six-over-six, double-hung window sashes. All of the windows have white marble lintels and sills, and the west and east entrances have white marble thresholds. All four elevations have white wooden panels between the first and second floors. Projecting from the house's north side is a one-story, side-gable, kitchen wing. The property has eight other buildings, one of which is a contributing frame smokehouse. The house maintains sufficient aspects of integrity to convey its historic architectural character. The house is a well-maintained example of Federal-style domestic architecture from the Eastern Shore Peninsula region. The house was listed in the VLR on April 18, 1972, and was listed in the NRHP on November 3, 1972.

The historic property located at 13485 Wharton Drive is listed in the NRHP under Criterion C for architecture. The property is located 2.9 miles northwest from the proposed project area and it directly faces the project area to the east. The property is situated 42 feet above sea level on one of the highest elevations of the Eastern Shore. There are trees and vegetation overgrowth acting as a visual buffer to the southeast of the property line, including marshlands to the southeast of the property line (Figure 12). Although there would be a potential for the communications tower to be visible from the southeast property line, the effect would not be adverse.

<u>Assateague Beach Coast Guard Station - NRHP and VLR Listed</u>

In a letter dated January 4, 2016, DHR concurred with NASA's determination of establishing a 3-mile radial APE around the proposed tower with the exception of an additional 3.5-mile "bump-out" to expressly include the Assateague Beach Coast Guard Station (DHR ID 001-0172), also known as the Assateague Beach Life-Saving Station, within the indirect APE. DHR included the station within the indirect APE due to the relatively unimpeded view to the proposed tower location. The station is located off of Beach Road on Fisherman's Point at the southern end of Assateague Island, a coastal island that straddles the Virginia-Maryland border. The life-saving station complex situated on 11.8 acres consists of the 1922 station house, 1938-1939 boathouse, 1922 garage/boathouse, 1959 generator house, 1931-1935 wharf and breakwater, 1922 station house cistern, 1943 boathouse cistern, 1922-1925 lookout tower, and 1940 garage cistern.

The complex of buildings and structures are organized in a narrow, almost linear sequence moving longitudinally north-south through the property's parcel and oriented toward the Atlantic (south) and Tom's Cove (north) shorelines. The station house is a two-story, Colonial Revival-style, gable-on-hip roof building that sits on a raised, poured concrete basement (Figure 13). The wood-frame building is clad with wood clapboard. The building is five bays in width, two bays in depth, is approximately 40x26 feet, and has a rectangular plan. The roof is clad with red, asbestos shingles and has a single brick chimney set off-center on the ridgeline, plank gable rakes and deep soffits, and a copper gutter system. Each gable end has a single, wood-frame, four-light, fixed window with a peaked top. The fenestration consists of wood-frame, six-over-six, double-hung, sash windows that are covered with aluminum storm windows. The south elevation has a one-story porch with a metal-seam flat roof supported by a plank architrave with wood square columns, posts, and pilasters, and is situated on a poured concrete stoop with cast concrete stairs. The south elevation entry has a paneled wood door with six-light window in the upper half. The west elevation has an elevated, one-story, hipped roof porch covered with wood shingles and supported by wood square columns, posts, and pilasters. The underside of the porch is enclosed in diagonal lattice with plank trim. The west elevation entry is similar to the south elevation entry, and the north elevation has an ancillary entry with a paneled wood door that is accessed with an open wood stair and deck. The east elevation had an ancillary entry covered with plywood that provides access to the basement.

Built in 1938-1939, the U.S. Coast Guard (USCG) Boathouse and Marine Rail Launchway anchor the north end of the station complex and are set on the shoreline of Tom's Cove (Figure 13). Around the west, south, and east sides of the building is a wood plank walkway supported on wood piles. The north side of the building has the marine rail launchway that slopes down to the watersheet. It is a one-story, Colonial Revival-style, hipped-roof building that rests on pilings. The building has a wood and steel frame, is three bays in width and five bays in depth, is approximately 46x46 feet, and has a rectangular plan. The roof is clad with red, wood-shingles and has three gabled dormers on the east and west slopes, and a single dormer on the north slope. The dormer windows are wood-frame, six-over-six, double-hung, sash windows with arched upper sashes. The fenestration consists of wood-frame, six-over-six, double-hung, sash windows. The exterior walls are clad with wood shingles and each of the building's corners has paired pilasters that rest on a stepped plank water table and are topped with a wide plank architrave. The main entrance is centered on the south elevation and has a wood paneled door that is flanked by half-height sidelights and topped by a paneled rectangular pediment. The entrance is sheltered by a pedimented gable-roofed porch supported on pairs of wood posts. The north elevation has three boat doors filled with vertical-lift wood panel roll doors with multiple lights in the upper panels. The boat doors are flanked by paired pilasters and topped with rectangular pediments.

Located near the Assateague Beach Coast Guard Station are three contributing buildings and five contributing structures: 1922 garage/boathouse; 1959 generator house; 1931-1935 wharf and breakwater; 1922 station house cistern; 1943 boathouse cistern; 1922-1925 lookout tower; and 1940 garage cistern. The Assateague Beach Coast Guard Station was listed in the VLR listing on February 20, 1973 and in the NRHP on November 2, 2015. The complex is significant under Criterion A in the area of Maritime History as an example of the federal life-saving station property type within the registration requirements established under the U.S. Government Lifesaving Stations, Houses of Refuge, and pre-1950 USCG Stations Multiple Property Documentation Form (MPDF). The complex maintains sufficient aspects of integrity to convey its national historic significance. The complex possess additional significance under Criterion C in the area of architecture as an example of the work of U.S. Life-Saving Service (USLSS) master architect Victor Mindeleff, as identified in the MPDF. URS concurs with a VDHR 2014 survey that all of the buildings and structures located within the life-saving station complex are in good condition except for 1931-1935 wharf and breakwater, which are in poor condition. The complex maintains sufficient aspects of integrity to convey its historic architectural character.

The Assateague Beach Coast Guard Station does not directly face towards the proposed tower's project area, which would be 6.4 miles to the southwest. The southwest, rear view of the property overlooks the Atlantic Ocean and the shoreline of the tower project area. However, the station building and contributing buildings and structures are focused towards the Atlantic Ocean to the east or to the north towards Tom's Cove (Figure 14). Although there is potential for the communications tower to be visible from the property, the effect would not be adverse.

<u>Assateague Lighthouse - NRHP and VLR Listed</u>

The Assateague Lighthouse (DHR ID 001-0078) is not within the indirect APE but was surveyed as part of our scope of services. The lighthouse was constructed in 1867 and is located at 8250 Beach Road on the southern end of Assateague Island, a barrier island (Figure 15). The lighthouse is 142 foot tall, conical brick tower situated on a 22-foot high dune. The lighthouse has a 12-foot foundation consisting of stone and cement, a rubble stone base to a height of 3 feet 6 inches, and is finished with a granite water table course. The base of the tower has a five step granite and brick stoop that leads to a double set of wooden doors. There are brass-framed, six-over-six, double-hung windows on the south side of the tower at the third, fifth, and seventh landings, and on the north side at the entry level, second, fourth and sixth landings. The tower is constructed with pressed red brick. The base of the tower is over 27 feet in diameter, gradually tapering to 13 feet 7 inches at the parapet, and finishes in the lantern room which is 12 feet in diameter. Surrounding the watch room is a cast iron gallery with wrought iron balustrade. Surrounding the lantern room is a narrower gallery. The lantern room is surrounded by 16 glass storm panels set in metal frames that are 9 feet 7 ¾ inches high. The original glass plates have been replaced to increase visibility and to make the lantern room weather tight from water damage. The lantern room is topped by a copper roof lined with zinc, surmounted with a ventilator ball. The lighthouse retains its alternating bands of broad red and white stripes, which were painted by the USCG in 1968. It was originally washed with Venetian red cement. Located near the Assateague Lighthouse are four other contributing buildings/structures: the 1892 oil shed; 1910 keepers' dwelling shed; 1910 Assistant Keepers' Dwelling; and 1900 well.

The Assateague Lighthouse is significant under Criterion A in the area of Maritime History as an example of a navigational aid for national and international commerce and transportation along the Atlantic Coast during the mid-19th century, and as an example of efforts by the federal government to provide safe passage around the dangerous shoals lying 5 to 12 miles off the coast. The lighthouse was listed in the VLR on April 17, 1973 and in the NRHP on June 4, 1973. The lighthouse maintains sufficient aspects of integrity to convey its national historic significance. The lighthouse possesses additional significance under Criterion C in the area of architecture as an excellent example of a mid-19th century lighthouse design and method construction that characterized first-order coastal lighthouses on the East coast of the United States. It maintains sufficient aspect of integrity to convey its historic architectural character.

The Assateague Lighthouse is outside of the indirect APE and does not directly face towards the proposed tower's project area located 8.4 miles to the southwest. The southwest, or rear, view of the property overlooks Tom's Cove, the Atlantic Ocean and the shoreline. Although there would be potential for the communications tower to be visible from the southwest property line, the effect would not be adverse.

Wallops Beach Life Saving Station/Observation Tower - NRHP and VLR Eligible

The Wallops Beach Life Saving Station (DHR ID 001-0027-0100) and the Observation Tower (DHR ID 001-0027-0101) are within the indirect APE.In 2004, the Wallops Beach Life Saving Station and Observation Tower were determined eligible for NRHP and on January 28, 2005, the DHR concurred with this determination. In 2007, NASA determined that the Wallops Beach Life Saving Station was located between a designated explosive hazard arc and would need to be transferred from Federal ownership and removed from the property. Preparing for said action, NASA contracted with a licensed environmental remediation company to abate the asbestos and remove painted surfaces and plasterwork within the station building. However, in consultation with the SHPO, NASA determined that the transfer and removal of the station building would have an adverse effect on this historic property. NASA's preparation to remove the property from Wallops Island were placed on hold for further consultation with SHPO and the ACHP. In 2014, NASA prepared a Programmatic Agreement (PA), entitled "Programmatic Agreement Regarding the Management of Facilities, Infrastructure, and Sites at the National Aeronautics and Space Administration's WFF, Wallops Island, Accomack, Virginia," to comprehensively address cultural resources at this facility. This PA was executed on December 17, 2014 by NASA, the SHPO, and the Advisory Council on Historic Preservation (ACHP). Pursuant to 42 U.S.C. 2473 (c)(3) and 36 CFR Part 800, NASA and the SHPO agreed that the transfer and removal of the station building could be implemented in accordance with the stipulations outlined in the PA in order to satisfy NASA's Section 106 responsibilities to take into account the effects of this undertaking on historic properties.

The station and tower were constructed in 1936 and are located at the north end of Wallops Island (Figure 16). The station is a two-and-one-half-story, Colonial Revival-style, side-gable roof building that is situated on a raised concrete basement story. The building is five bays in width, three bays in depth, and has a rectangular plan. The roof is clad with wood shingles, has three gable dormers on both slopes, and an interior brick chimney near the roof's northwest corner. The wood-frame building is clad with wood shingles. There is a wooden water table at the base of the second floor windows on all elevations and above the second floor windows on the north and south elevations. The station is absent of paint because of lead abatement conducted in 2008, which required the building's windows and main entry door to be removed for treatment and covered with plywood. The building has wood-frame, three-over-three, double-hung windows at the basement story, and wood-frame, six-over-six, double-hung windows on the first and second stories. Near the gable peaks are half-moon window openings covered with plywood, which contained four-light lunette windows. The lunette windows were removed and placed into storage during the lead abatement. The façade has a one-story front porch that rest on concrete piers, and has a wood-shingled shed roof supported by square wood columns. Replacement wood steps access the porch. The underside of the porch is enclosed in contemporary wood lattice with plank trim. There is an ancillary entry on the north elevation that has a wood door with lower panels and three-by-two lights at the upper half. The entry is sheltered by a large pedimented canopy supported by wood brackets. The station building is in moderately poor exterior condition because of the lack of paint and the temporary removal of the windows and main entry; however it appears structurally sound with no apparent structural decay or collapse.

The Observation Tower is a four-story, square-plan tower made of steel with concrete plinths supporting the four corner posts. The posts taper in toward the center as the tower rises. A concrete plinth also supports the base of the centrally located steel staircase. The staircase rises to a landing that supports another stair that in turn rises in the opposite direction to a second landing. There are three landing areas that support staircases, before reaching the top of the structure that has metal grate flooring and a guardrail encircling the outside edge. Steel crossbeams and ties are found on each side of the structure and across the interior, supporting the stair landing platforms. The Observation Tower is in good condition and appears to have had no alterations over time.

In 2004, the Wallops Beach Life Saving Station and Observation Tower were determined eligible for NRHP and on January 28, 2005, the DHR concurred with this determination. As a single resource, the station and tower are eligible under Criterion A for their association with the USCG and its predecessor, the USLSS, which played a vital role as protector of shipping and human lives and the economic development of Virginia's Eastern Shore. The station and tower are also eligible under Criterion C for architecture as they are an example of Colonial Revival-style architecture designed and constructed for the Coast Guard mission on the Eastern Shore during the 20th century. The property is outside of the indirect APE and does not directly face towards the project area, located 3.1 miles to the southwest. Creating a visual buffer south of the property line are trees and vegetation (Figure 17). Although there would be a potential for the project to be visible from the property, the effect would not be adverse.

31545 Point Breeze Lane – NRHP Eligible

The residence at 31545 Point Breeze Lane was built in circa 1890 as a vernacular interpretation of the Greek Revival-style (Figure 18). The house is located within the indirect APE. The house overlooks Arbuckle Creek, Womans Bay, and Wallops Island. This two-and-one-half-story, L-shaped plan building stands on a fieldstone foundation. The wood-frame building is clad with wood clapboard. The majority of the wood clapboard is not coated with paint and is unprotected. The house has a combination of two-over-two and six-over-six, wood-frame, double-hung windows topped by wood crowns and wood surrounds. The main section of the house faces southeast, is three bays in width and two bays in depth, and has a side-gable roof. The façade is symmetrical having a centered main entry that is fronted with a modern metal and glass storm door. At the north corner of the house is a two-story, rear L-extension with a gable roof. The L-extension is one-bay by one-bay. The roofs are clad with asphalt shingles and three of the gable ends have returned eaves with wide inside wood trim. The L-extension's gable end has an interior brick chimney. Following the L-extension's north elevation is a one-and-one-half story gabled roof extension that has shed roof porches on the northwest and southwest elevations and nine-over-nine wood-frame double-hung windows. The house maintains sufficient aspects of integrity to convey its historic architectural character. Other than the lack of paint as a protective barrier to the elements, the house is a well-maintained example of a vernacular interpretation of the Greek Revival-style from the Eastern Shore Peninsula region. Therefore, the house is recommended as NRHP eligible under Criterion C for architecture at the local level.

The property faces directly east 2.35 miles towards the proposed communication tower's project area (Figure 19). There would be a high potential that the communication tower would be visible from the house's façade, but it would be less visible than the existing 300-feet water tower next to the project site, which currently has large massing with its spherical-shaped reservoir, wide tower, and overall white color. While the project may have an effect on the historic property, the effect would not be adverse.

<u>Wisharts Point Historic District - NRHP Eligible</u>

Near the southeast end of Wisharts Point Road is a former fishing community that accesses Bogues Bay and Powells Bay. The community consists of eight historic houses constructed from 1900 to 1920, of which all are located within the indirect APE. It is NRHP eligible as a historic district under Criterion C for architecture at the local level (Figure 20). The houses are vernacular interpretations of the Greek Revival, Gothic Revival, Colonial Revival, and Bungalow styles. The boundary of the proposed historic district is defined as the northwest property line for 33260 Wisharts Point Road, the northeast side of Wisharts Point Road, the southeast-south peninsula of Wisharts Point Road, and the southwest property line of the eight historic houses. The following brief architectural descriptions of the eight houses are presented from northwest to southeast along Wisharts Point Road.

33260 Wisharts Point Road is a two-story, side-gable roofed house constructed in 1900 in the vernacular interpretation of the Colonial Revival-style (Figure 21). The house is two bays in length and one bay in depth, and has a rectangular plan. The roof is clad with asphalt shingles, has an interior brick chimney, and the gable ends have pediments. The southeast (side) elevation has a one-and-one-half-story, gable roof extension. Alterations include vinyl siding and windows, a one-story, side and rear addition.

33288 Wisharts Point Road is a two-story, side-gable roofed house is constructed in 1920 in the vernacular interpretation of the Greek Revival-style (Figure 21). The house has a concrete block foundation, is three bays in length and two bays in depth, and has a center-hall plan. The roof is clad with asphalt shingles and the gable ends have returned eaves. The southeast (side) elevation has a one-and-one-half-story, gable roof extension with an exterior brick chimney. The rear elevation has a two-story, gable roof extension. Alterations include vinyl siding and windows and a shed roof front porch enclosure.

33298 Wisharts Point Road is a one-and-one-half-story, cross-gable roofed house constructed in 1920 in the Bungalow style (Figure 22). The house has a concrete block foundation, is three bays in length and four bays in depth, and has an asymmetrical façade. The roof is clad with asphalt shingles, has an interior brick chimney, and a cross-gable at the southeast (side) slope. The house has wood-frame, four-over-one, double-hung windows that are fronted by aluminum storm windows. The four lights in the upper sashes are vertically oriented. The half story has a fixed wood-frame window with four vertically oriented lights. The main entry has a wood door with four vertically oriented lights, is sheltered by a gable hood supported by brackets, and accessed by four brick steps. Alterations include vinyl siding and shutters.

33322 Wisharts Point Road is a two-story house constructed in 1920 in the vernacular interpretation of the Gothic Revival-style (Figure 22). The house is three bays in width and two bays in depth, has a center-hall plan, and sits on a brick foundation. It has a side-gable roof with center gable clad with asphalt shingles. The inside of the center gable is clad with shingles. The gables have returned eaves. Alterations include vinyl siding and windows, a wrap-around-porch addition, bay window addition, and a two-story, side addition at the southeast elevation.

33332 Wisharts Point Road is a two-story house with a side-gable roof constructed in 1920 in the vernacular interpretation of the Greek Revival-style (Figure 23). The house is three bays in width and one bay in depth, has a center-hall plan, and rests on a concrete block foundation. The roof is clad with asphalt shingles, the gables have returned eaves, and an exterior concrete block chimney pierces through the southeast gable. The centered main entry is sheltered by a gabled-roof front porch supported by wood posts. Alterations include vinyl siding and windows and a one-story, rear addition.

33340 Wisharts Point Road is a two-and-one-half-story house with a front-gable roof constructed in 1900 in the vernacular interpretation of the Greek Revival-style (Figure 23). The house is two bays in width and three bays in depth, has a rectangular plan, and sits on a rusticated concrete block foundation. The roof is clad with asphalt shingles. The gabled ends are clad with wood shingles and have returned eaves. The façade has an exterior, centered brick chimney that pierces through the gable's eave. The house has a combination of wood-frame, two-over-two, double-hung windows and vinyl-frame double-hung windows. Other alterations include vinyl siding, front porch enclosure, and a one-story, rear addition.

33348 Wisharts Point Road is a one-and-one-half-story house with a front-gable roof constructed in 1920 in the Bungalow style (Figure 24). The house is two bays in length and four bays in depth, has a rectangular plan, and rests on a rusticated concrete block foundation. The roof is clad with asphalt shingles. Alterations include vinyl siding and window and a replacement door at the main entry.

33362 Wisharts Point Road is a two-and-one-half-story house with a side-gable roof constructed in 1900 in the vernacular interpretation of the Greek Revival-style (Figure 24). The house is two bays in length and one bay in depth. The roof is clad with asphalt shingles and has an interior brick chimney. The gable ends have eave returns. The house has wood-frame, three-over-one, double-hung windows that are covered with aluminum storm windows. The three lights in the upper sashes are vertically oriented. The off-centered main entry has a wood door with four lights in the upper half that are vertically oriented. The off-centered main entry is sheltered by a gable canopy with pediment that is supported by decorative metal posts that rest on a concrete stoop accessed by two concrete steps. The rear elevation has a gabled-roof, two-story extension that is two bays in depth and one bay in length, and has an interior brick chimney. The extension's side elevation has a one-story porch enclosure. Alterations include asbestos siding, a shed addition near the extension's west corner, and the extension's porch enclosure.

The community located on Wisharts Point is NRHP eligible under Criterion C for architecture, at the local level, as a historic district. The community's period of significance is 1900 to 1920 and contains vernacular interpretations of the Gothic Revival, Colonial Revival, Greek Revival, and Bungalow styles. Facing northwest, the eight houses are 2.9 to 3.0 miles northwest of the project area. The proposed project may only be visible to 33362 Wisharts Point Road from its southeast side property line. The project may have an effect on the potential NRHP eligible historic district, but the effect would not be adverse.

Direct APE

The proposed communications tower would be placed on previously disturbed soils resulting from the construction of underground utility conduits, a parking lot, and two modern buildings, X-015 and X-035, east of the project site. These have significantly impacted the original ground surface and any excavations required to bury the new cable run would occur within previously disturbed soils. There is no potential for undisturbed soils or intact cultural deposits within a 2-foot depth of the existing grade. Also, based on the *Cultural Resources Assessment of NASA Wallops Flight Facility* conducted in 2003, the project site would be located in an area of low sensitivity for prehistoric or historic archaeological sites. As such, this proposed undertaking has no potential to impact significant archaeological sites and would have no effect on archaeological historic properties. It is recommended that no archaeological survey would be necessary within the direct APE.

Summary

The proposed communications tower has no potential to affect significant archaeological sites and would have no effect on archaeological historic properties. It is recommended that no archaeological survey would be necessary within the direct APE. While the proposed communications tower may have an effect on the six above-ground historic properties and the one historic district, any effects would not be adverse. No further cultural resource investigations are recommended for this proposed undertaking.

If you have any questions or comments, please feel free to contact me at (301) 820-3145 or scott.seibel@aecom.com.

Sincerely,

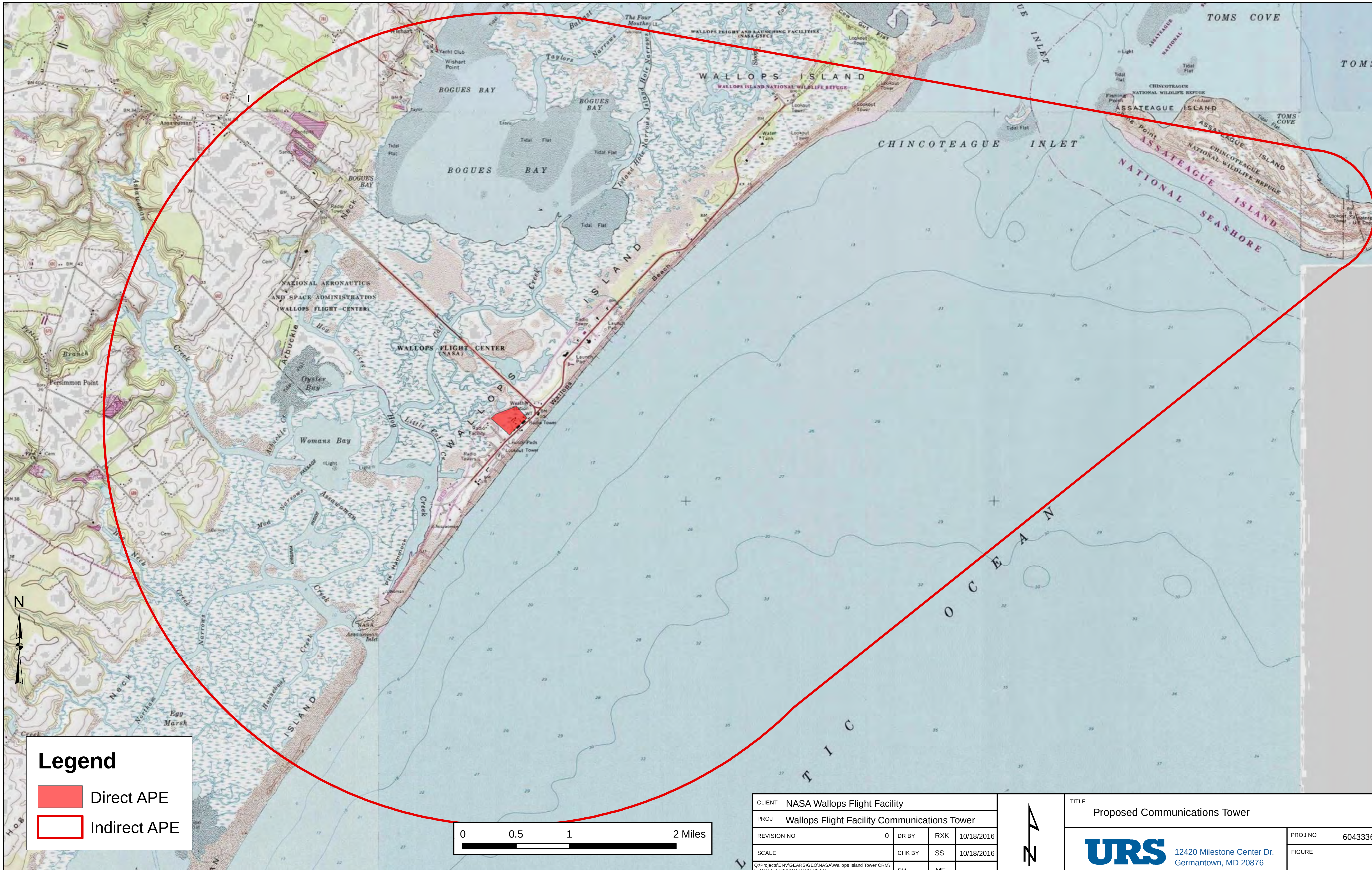
URS Group, Inc.

Loin V. Faris

Scott Seibel, RPA
Archaeology Program Manager

Lorin V. Farris, MA
Architectural Historian

Attachments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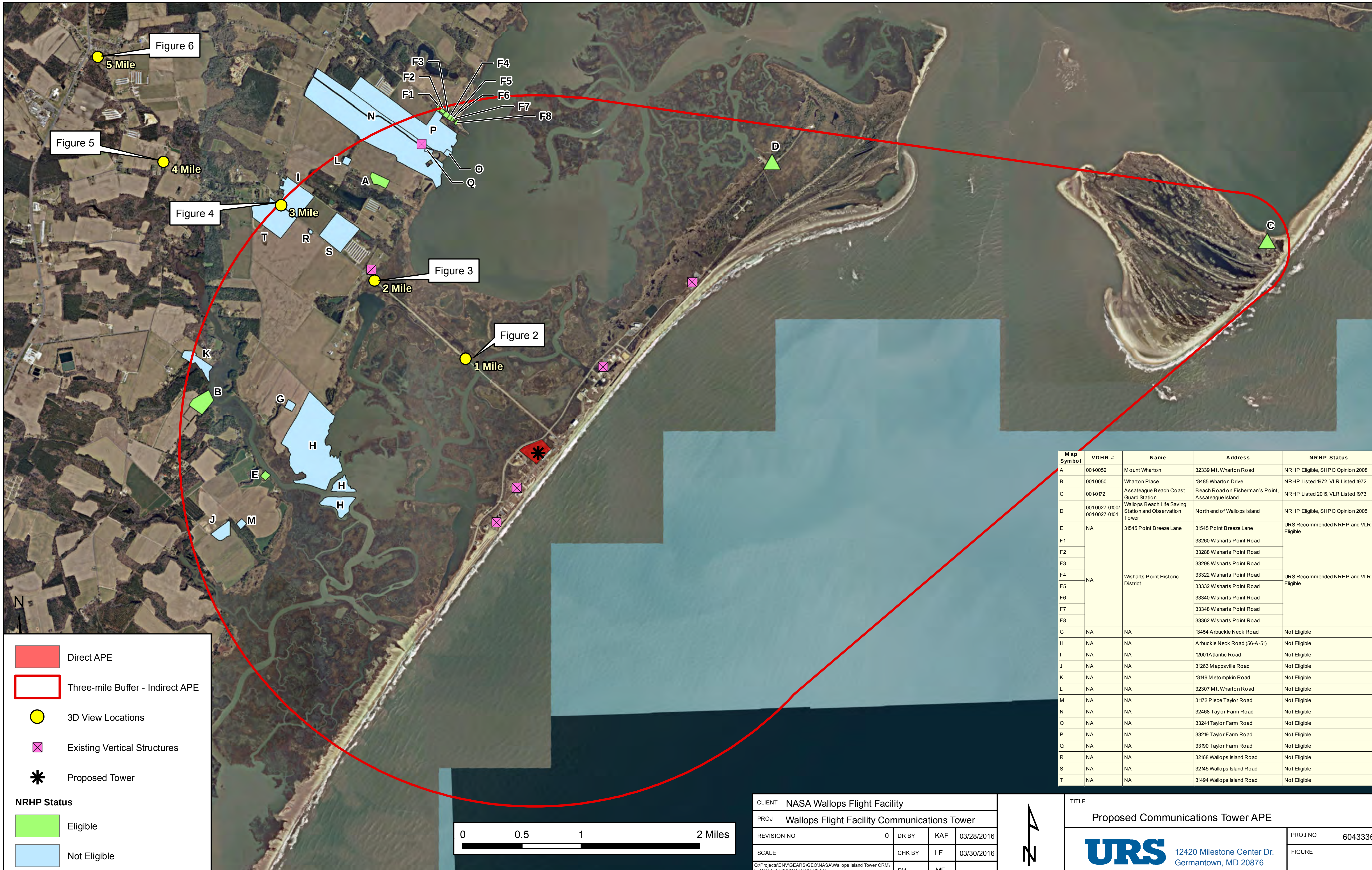
TITLE
Proposed Communications Tower
URS
12420 Milestone Center Dr.
Germantown, MD 20876
PROJ NO
60433362
FIGURE
BOGUES BAY
WALLOPS ISLAND
CHINCOTEAGUE INLET
ASSATEAGUE ISLAND
TOMS COVE
NATIONAL SEASHORE
WALLOPS FLIGHT CENTER (NASA)
NATIONAL AERONAUTICS AND SPACE ADMINISTRATION (WALLOPS FLIGHT CENTER)
Womans Bay
Oyster Bay
ATLANTIC OCEAN



Map Symbol	VDHR #	Name	Address	NRHP Status
A	001-0052	Mount Wharton	32339 Mt. Wharton Road	NRHP Eligible, SHPO Opinion 2008
B	001-0050	Wharton Place	13485 Wharton Drive	NRHP Listed 1972, VLR Listed 1972
C	001-0172	Assateague Beach Coast Guard Station	Beach Road on Fisherman's Point, Assateague Island	NRHP Listed 2015, VLR Listed 1973
D	001-0027-0100/ 001-0027-0101	Wallops Beach Life Saving Station and Observation Tower	North end of Wallops Island	NRHP Eligible, SHPO Opinion 2005
E	NA	31545 Point Breeze Lane	31545 Point Breeze Lane	URS Recommended NRHP and VLR Eligible
F1	NA	Wisharts Point Historic District	33260 Wisharts Point Road	URS Recommended NRHP and VLR Eligible
F2			33288 Wisharts Point Road	
F3			33298 Wisharts Point Road	
F4			33322 Wisharts Point Road	
F5			33332 Wisharts Point Road	
F6			33340 Wisharts Point Road	
F7			33348 Wisharts Point Road	
F8			33362 Wisharts Point Road	
G	NA	NA	13454 Arbuckle Neck Road	Not Eligible
H	NA	NA	Arbuckle Neck Road (56-A-51)	Not Eligible
I	NA	NA	12001 Atlantic Road	Not Eligible
J	NA	NA	31263 Mappsville Road	Not Eligible
K	NA	NA	13149 Metompkin Road	Not Eligible
L	NA	NA	32307 Mt. Wharton Road	Not Eligible
M	NA	NA	31172 Piece Taylor Road	Not Eligible
N	NA	NA	32468 Taylor Farm Road	Not Eligible
O	NA	NA	33241 Taylor Farm Road	Not Eligible
P	NA	NA	33219 Taylor Farm Road	Not Eligible
Q	NA	NA	33190 Taylor Farm Road	Not Eligible
R	NA	NA	32168 Wallops Island Road	Not Eligible
S	NA	NA	32145 Wallops Island Road	Not Eligible
T	NA	NA	31494 Wallops Island Road	Not Eligible

CLIENT NASA Wallops Flight Facility

PROJ Wallops Flight Facility Communications Tower

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N

TITLE

Proposed Communications Tower APE

URS

12420 Milestone Center Dr.
Germantown, MD 20876

PROJ NO 60433362

FIGURE 1

CLIENT NASA Wallops Flight Facility			
PROJ Wallops Flight Facility Communications Tower			
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TITLE Proposed Communications Tower - Direct APE

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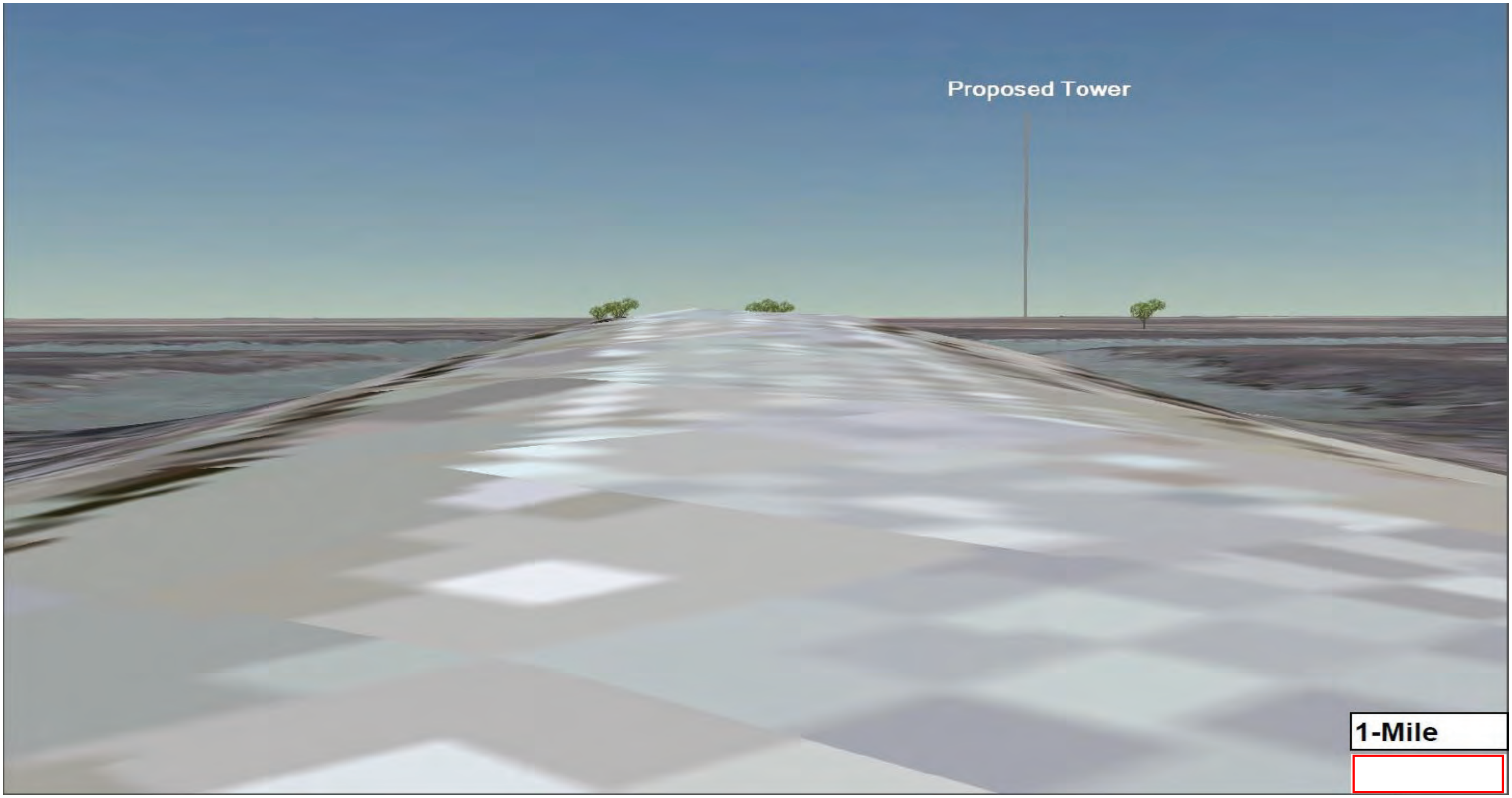
PROJ NO 60433362

FIGURE 2



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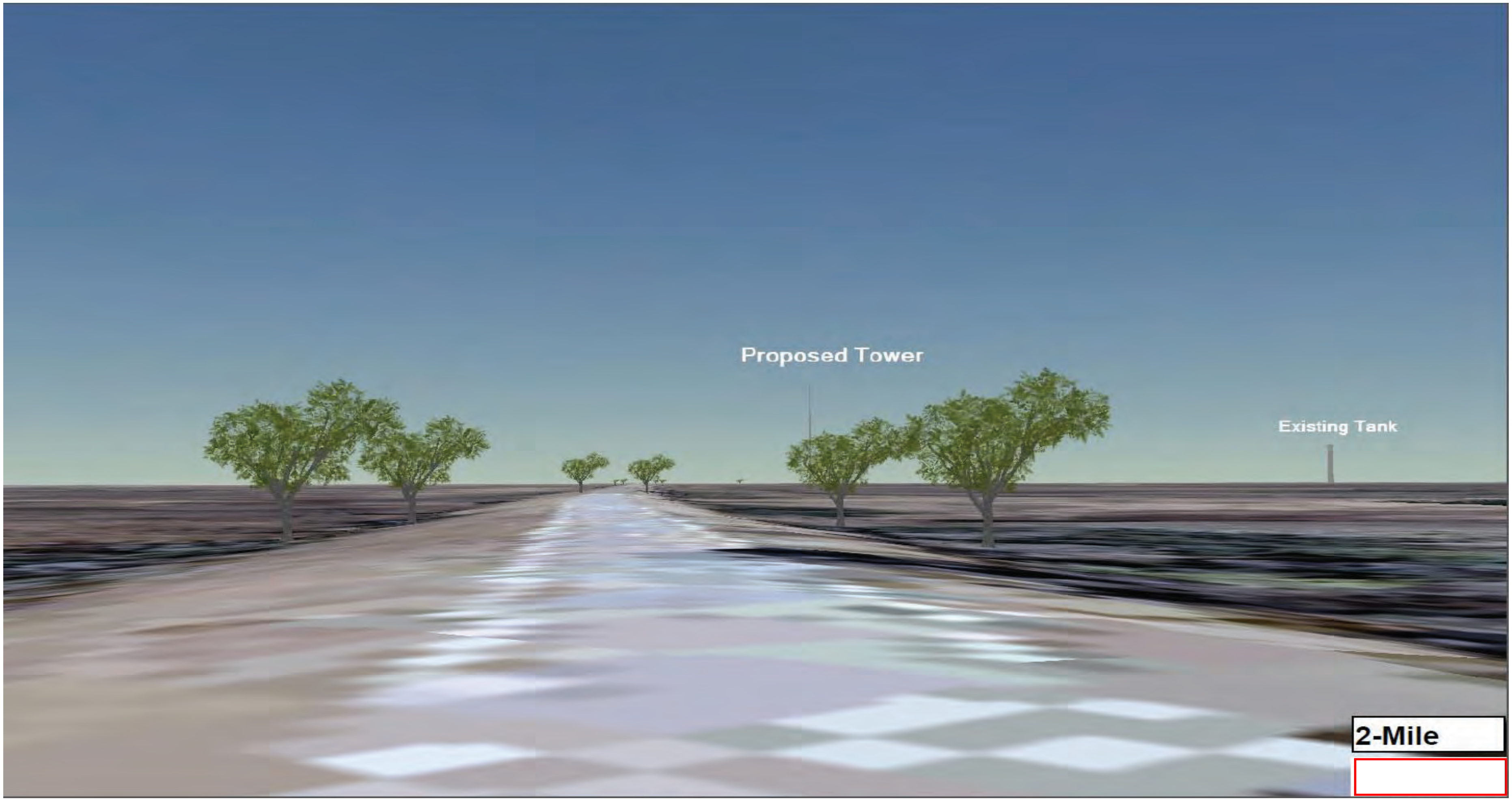
TITLE Representative Views of Proposed Communications Tower

URS 12420 Milestone Center Dr.
Germantown, MD 20876

PROJ NO 60433362

FIGURE 3



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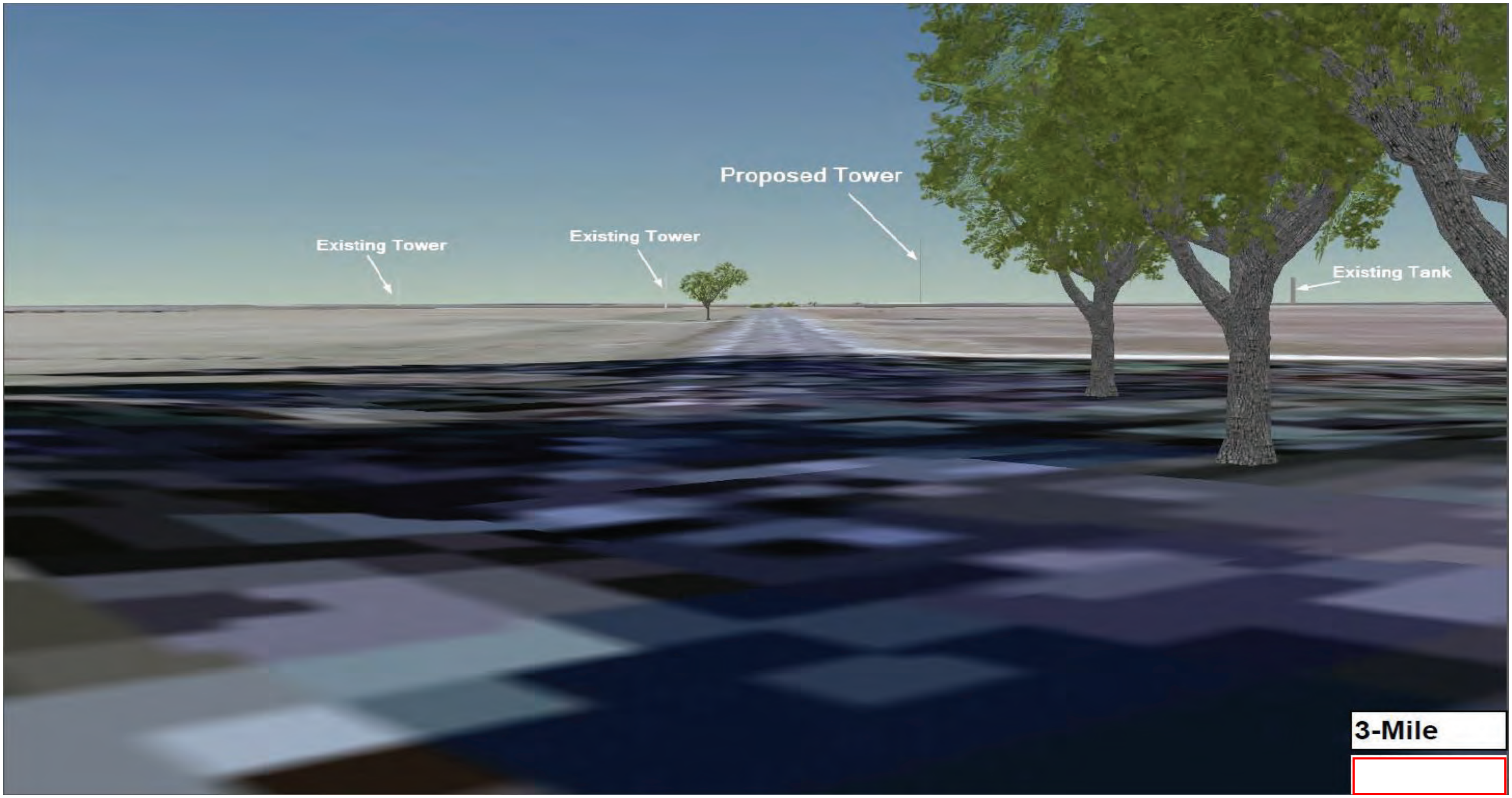
TITLE Representative Views of Proposed Communications Tower

URS 12420 Milestone Center Dr. Germantown, MD 20876

PROJ NO 60433362

FIGURE 4



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TITLE Representative Views of Proposed Communications Tower

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FIGURE 5

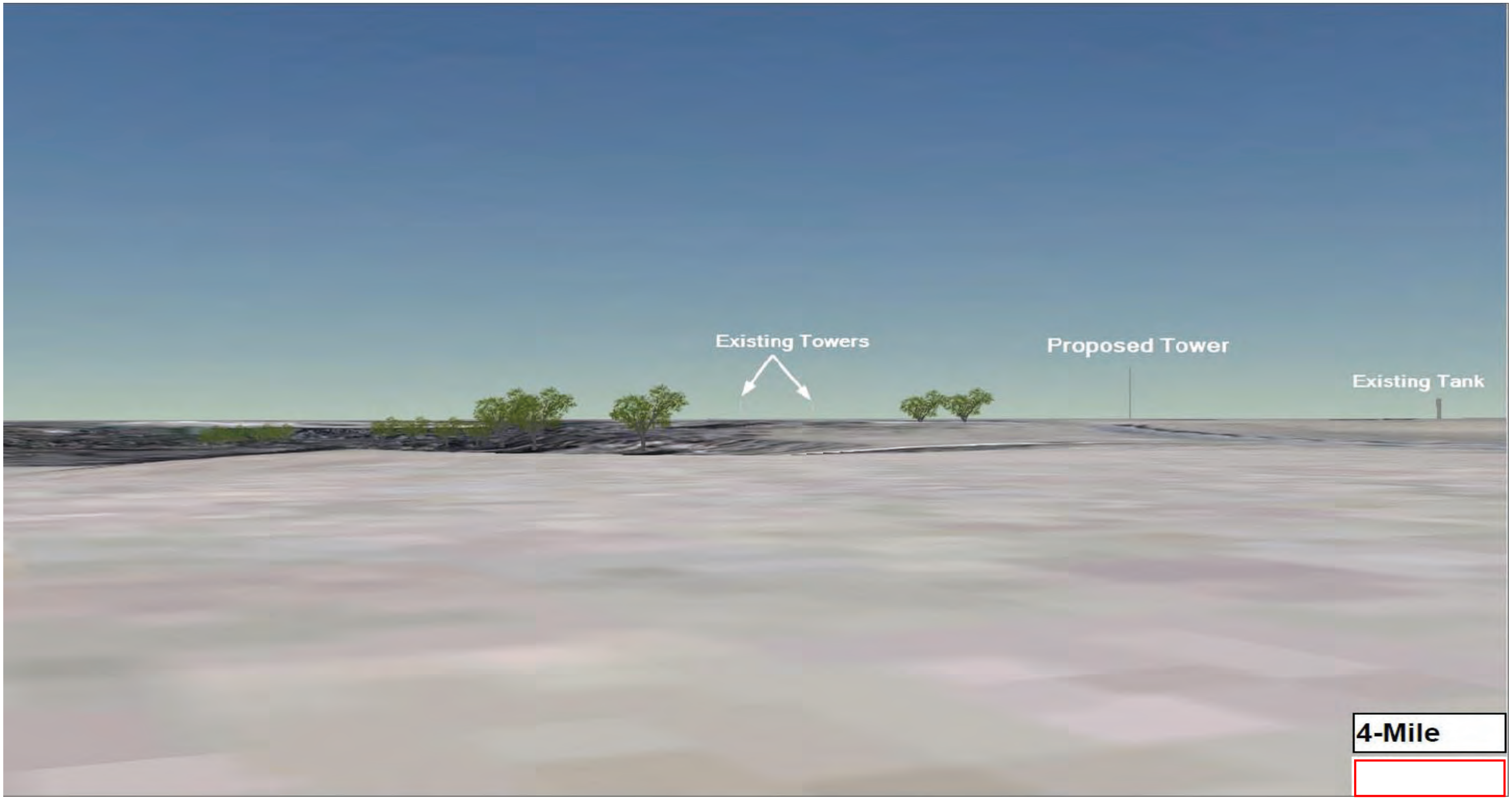

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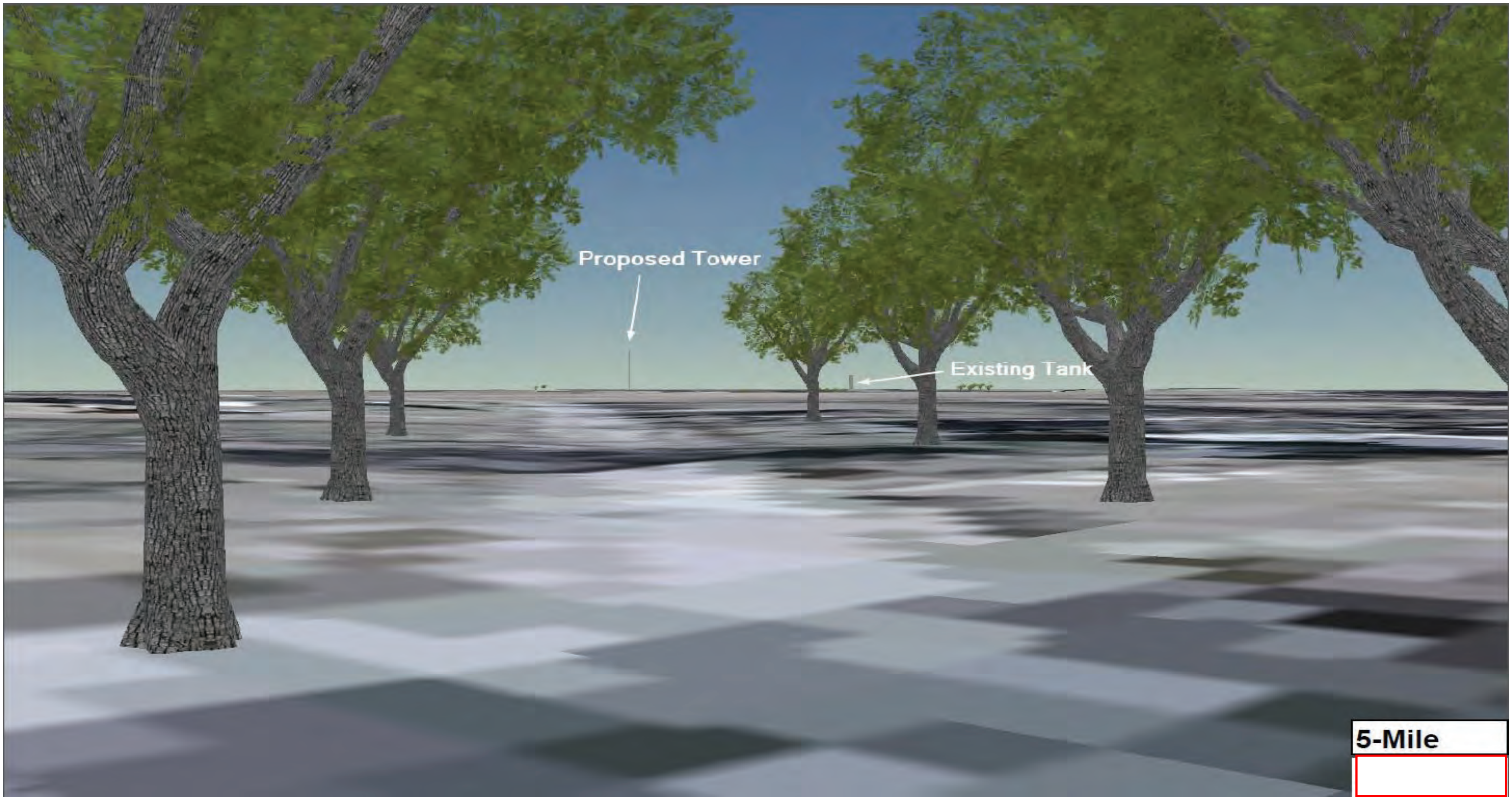
FIGURE 6



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TITLE Representative Views of Proposed Communications Tower

URS 12420 Milestone Center Dr. Germantown, MD 20876

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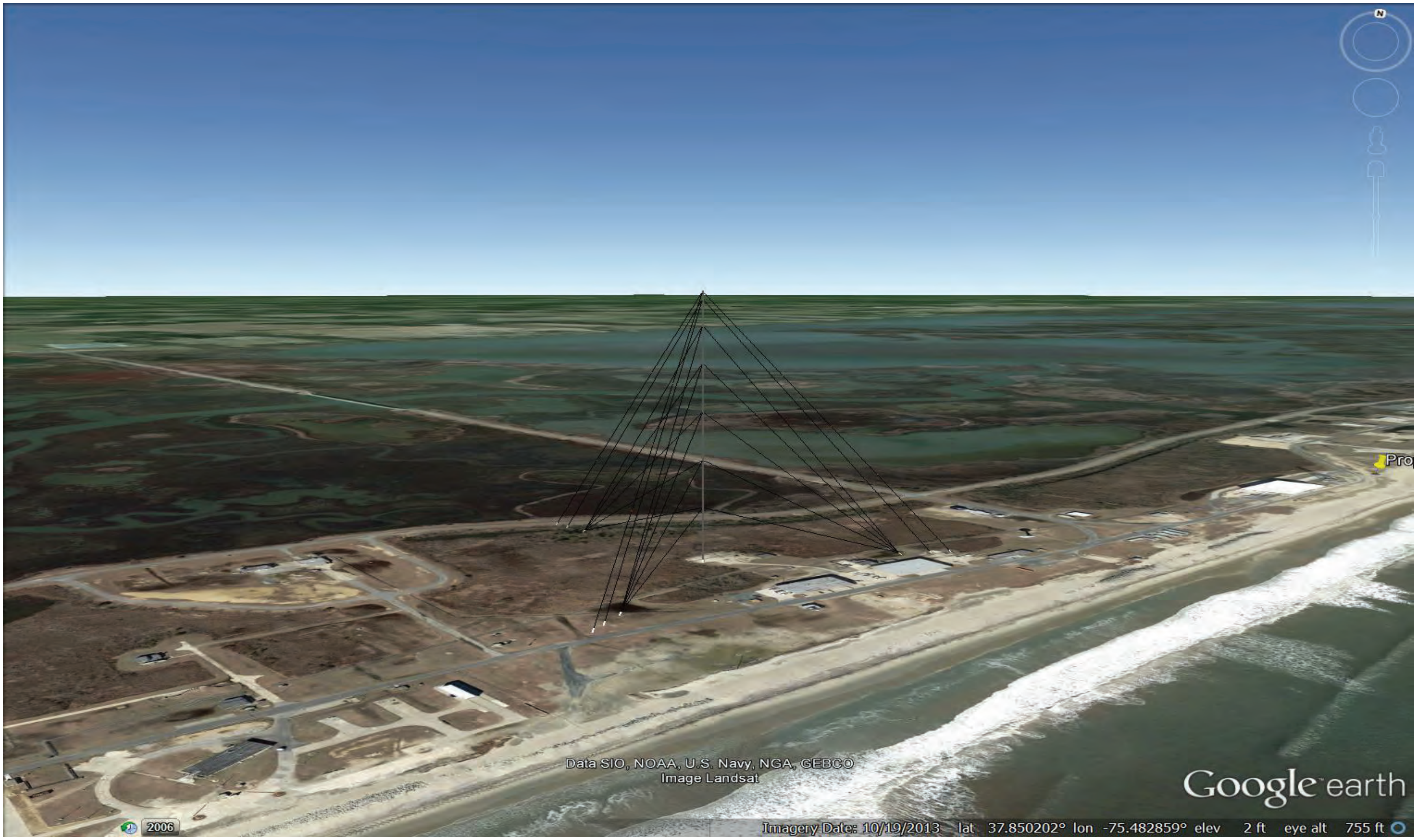
FIGURE 7



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TITLE Proposed Communications Tower and Surrounding Area

URS 12420 Milestone Center Dr. Germantown, MD 20876

PROJ NO 60433362

FIGURE 8

Photo 1. 32339 Mt. Wharton Road, Looking Southeast

Photo 2. 32339 Mt. Wharton Road, Looking North

CLIENT NASA Wallops Flight Facility					TITLE Historic Property Photographs	
PROJ Wallops Flight Facility Communications Tower						
REVISION NO 0	DR BY	LF	02/24/2016	URS 12420 Milestone Center Dr Germantown, MD 20876	PROJ NO	60433362
SCALE n/a	CHK BY	ME	02/25/2016		FIGURE	9
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Photo 3. 32339 Mt. Wharton Road, Looking Southeast Towards Project Site

CLIENT NASA Wallops Flight Facility				
PROJ Wallops Flight Facility Communications Tower				
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TITLE
Historic Property Photographs

URS 12420 Milestone Center Dr
Germantown, MD 20876

PROJ NO 60433362
FIGURE 10

Photo 1. 13485 Wharton Drive, Looking Northwest

Photo 2. 13485 Wharton Drive, Looking Southwest

CLIENT NASA Wallops Flight Facility				
PROJ Wallops Flight Facility Communications Tower				
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TITLE Historic Property Photographs

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PROJ NO 60433362

FIGURE 11

Photo 3. 13485 Wharton Drive, Looking East Towards Project Site

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PROJ Wallops Flight Facility Communications Tower				
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TITLE Historic Property Photographs

URS 12420 Milestone Center Dr Germantown, MD 20876

PROJ NO 60433362

FIGURE 12

Photo 1. Assateague Beach Coast Guard Station, Looking Southeast (VDHR)

Photo 2. Assateague Beach Coast Guard Boathouse and Marine Rail Launchway, Looking Southeast (NPS)

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PROJ Wallops Flight Facility Communications Tower				
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TITLE Historic Property Photographs

URS 12420 Milestone Center Dr Germantown, MD 20876

PROJ NO	60433362
FIGURE	13

Photo 3. Looking Northeast Towards Assateague Beach Coast Guard Station from Project Site

CLIENT NASA Wallops Flight Facility				
PROJ Wallops Flight Facility Communications Tower				
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TITLE Historic Property Photographs

URS 12420 Milestone Center Dr Germantown, MD 20876

PROJ NO	60433362
FIGURE	14

Photo 1. Assateague Lighthouse, Looking Northwest (LOC)

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PROJ Wallops Flight Facility Communications Tower				
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TITLE Historic Property Photographs

URS 12420 Milestone Center Dr Germantown, MD 20876

PROJ NO 60433362

FIGURE 15

Photo 1. Wallops Beach Life Saving Station, Looking Northwest

Photo 2. Wallops Beach Life Saving Station and Observation Tower, Looking Southwest

CLIENT NASA Wallops Flight Facility				
PROJ Wallops Flight Facility Communications Tower				
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TITLE Historic Property Photographs	
URS 12420 Milestone Center Dr Germantown, MD 20876	PROJ NO 60433362
	FIGURE 16

Photo 3. Wallops Beach Life Saving Station and Observation Tower, Looking Southwest to Project Site

CLIENT NASA Wallops Flight Facility				
PROJ Wallops Flight Facility Communications Tower				
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TITLE Historic Property Photographs

URS 12420 Milestone Center Dr Germantown, MD 20876

PROJ NO 60433362

FIGURE 17

Photo 1. 31545 Point Breeze Lane, Looking North

Photo 2. 31545 Point Breeze Lane, Looking Southeast

CLIENT NASA Wallops Flight Facility				TITLE Historic Property Photographs	
PROJ Wallops Flight Facility Communications Tower					
REVISION NO 0	DR BY	LF	02/24/2016	URS 12420 Milestone Center Dr Germantown, MD 20876	PROJ NO 60433362
SCALE n/a	CHK BY	ME	02/25/2016		FIGURE 18
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Photo 3. 31545 Point Breeze Lane, Looking Southeast to Project Site

CLIENT NASA Wallops Flight Facility				
PROJ Wallops Flight Facility Communications Tower				
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TITLE
Historic Property Photographs

URS 12420 Milestone Center Dr Germantown, MD 20876

PROJ NO	60433362
FIGURE	19

Photo 1. Wisharts Point Road Historic District, Aerial View (Bing)

CLIENT NASA Wallops Flight Facility				TITLE Historic Property Photographs	
PROJ Wallops Flight Facility Communications Tower					
REVISION NO 0	DR BY	LF	02/24/2016	URS 12420 Milestone Center Dr Germantown, MD 20876	PROJ NO 60433362
SCALE n/a	CHK BY	ME	02/25/2016		FIGURE 20
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Photo 1. 33260 Wisharts Point Road, Looking Southeast

Photo 2. 33288 Wisharts Point Road, Looking Southwest

CLIENT NASA Wallops Flight Facility				TITLE Historic Property Photographs	
PROJ Wallops Flight Facility Communications Tower					
REVISION NO 0	DR BY	LF	02/24/2016	URS 12420 Milestone Center Dr Germantown, MD 20876	PROJ NO 60433362
SCALE n/a	CHK BY	ME	02/25/2016		FIGURE 21
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Photo 3. 33298 Wisharts Point Road, Looking Southwest

Photo 4. 33322 Wisharts Point Road, Looking Southwest

CLIENT NASA Wallops Flight Facility					TITLE Historic Property Photographs	
PROJ Wallops Flight Facility Communications Tower						
REVISION NO	0	DR BY	LF	02/24/2016	URS 12420 Milestone Center Dr Germantown, MD 20876	PROJ NO 60433362
SCALE	n/a	CHK BY	ME	02/25/2016		FIGURE 22
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Photo 5. 33332 Wisharts Point Road, Looking Southwest

Photo 6. 33340 Wisharts Point Road, Looking Southwest

CLIENT NASA Wallops Flight Facility				
PROJ Wallops Flight Facility Communications Tower				
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TITLE
Historic Property Photographs

URS
12420 Milestone Center Dr
Germantown, MD 20876

PROJ NO 60433362
FIGURE 23

Photo 7. 33348 Wisharts Point Road, Looking Southeast

Photo 8. 33362 Wisharts Point Road, Looking Southwest

CLIENT NASA Wallops Flight Facility				
PROJ Wallops Flight Facility Communications Tower				
REVISION NO 0	DR BY	LF	02/24/2016	
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TITLE Historic Property Photographs		
URS 12420 Milestone Center Dr Germantown, MD 20876	PROJ NO	60433362
	FIGURE	24

Photo 1. 13454 Arbuckle Neck Road does not retain integrity because of window replacement, rear additions, and asbestos siding.

Photo 2. House at Arbuckle Neck Road does not retain integrity because of aluminum siding, removal of windows, and deteriorated condition.

Photo 3. 12001 Atlantic Road does not retain integrity because of porch enclosure, corrugated metal awnings, and asbestos siding.

Photo 4. 31263 Mappsville Road does not retain integrity because of vinyl siding, window replacement, and porch enclosures.

Photo 5. 13149 Metompkin Road does not retain integrity because of aluminum siding, porch enclosures, and large, two-story rear addition.

Photo 6. 32307 Mt. Wharton Road does not retain integrity because of window replacement, concrete block cladding at the foundation, and large two-story rear addition.

CLIENT NASA Wallops Flight Facility				
PROJ Wallops Flight Facility Communications Tower				
REVISION NO	0	DR BY	LF	02/24/2016
SCALE	n/a	CHK BY	ME	02/25/2016
Q:\Projects\ENV\GEARS\GEO\NASA\Wallops Island Tower CRM \E. Data\E.5 Graphics\Illustrator\Photographs & Graphics		PM	SS	02/26/2016

TITLE
Non-Eligible Property Photographs and Condition Assessments

URS
12420 Milestone Center Dr
Germantown, MD 20876

PROJ NO	60433362
FIGURE	25

Photo 7. 31172 Pierce Taylor Road does not retain integrity because of asbestos siding, window replacement, and front addition.

Photo 8. 32468 Taylor Farm Road does not retain integrity because of front and rear porch enclosures, porch removal, and asbestos siding.

Photo 9. 33241 Taylor Farm Road does not retain integrity because of side addition, porch enclosures, and aluminum siding.

Photo 10. 33219 Taylor Farm Road does not retain integrity because of front porch enclosure and deteriorated condition.

Photo 11. 33190 Taylor Farm Road does not retain integrity because of side addition, window replacement, and vinyl siding.

Photo 12. 32168 Wallops Island Road does not retain integrity because of vinyl siding and side addition.

CLIENT NASA Wallops Flight Facility					
PROJ Wallops Flight Facility Communications Tower					
REVISION NO	0	DR BY	LF	02/24/2016	
SCALE	n/a	CHK BY	ME	02/25/2016	
Q:\Projects\ENV\GEARS\GEO\NASA\Wallops Island Tower CRM\E. Data\E.5 Graphics\Illustrator\Photographs & Graphics		PM	SS	02/26/2016	

TITLE Non-Eligible Property Photographs and Condition Assessments		
URS 12420 Milestone Center Dr Germantown, MD 20876	PROJ NO	60433362
	FIGURE	26

Photo 13. 32145 Wallops Island Road does not retain integrity because of asbestos siding, and rear porch enclosure.

Photo 14. 31494 Wallops Island Road does not retain integrity because of aluminum siding, side addition, and garage doors and window replacement.

CLIENT NASA Wallops Flight Facility				
PROJ Wallops Flight Facility Communications Tower				
REVISION NO 0	DR BY	LF	02/24/2016	
SCALE n/a	CHK BY	ME	02/25/2016	
Q:\Projects\ENV\GEARS\GEO\NASA\Wallops Island Tower CRM \E. Data\E.5 Graphics\Illustrator\Photographs & Graphics	PM	SS	02/26/2016	

TITLE Non-Eligible Property Photographs and Condition Assessments	
URS 12420 Milestone Center Dr Germantown, MD 20876	PROJ NO 60433362
	FIGURE 27

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Federal Consistency Determination [to be provided]

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Scoping Correspondence

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National Aeronautics and Space Administration

Goddard Space Flight Center
Wallops Flight Facility
Wallops Island, VA 23337-5099

February 5, 2016

Reply to Attn of: 250.W

[redacted]

Dear [redacted]

In accordance with the National Environmental Policy Act of 1969 (NEPA), as amended, the National Aeronautics and Space Administration (NASA) Goddard Space Flight Center's Wallops Flight Facility (WFF) in Wallops Island, Virginia, is currently preparing an Environmental Assessment (EA) to address the proposed construction and operation of an instrumented tower on Wallops Island, Accomack County, Virginia. Under the Proposed Action, NASA would authorize the Department of Defense to install and operate a guyed instrumentation tower on mid-Wallops Island. The structure could be as tall as 750 feet and the primary purpose would be to act as an instrumentation tower. The EA will analyze the potential direct, indirect, and cumulative environmental effects of the Proposed Action and a range of reasonable alternatives, including a No Action Alternative.

You are receiving this letter because public participation is an important part of the NEPA process, and NASA believes either you or your organization may have an interest in the proposed project.

Tower Siting

Prior to requesting that NASA consider allowing the installation of an instrumentation tower at Wallops Island, the Department of Defense considered multiple alternative sites that could potentially meet its objectives. To be considered a viable alternative, the location for the communications tower must be: (1) within 10 nautical miles of the Atlantic Coast in the northern Virginia or southern Maryland regions, with sites closest to the coast preferred; (2) on a guarded military or other Government-owned facility for security requirements; (3) on a site which affords vehicular access, electrical, and communication services without substantial site preparation and/or additional infrastructure investment; (4) in an open area to support up to an approximately 500-foot radius to enable the required guy wire footprint; and (5) outside of an established or proposed aircraft flight corridor, thereby, allowing for construction at a minimum height of approximately 500 feet, with an optimum height of approximately 750 feet (Figure 1).

Figure 1: Location of NASA's Wallops Flight Facility

Tower Design

The tower would be a typical 3-sided lattice structure, approximately 48 inches per side and constructed of galvanized steel. Steel guy wires would be installed along three radii from the tower at angles of 120 degrees from each other. Guys would be required approximately every 60 feet and would tie into two or three anchor points positioned in-line with each of the three radii. Therefore, each of the three guy radii could contain up to approximately twelve individual guys, depending upon the final tower height.

All structural components of the tower would be pile-supported due to the underlying geologic conditions (i.e., silty material beneath a thin layer of sand). Piles could be driven or cast in place. Based upon previous projects on Wallops Island, it is expected that piles would need to be installed to approximately 100 feet in depth. If necessary, gravel access roads may be installed from the paved roads or parking lots to the base of the tower and to the guy anchors.

In addition to the tower itself, a small (approximately 10 feet x 20 feet) enclosure would be installed at the base of the tower to house electronics and tower-related equipment. Electricity and communication utility lines would be tied-in from nearby existing locations. To provide back-up electricity, a 30-kilowatt propane-fueled generator (and associated fuel tank) would be installed adjacent to the electronics enclosure. To mitigate the potential for flooding during storm events, the enclosure and all supporting equipment would be elevated to at least 11 feet above mean sea level.

Measures to Mitigate Adverse Environmental Effects

In accordance with Federal Aviation Administration (FAA) guidelines, the tower would be lit for pilot safety. However, to minimize the collision risk to nocturnally-active avian species, the tower's lighting scheme would be consistent with the September 14, 2000 *Service Guidance on the Siting, Construction, Operation and Decommissioning of Communications Towers* (**USFWS 2000**) as well as a recent FAA-commissioned study **(Patterson 2012)** which verified the visibility of more bird-friendly tower lighting configurations (i.e., flashing lights versus steady-burning fixtures) to pilots. Likewise, the guy wires would include visual aerial markers (per **APLIC [2012]** recommendations) to reduce the potential for diurnal (daytime) avian collisions.

In response to a recommendation by the U.S. Fish and Wildlife Service (USFWS) Virginia Field Office, the Department of Defense would fund a minimum of two years of post-construction avian mortality monitoring. The details of the monitoring program would be developed in accordance with USFWS and other avian stakeholders, as appropriate.

Request for Stakeholder Input

In scoping the forthcoming EA and monitoring plan, NASA request's your input regarding potential environmental concerns or possible project alternatives, and suggestions for the avian monitoring program, such that these can be considered in preparing the Draft documents.

Comments may be submitted by mail, phone, fax, or email, and will be accepted throughout the entire Draft EA analysis process. However, for full early consideration and to best help shape and refine the proposal, please submit comments by March 7, 2016 to:

Shari Miller
Manager, Instrumentation Tower EA
NASA Goddard Space Flight Center's Wallops Flight Facility
Wallops Island, VA 23337
Phone: (757) 824-2327
Fax: (757) 824-1819
Email: Shari.A.Miller@nasa.gov

If you do not have input at this time, other means for involvement, including reviews of the Draft and Final EA, will be offered in the future. You will be provided mailed notices regarding the availability of these documents unless you request to be removed from our distribution list. On behalf of the entire EA team, I would like to thank you for your interest in this project. We look forward to working with you.

Sincerely,

Theodore J. Meyer

Theodore J. Meyer
Associate Chief, Medical and Environmental Management Division

cc:
200/Ms. C. Massey
250/Mr. E. Connell

References:

APLIC (Avian Power Line Interaction Committee). (2012). *Reducing avian collisions with power lines: the state of the art in 2012*. Edison Electric Institute and APLIC. Washington, DC.

Patterson Jr, J. W. (2012). *Evaluation of new obstruction lighting techniques to reduce avian fatalities* (No. DOT/FAA/TC-TN12/9).

USFWS (U.S. Fish and Wildlife Service). (2000). *Service guidance on the siting, construction, operation and decommissioning of communications towers*. Washington DC:Author.

DEPARTMENT OF THE AIR FORCE

AIR FORCE CIVIL ENGINEER CENTER

JOINT BASE SAN ANTONIO LACKLAND TEXAS

March 01, 2017

SUBJECT: Interagency Intergovernmental Coordination of Environmental Planning for a Tower Construction Project on Wallops Island, VA

Dear potential stakeholder,

In accordance with the National Environmental Policy Act of 1969 (NEPA), as amended, the United States Air Force (USAF) is preparing an Environmental Assessment (EA) to analyze the potential impacts associated with the proposed construction and operation of a 750-foot tall instrumentation tower on Wallops Island in Accomack County, Virginia. The proposed project location and an alternative site are within the current boundaries of the National Aeronautics and Space Administration (NASA) Goddard Space Flight Center's Wallops Flight Facility (WFF) (see Enclosures 1 and 2). As such, NASA is serving as a Cooperating Agency in preparing the EA. Similarly, the United States Naval Air Systems Command, along with NASA, would be co-locating instrumentation on this tower and, therefore, and are therefore serving as a Cooperating Agencies for this EA.

The proposed action includes constructing a 750-foot guyed tower, two prefabricated base shelters, and a 500-gallon propane tank and generator for back-up power supply. Specific instrumentation proposed to be installed on the tower includes: ultra-high frequency/very high frequency (UHF/VHF) radios, telemetry dishes, global positioning system (GPS) antennas, spectrum monitoring antennas, and a flight termination system. The purpose of the proposed project is to enhance currently operating research, development, test, and evaluation support capabilities and extend coverage in the mid-Atlantic operating areas, allowing for refined communications infrastructure in and around the WFF. The increased prevalence of Unmanned Aerial Systems (UAS) testing has led the Department of Defense (DoD) to identify requirements for off-shore situational awareness to support UAS testing. Current systems are limited in providing airspace management, flight test control and range safety functions, and spectrum management. The Proposed Action would expand these services and reduce current limitations. This tower would be used to conduct testing in collaboration with other DoD services and Government agencies.

As USAF initiates the NEPA analysis, it is requesting input from potential stakeholders and interested parties, including Federal and State regulatory agencies, non-government organizations (NGO), and others to inform and focus the analysis. The USAF respectfully requests that you provide comments or concerns by April 3, 2017. Please email responses and inquiries to tower.comments@aecom.com or send responses via U.S. mail to the following address:

Tower Project
c/o URS Corp
12420 Milestone Center Drive, Suite 150 (4th floor)
Germantown, MD 20876

Sincerely,

Michael Ackerman
Air Force Civil Engineering Center
NEPA Division (AFCEC/CZN)

Two (2) Enclosures
1. Locations of Alternatives Under Consideration
2. Conceptual Rendering of Proposed Action (Preferred Alternative)

DEPARTMENT OF THE AIR FORCE
AIR FORCE CIVIL ENGINEER CENTER
JOINT BASE SAN ANTONIO LACKLAND TEXAS

March 01, 2017

SUBJECT: Interagency Intergovernmental Coordination of Environmental Planning for a Tower Construction Project on Wallops Island, VA

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In prior correspondence, the project was proposed by the United States Army Research, Development, and Engineering Command. Since that time, the project has been realigned to the USAF to lead and execute. No other aspects of the Proposed Action have changed.

The proposed action includes constructing a 750-foot guyed tower, two prefabricated base shelters, and a 500-gallon propane tank and generator for back-up power supply. Specific instrumentation proposed to be installed on the tower includes: ultra-high frequency/very high frequency (UHF/VHF) radios, telemetry dishes, global positioning system (GPS) antennas, spectrum monitoring antennas, and a flight termination system. The purpose of the proposed project is to enhance currently operating research, development, test, and evaluation support capabilities and extend coverage in the mid-Atlantic operating areas, allowing for refined communications infrastructure in and around the WFF. The increased prevalence of Unmanned Aerial Systems (UAS) testing has led the Department of Defense (DoD) to identify requirements for off-shore situational awareness to support UAS testing. Current systems are limited in providing airspace management, flight test control and range safety functions, and spectrum management. The Proposed Action would expand these services and reduce current limitations. This tower would be used to conduct testing in collaboration with other DoD services and Government agencies.

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Tower Project
c/o URS Corp
12420 Milestone Center Drive, Suite 150 (4th floor)
Germantown, MD 20876

Sincerely,

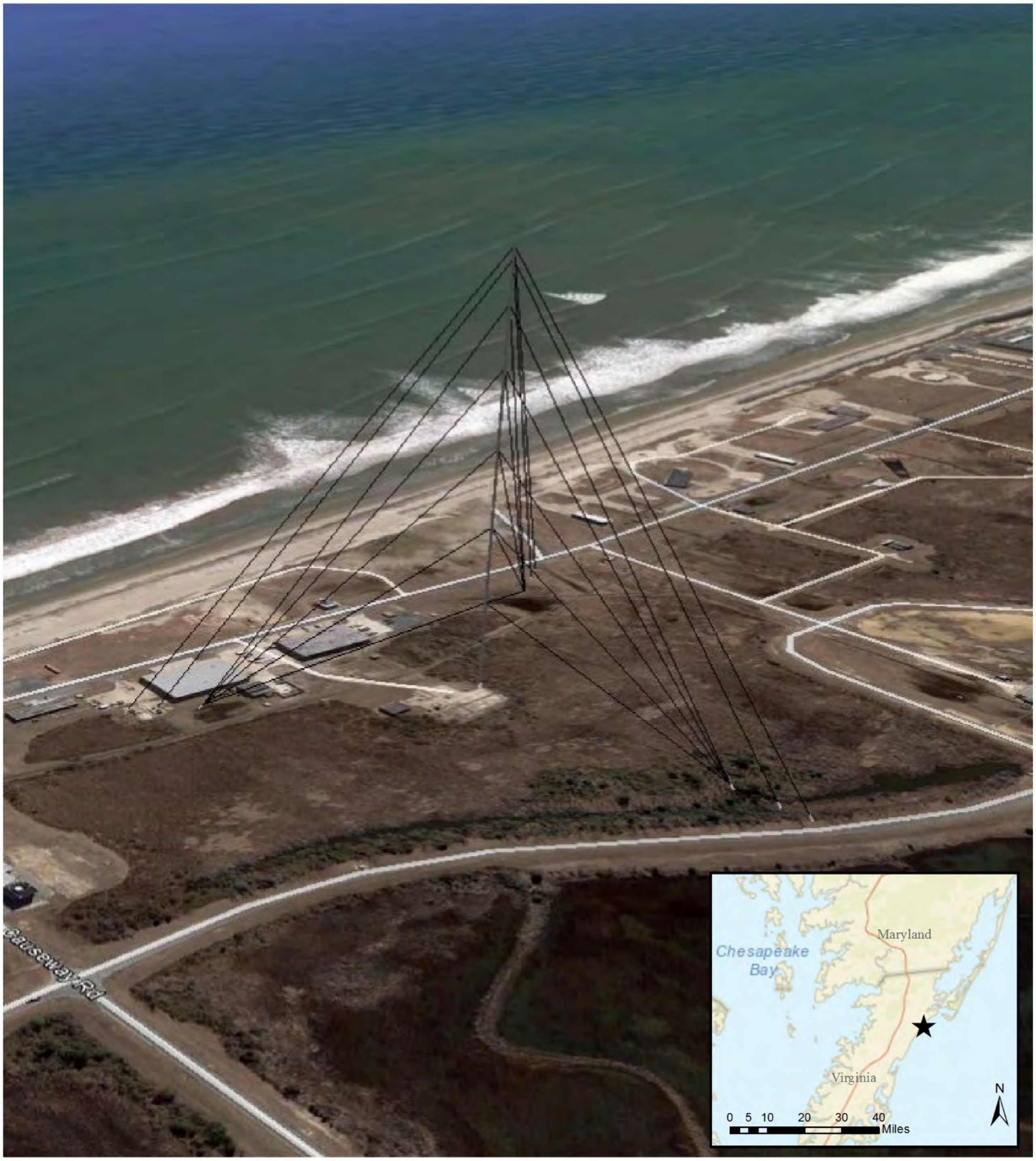
Michael Ackerman
Air Force Civil Engineering Center
NEPA Division (AFCEC/CZN)

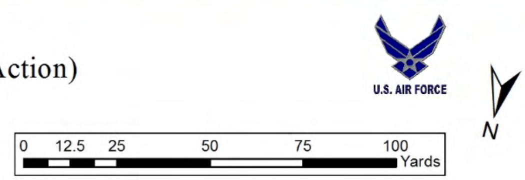
Two (2) Enclosures
1. Locations of Alternatives Under Consideration
2. Conceptual Rendering of Proposed Action (Preferred Alternative)

Enclosure 1: Locations of Alternatives Under Consideration.

Sources: Spatial Data courtesy of NASA (2016); Esri (2016) Disclaimer: No warranty is made by AECOM as to the accuracy, reliability, or completeness of these data for individual use or aggregate use with other data. This map is a "living document", in that it is intended to change as new data become available and is incorporated into the GIS database.

Enclosure 2: Conceptual Rendering of Proposed Action (Preferred Alternative).





3-D Representation of X-015 Tower Location (Proposed Action)

Sources: Spatial Data courtesy of NASA (2016); Esri (2016); Google (2016) Disclaimer: No warranty is made by AECOM as to the accuracy, reliability, or completeness of these data for individual use or aggregate use with other data. This map is a "living document", in that it is intended to change as new data become available and is incorporated into the GIS database.

Correspondence / Comments on the Draft EA
[to be provided after public review of the Draft EA]

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Appendix B – Record of Air Analysis

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Appendix B Contents

Record of Air Analysis (ROAA)

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AIR CONFORMITY APPLICABILITY MODEL REPORT
RECORD OF AIR ANALYSIS (ROAA)

1. General Information: The Air Force's Air Conformity Applicability Model (ACAM) was used to perform an analysis to assess the potential air quality impact/s associated with the action in accordance with the Air Force Instruction 32-7040, Air Quality Compliance And Resource Management; the Environmental Impact Analysis Process (EIAP, 32 CFR 989); and the General Conformity Rule (GCR, 40 CFR 93 Subpart B). This report provides a summary of the ACAM analysis.

a. Action Location:
Base: NO BASE
County(s): Accomack
Regulatory Area(s): NOT IN A REGULATORY AREA

b. Action Title: See EA

c. Project Number/s (if applicable): NA

d. Projected Action Start Date: 9 / 2017

e. Action Description:

See EA

The ACAM software is the only Air Force approved software for this analysis. The software did not allow propane to be entered in its calculations, so diesel fuel (higher emission factor) was used instead. None of estimated emissions associated with this action are above the GCR indicators, indicating no significant impact to air quality; therefore, no further air assessment is needed.

f. Point of Contact:
Name: James P. Maravelias
Title: Environmental Engineer
Organization: Oasis Systems, LLC

2. Air Impact Analysis: Based on the attainment status at the action location, the requirements of the General Conformity Rule are:

_____ applicable
__X__ not applicable

Total combined direct and indirect emissions associated with the action were estimated through ACAM on a calendar-year basis for the "worst-case" and "steady state" (net gain/loss upon action fully implemented) emissions.

"Air Quality Indicators" were used to provide an indication of the significance of potential impacts to air quality. These air quality indicators are EPA GCR thresholds (de minimis levels) that are applied out of context to their intended use. Therefore, these indicators do not trigger a regulatory requirement; however, they provide a warning that the action is potentially significant. It is important to note that these indicators only provide a clue to the potential impacts to air quality.

Given the GCR de minimis threshold values are the maximum net change an action can acceptably emit in non-attainment and maintenance areas, these threshold values would also conservatively indicate an actions emissions within an attainment would also be acceptable. An air quality indicator value of 100 tons/yr is used based on the GCR de minimis threshold for the least severe non-attainment classification for all criteria pollutants (see 40 CFR 93.153). Therefore, the worst-case year emissions were compared against the GCR Indicator and are summarized below.

A-1

AIR CONFORMITY APPLICABILITY MODEL REPORT
RECORD OF AIR ANALYSIS (ROAA)

Analysis Summary:

2017

Pollutant	Action Emissions (ton/yr)	AIR QUALITY INDICATOR	
		Threshold (ton/yr)	Exceedance (Yes or No)
NOT IN A REGULATORY AREA			
VOC	0.330	100	No
NOx	2.277	100	No
CO	1.731	100	No
SOx	0.005	100	No
PM 10	0.158	100	No
PM 2.5	0.107	100	No
Pb	0.000	100	No
NH3	0.001	100	No
CO2e	404.7		

2018

Pollutant	Action Emissions (ton/yr)	AIR QUALITY INDICATOR	
		Threshold (ton/yr)	Exceedance (Yes or No)
NOT IN A REGULATORY AREA			
VOC	0.195	100	No
NOx	1.257	100	No
CO	1.093	100	No
SOx	0.007	100	No
PM 10	0.065	100	No
PM 2.5	0.065	100	No
Pb	0.000	100	No
NH3	0.001	100	No
CO2e	236.0		

2019

Pollutant	Action Emissions (ton/yr)	AIR QUALITY INDICATOR	
		Threshold (ton/yr)	Exceedance (Yes or No)
NOT IN A REGULATORY AREA			
VOC	0.038	100	No
NOx	0.229	100	No
CO	0.195	100	No
SOx	0.005	100	No
PM 10	0.015	100	No
PM 2.5	0.015	100	No
Pb	0.000	100	No
NH3	0.000	100	No
CO2e	41.6		

A-2

AIR CONFORMITY APPLICABILITY MODEL REPORT
RECORD OF AIR ANALYSIS (ROAA)

2020 - (Steady State)

Pollutant	Action Emissions (ton/yr)	AIR QUALITY INDICATOR	
		Threshold (ton/yr)	Exceedance (Yes or No)
NOT IN A REGULATORY AREA			
VOC	0.007	100	No
NOx	0.023	100	No
CO	0.016	100	No
SOx	0.005	100	No
PM 10	0.005	100	No
PM 2.5	0.005	100	No
Pb	0.000	100	No
NH3	0.000	100	No
CO2e	2.7		

None of estimated emissions associated with this action are above the GCR indicators, indicating no significant impact to air quality; therefore, no further air assessment is needed.

James P Maravelias

JAMES P. MARAVELIAS, Environmental Engineer

3/22/2017

DATE

A-3

DETAIL AIR CONFORMITY APPLICABILITY MODEL REPORT

1. General Information

- Action Location
Base: NO BASE
County(s): Accomack
Regulatory Area(s): NOT IN A REGULATORY AREA

- Action Title: See EA

- Project Number/s (if applicable): NA

- Projected Action Start Date: 9 / 2017

- Action Purpose and Need:
See EA

- Action Description:
See EA

The ACAM software is the only Air Force approved software for this analysis. The software did not allow propane to be entered in its calculations, so diesel fuel (higher emission factor) was used instead. None of estimated emissions associated with this action are above the General Conformity Rule (GCR) indicators, indicating no significant impact to air quality; therefore, no further air assessment is needed.

- Point of Contact
Name: JAMES P MARAVELIAS
Title: Environmental Engineer
Organization: Oasis Systems, LLC

- Activity List:

	Activity Type	Activity Title
2.	Construction / Demolition	Construction
3.	Emergency Generator	Emergency Generator
4.	Tanks	Emergency Generator Tank

2. Construction / Demolition

2.1 General Information & Timeline Assumptions

- Activity Location
County: Accomack
Regulatory Area(s): NOT IN A REGULATORY AREA

- Activity Title: Construction

- Activity Description:
Tower Foundation Trenching
Tower Construction
Shelter Foundation Trenching
Tank Foundation Trenching
Utility Lines Tenching
Other Foundation Trenching
Grading

DETAIL AIR CONFORMITY APPLICABILITY MODEL REPORT

- **Activity Start Date**
  - **Start Month:** 9
  - **Start Month:** 2017

- **Activity End Date**
  - **Indefinite:** False
  - **End Month:** 2
  - **End Month:** 2019

- **Activity Emissions:**

Pollutant	Total Emissions (TONs)
VOC	0.549063
SO_x	0.006982
NO_x	3.712492
CO	2.984618
PM 10	0.227600

Pollutant	Total Emissions (TONs)
PM 2.5	0.175743
Pb	0.000000
NH_3	0.001712
CO_2e	676.5

2.1 Site Grading Phase

2.1.1 Site Grading Phase Timeline Assumptions

- **Phase Start Date**
  - **Start Month:** 9
  - **Start Quarter:** 1
  - **Start Year:** 2017

- **Phase Duration**
  - **Number of Month:** 4
  - **Number of Days:** 0

2.1.2 Site Grading Phase Assumptions

- **General Site Grading Information**
  - **Area of Site to be Graded (ft^2):** 300
  - **Amount of Material to be Hauled On-Site (yd^3):** 0
  - **Amount of Material to be Hauled Off-Site (yd^3):** 0

- **Site Grading Default Settings**
  - **Default Settings Used:** Yes
  - **Average Day(s) worked per week:** 5 (default)

- **Construction Exhaust (default)**

Equipment Name	Number Of Equipment	Hours Per Day
Graders Composite	1	6
Other Construction Equipment Composite	1	8
Rubber Tired Dozers Composite	1	6
Tractors/Loaders/Backhoes Composite	1	7

- **Vehicle Exhaust**
  - **Average Hauling Truck Capacity (yd^3):** 20 (default)
  - **Average Hauling Truck Round Trip Commute (mile):** 20 (default)

- **Vehicle Exhaust Vehicle Mixture (%)**

	LDGV	LDGT	HDGV	LDDV	LDDT	HDDV	MC
POVs	0	0	0	0	0	100.00	0

- Worker Trips

Average Worker Round Trip Commute (mile): 20 (default)

- Worker Trips Vehicle Mixture (%)

	LDGV	LDGT	HDGV	LDDV	LDDT	HDDV	MC
POVs	50.00	50.00	0	0	0	0	0

2.1.3 Site Grading Phase Emission Factor(s)

- Construction Exhaust Emission Factors (lb/hour) (default)

Graders Composite								
	VOC	**SO_x**	**NO_x**	**CO**	**PM 10**	**PM 2.5**	**CH_4**	**CO_2e**
Emission Factors	0.1120	0.0014	0.8007	0.5843	0.0396	0.0396	0.0101	132.99
Other Construction Equipment Composite								
	VOC	**SO_x**	**NO_x**	**CO**	**PM 10**	**PM 2.5**	**CH_4**	**CO_2e**
Emission Factors	0.0674	0.0012	0.5044	0.3568	0.0206	0.0206	0.0060	122.69
Rubber Tired Dozers Composite								
	VOC	**SO_x**	**NO_x**	**CO**	**PM 10**	**PM 2.5**	**CH_4**	**CO_2e**
Emission Factors	0.2464	0.0024	1.9508	0.9300	0.0796	0.0796	0.0222	239.64
Tractors/Loaders/Backhoes Composite								
	VOC	**SO_x**	**NO_x**	**CO**	**PM 10**	**PM 2.5**	**CH_4**	**CO_2e**
Emission Factors	0.0558	0.0007	0.3680	0.3666	0.0221	0.0221	0.0050	66.923

- Vehicle Exhaust & Worker Trips Emission Factors (grams/mile)

	VOC	SO_x	NO_x	CO	PM 10	PM 2.5	Pb	NH_3	CO_2e
LDGV	000.383	000.002	000.346	003.888	000.010	000.008		000.027	00350.149
LDGT	000.501	000.003	000.598	005.836	000.012	000.010		000.028	00455.665
HDGV	000.951	000.005	001.497	018.972	000.028	000.024		000.045	00778.626
LDDV	000.139	000.003	000.171	002.599	000.004	000.004		000.008	00344.855
LDDT	000.366	000.004	000.557	005.336	000.007	000.007		000.008	00509.735
HDDV	000.638	000.014	006.576	002.197	000.258	000.237		000.029	01537.222
MC	002.476	000.003	000.754	013.506	000.027	000.024		000.052	00397.294

2.1.4 Site Grading Phase Formula(s)

- Fugitive Dust Emissions per Phase

$PM10_{FD} = (20 * ACRE * WD) / 2000$

$PM10_{FD}$: Fugitive Dust PM 10 Emissions (TONs)
20: Conversion Factor Acre Day to pounds (20 lb / 1 Acre Day)
ACRE: Total acres (acres)
WD: Number of Total Work Days (days)
2000: Conversion Factor pounds to tons

- Construction Exhaust Emissions per Phase

$CEE_{POL} = (NE * WD * H * EF_{POL}) / 2000$

CEE_{POL}: Construction Exhaust Emissions (TONs)
NE: Number of Equipment
WD: Number of Total Work Days (days)
H: Hours Worked per Day (hours)

EF_{POL}: Emission Factor for Pollutant (lb/hour)
2000: Conversion Factor pounds to tons

- Vehicle Exhaust Emissions per Phase
$VMT_{VE} = (HA_{OnSite} + HA_{OffSite}) * (1 / HC) * HT$

VMT_{VE}: Vehicle Exhaust Vehicle Miles Travel (miles)
HA_{OnSite}: Amount of Material to be Hauled On-Site (yd^3)
$HA_{OffSite}$: Amount of Material to be Hauled Off-Site (yd^3)
HC: Average Hauling Truck Capacity (yd^3)
(1 / HC): Conversion Factor cubic yards to trips (1 trip / HC yd^3)
HT: Average Hauling Truck Round Trip Commute (mile/trip)

$V_{POL} = (VMT_{VE} * 0.002205 * EF_{POL} * VM) / 2000$

V_{POL}: Vehicle Emissions (TONs)
VMT_{VE}: Vehicle Exhaust Vehicle Miles Travel (miles)
0.002205: Conversion Factor grams to pounds
EF_{POL}: Emission Factor for Pollutant (grams/mile)
VM: Vehicle Exhaust On Road Vehicle Mixture (%)
2000: Conversion Factor pounds to tons

- Worker Trips Emissions per Phase
$VMT_{WT} = WD * WT * 1.25 * NE$

VMT_{WT}: Worker Trips Vehicle Miles Travel (miles)
WD: Number of Total Work Days (days)
WT: Average Worker Round Trip Commute (mile)
1.25: Conversion Factor Number of Construction Equipment to Number of Works
NE: Number of Construction Equipment

$V_{POL} = (VMT_{WT} * 0.002205 * EF_{POL} * VM) / 2000$

V_{POL}: Vehicle Emissions (TONs)
VMT_{WT}: Worker Trips Vehicle Miles Travel (miles)
0.002205: Conversion Factor grams to pounds
EF_{POL}: Emission Factor for Pollutant (grams/mile)
VM: Worker Trips On Road Vehicle Mixture (%)
2000: Conversion Factor pounds to tons

2.2 Trenching/Excavating Phase

2.2.1 Trenching / Excavating Phase Timeline Assumptions

- Phase Start Date
Start Month: 9
Start Quarter: 1
Start Year: 2017

- Phase Duration
Number of Month: 4
Number of Days: 0

2.2.2 Trenching / Excavating Phase Assumptions

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DETAIL AIR CONFORMITY APPLICABILITY MODEL REPORT

- General Trenching/Excavating Information

Area of Site to be Trenched/Excavated (ft^2): 1000
Amount of Material to be Hauled On-Site (yd^3): 0
Amount of Material to be Hauled Off-Site (yd^3): 0

- Trenching Default Settings

Default Settings Used: Yes
Average Day(s) worked per week: 5 (default)

- Construction Exhaust (default)

Equipment Name	Number Of Equipment	Hours Per Day
Excavators Composite	2	8
Other General Industrial Equipmen Composite	1	8
Tractors/Loaders/Backhoes Composite	1	8

- Vehicle Exhaust

Average Hauling Truck Capacity (yd^3): 20 (default)
Average Hauling Truck Round Trip Commute (mile): 20 (default)

- Vehicle Exhaust Vehicle Mixture (%)

	LDGV	LDGT	HDGV	LDDV	LDDT	HDDV	MC
POVs	0	0	0	0	0	100.00	0

- Worker Trips

Average Worker Round Trip Commute (mile): 20 (default)

- Worker Trips Vehicle Mixture (%)

	LDGV	LDGT	HDGV	LDDV	LDDT	HDDV	MC
POVs	50.00	50.00	0	0	0	0	0

2.2.3 Trenching / Excavating Phase Emission Factor(s)

- Construction Exhaust Emission Factors (lb/hour) (default)

Graders Composite								
	VOC	SO_x	NO_x	CO	PM 10	PM 2.5	CH_4	CO_2e
Emission Factors	0.1120	0.0014	0.8007	0.5843	0.0396	0.0396	0.0101	132.99
Other Construction Equipment Composite								
	VOC	SO_x	NO_x	CO	PM 10	PM 2.5	CH_4	CO_2e
Emission Factors	0.0674	0.0012	0.5044	0.3568	0.0206	0.0206	0.0060	122.69
Rubber Tired Dozers Composite								
	VOC	SO_x	NO_x	CO	PM 10	PM 2.5	CH_4	CO_2e
Emission Factors	0.2464	0.0024	1.9508	0.9300	0.0796	0.0796	0.0222	239.64
Tractors/Loaders/Backhoes Composite								
	VOC	SO_x	NO_x	CO	PM 10	PM 2.5	CH_4	CO_2e
Emission Factors	0.0558	0.0007	0.3680	0.3666	0.0221	0.0221	0.0050	66.923

- Vehicle Exhaust & Worker Trips Emission Factors (grams/mile)

	VOC	SO_x	NO_x	CO	PM 10	PM 2.5	Pb	NH_3	CO_2e
LDGV	000.383	000.002	000.346	003.888	000.010	000.008		000.027	00350.149
LDGT	000.501	000.003	000.598	005.836	000.012	000.010		000.028	00455.665
HDGV	000.951	000.005	001.497	018.972	000.028	000.024		000.045	00778.626
LDDV	000.139	000.003	000.171	002.599	000.004	000.004		000.008	00344.855
LDDT	000.366	000.004	000.557	005.336	000.007	000.007		000.008	00509.735

HDDV	000.638	000.014	006.576	002.197	000.258	000.237		000.029	01537.222
MC	002.476	000.003	000.754	013.506	000.027	000.024		000.052	00397.294

2.2.4 Trenching / Excavating Phase Formula(s)

- Fugitive Dust Emissions per Phase

$PM10_{FD} = (20 * ACRE * WD) / 2000$

$PM10_{FD}$: Fugitive Dust PM 10 Emissions (TONs)
20: Conversion Factor Acre Day to pounds (20 lb / 1 Acre Day)
ACRE: Total acres (acres)
WD: Number of Total Work Days (days)
2000: Conversion Factor pounds to tons

- Construction Exhaust Emissions per Phase

$CEE_{POL} = (NE * WD * H * EF_{POL}) / 2000$

CEE_{POL}: Construction Exhaust Emissions (TONs)
NE: Number of Equipment
WD: Number of Total Work Days (days)
H: Hours Worked per Day (hours)
EF_{POL}: Emission Factor for Pollutant (lb/hour)
2000: Conversion Factor pounds to tons

- Vehicle Exhaust Emissions per Phase

$VMT_{VE} = (HA_{OnSite} + HA_{OffSite}) * (1 / HC) * HT$

VMT_{VE}: Vehicle Exhaust Vehicle Miles Travel (miles)
HA_{OnSite}: Amount of Material to be Hauled On-Site (yd^3)
$HA_{OffSite}$: Amount of Material to be Hauled Off-Site (yd^3)
HC: Average Hauling Truck Capacity (yd^3)
(1 / HC): Conversion Factor cubic yards to trips (1 trip / HC yd^3)
HT: Average Hauling Truck Round Trip Commute (mile/trip)

$V_{POL} = (VMT_{VE} * 0.002205 * EF_{POL} * VM) / 2000$

V_{POL}: Vehicle Emissions (TONs)
VMT_{VE}: Vehicle Exhaust Vehicle Miles Travel (miles)
0.002205: Conversion Factor grams to pounds
EF_{POL}: Emission Factor for Pollutant (grams/mile)
VM: Vehicle Exhaust On Road Vehicle Mixture (%)
2000: Conversion Factor pounds to tons

- Worker Trips Emissions per Phase

$VMT_{WT} = WD * WT * 1.25 * NE$

VMT_{WT}: Worker Trips Vehicle Miles Travel (miles)
WD: Number of Total Work Days (days)
WT: Average Worker Round Trip Commute (mile)
1.25: Conversion Factor Number of Construction Equipment to Number of Works
NE: Number of Construction Equipment

$V_{POL} = (VMT_{WT} * 0.002205 * EF_{POL} * VM) / 2000$

V_{POL}: Vehicle Emissions (TONs)

VMT_{VE}: Worker Trips Vehicle Miles Travel (miles)
0.002205: Conversion Factor grams to pounds
EF_{POL}: Emission Factor for Pollutant (grams/mile)
VM: Worker Trips On Road Vehicle Mixture (%)
2000: Conversion Factor pounds to tons

2.3 Building Construction Phase

2.3.1 Building Construction Phase Timeline Assumptions

- Phase Start Date
Start Month: 9
Start Quarter: 1
Start Year: 2017

- Phase Duration
Number of Month: 18
Number of Days: 0

2.3.2 Building Construction Phase Assumptions

- General Building Construction Information
Building Category: Commercial or Retail
Area of Building (ft^2): 25
Height of Building (ft): 730
Number of Units: N/A

- Building Construction Default Settings
Default Settings Used: Yes
Average Day(s) worked per week: 5 (default)

- Construction Exhaust (default)

Equipment Name	Number Of Equipment	Hours Per Day
Cranes Composite	1	4
Forklifts Composite	2	6
Tractors/Loaders/Backhoes Composite	1	8

- Vehicle Exhaust
Average Hauling Truck Round Trip Commute (mile): 20 (default)

- Vehicle Exhaust Vehicle Mixture (%)

	LDGV	LDGT	HDGV	LDDV	LDDT	HDDV	MC
POVs	0	0	0	0	0	100.00	0

- Worker Trips
Average Worker Round Trip Commute (mile): 20 (default)

- Worker Trips Vehicle Mixture (%)

	LDGV	LDGT	HDGV	LDDV	LDDT	HDDV	MC
POVs	50.00	50.00	0	0	0	0	0

- Vendor Trips
Average Vendor Round Trip Commute (mile): 40 (default)

DETAIL AIR CONFORMITY APPLICABILITY MODEL REPORT

- Vendor Trips Vehicle Mixture (%)

	LDGV	LDGT	HDGV	LDDV	LDDT	HDDV	MC
POVs	0	0	0	0	0	100.00	0

2.3.3 Building Construction Phase Emission Factor(s)

- Construction Exhaust Emission Factors (lb/hour) (default)

Cranes Composite								
	VOC	SO_x	NO_x	CO	PM 10	PM 2.5	CH_4	CO_2e
Emission Factors	0.1073	0.0013	0.8624	0.4152	0.0352	0.0352	0.0096	128.87
Forklifts Composite								
	VOC	SO_x	NO_x	CO	PM 10	PM 2.5	CH_4	CO_2e
Emission Factors	0.0399	0.0006	0.2492	0.2181	0.0118	0.0118	0.0036	54.485
Tractors/Loaders/Backhoes Composite								
	VOC	SO_x	NO_x	CO	PM 10	PM 2.5	CH_4	CO_2e
Emission Factors	0.0558	0.0007	0.3680	0.3666	0.0221	0.0221	0.0050	66.923

- Vehicle Exhaust & Worker Trips Emission Factors (grams/mile)

	VOC	SO_x	NO_x	CO	PM 10	PM 2.5	Pb	NH_3	CO_2e
LDGV	000.383	000.002	000.346	003.888	000.010	000.008		000.027	00350.149
LDGT	000.501	000.003	000.598	005.836	000.012	000.010		000.028	00455.665
HDGV	000.951	000.005	001.497	018.972	000.028	000.024		000.045	00778.626
LDDV	000.139	000.003	000.171	002.599	000.004	000.004		000.008	00344.855
LDDT	000.366	000.004	000.557	005.336	000.007	000.007		000.008	00509.735
HDDV	000.638	000.014	006.576	002.197	000.258	000.237		000.029	01537.222
MC	002.476	000.003	000.754	013.506	000.027	000.024		000.052	00397.294

2.3.4 Building Construction Phase Formula(s)

- Construction Exhaust Emissions per Phase

$CEE_{POL} = (NE * WD * H * EF_{POL}) / 2000$

CEE_{POL}: Construction Exhaust Emissions (TONs)
NE: Number of Equipment
WD: Number of Total Work Days (days)
H: Hours Worked per Day (hours)
EF_{POL}: Emission Factor for Pollutant (lb/hour)
2000: Conversion Factor pounds to tons

- Vehicle Exhaust Emissions per Phase

$VMT_{VE} = BA * BH * (0.32 / 1000) * HT$

VMT_{VE}: Vehicle Exhaust Vehicle Miles Travel (miles)
BA: Area of Building (ft^2)
BH: Height of Building (ft)
(0.32 / 1000): Conversion Factor ft^3 to trips (0.32 trip / 1000 ft^3)
HT: Average Hauling Truck Round Trip Commute (mile/trip)

$V_{POL} = (VMT_{VE} * 0.002205 * EF_{POL} * VM) / 2000$

V_{POL}: Vehicle Emissions (TONs)
VMT_{VE}: Vehicle Exhaust Vehicle Miles Travel (miles)
0.002205: Conversion Factor grams to pounds
EF_{POL}: Emission Factor for Pollutant (grams/mile)
VM: Worker Trips On Road Vehicle Mixture (%)

2000: Conversion Factor pounds to tons

- Worker Trips Emissions per Phase
$VMT_{WT} = WD * WT * 1.25 * NE$

VMT_{WT}: Worker Trips Vehicle Miles Travel (miles)
WD: Number of Total Work Days (days)
WT: Average Worker Round Trip Commute (mile)
1.25: Conversion Factor Number of Construction Equipment to Number of Works
NE: Number of Construction Equipment

$V_{POL} = (VMT_{WT} * 0.002205 * EF_{POL} * VM) / 2000$

V_{POL}: Vehicle Emissions (TONs)
VMT_{WT}: Worker Trips Vehicle Miles Travel (miles)
0.002205: Conversion Factor grams to pounds
EF_{POL}: Emission Factor for Pollutant (grams/mile)
VM: Worker Trips On Road Vehicle Mixture (%)
2000: Conversion Factor pounds to tons

- Vender Trips Emissions per Phase
$VMT_{VT} = BA * BH * (0.05 / 1000) * HT$

VMT_{VT}: Vender Trips Vehicle Miles Travel (miles)
BA: Area of Building (ft^2)
BH: Height of Building (ft)
(0.05 / 1000): Conversion Factor ft^3 to trips (0.05 trip / 1000 ft^3)
HT: Average Hauling Truck Round Trip Commute (mile/trip)

$V_{POL} = (VMT_{VT} * 0.002205 * EF_{POL} * VM) / 2000$

V_{POL}: Vehicle Emissions (TONs)
VMT_{VT}: Vender Trips Vehicle Miles Travel (miles)
0.002205: Conversion Factor grams to pounds
EF_{POL}: Emission Factor for Pollutant (grams/mile)
VM: Worker Trips On Road Vehicle Mixture (%)
2000: Conversion Factor pounds to tons

3. Emergency Generator

3.1 General Information & Timeline Assumptions

- Add or Remove Activity from Baseline? Add

- Activity Location
County: Accomack
Regulatory Area(s): NOT IN A REGULATORY AREA

- Activity Title: Emergency Generator

- Activity Description:
Emergency Generator

- Activity Start Date

DETAIL AIR CONFORMITY APPLICABILITY MODEL REPORT

Start Month: 11
Start Year: 2017

- Activity End Date
Indefinite: Yes
End Month: N/A
End Year: N/A

- Activity Emissions:

Pollutant	Emissions Per Year (TONs)
VOC	0.005650
SO_x	0.004759
NO_x	0.023288
CO	0.015552
PM 10	0.005083

Pollutant	Emissions Per Year (TONs)
PM 2.5	0.005083
Pb	0.000000
NH_3	0.000000
CO_2e	2.7

3.2 Emergency Generator Assumptions

- Emergency Generator
Type of Fuel used in Emergency Generator: Diesel
Number of Emergency Generators: 1

- Default Settings Used: Yes

- Emergency Generators Consumption
Emergency Generator's Horsepower: 135 (default)
Average Operating Hours Per Year (hours): 30 (default)

3.3 Emergency Generator Emission Factor(s)

- Emergency Generators Emission Factor (lb/hp-hr)

VOC	SO_x	NO_x	CO	PM 10	PM 2.5	Pb	NH_3	CO_2e
0.00279	0.00235	0.0115	0.00768	0.00251	0.00251			1.33

3.4 Emergency Generator Formula(s)

- Emergency Generator Emissions per Year

$AE_{POL} = (NGEN * HP * OT * EF_{POL}) / 2000$

AE_{POL}: Activity Emissions (TONs per Year)
NGEN: Number of Emergency Generators
HP: Emergency Generator's Horsepower (hp)
OT: Average Operating Hours Per Year (hours)
EF_{POL}: Emission Factor for Pollutant (lb/hp-hr)

4. Tanks

4.1 General Information & Timeline Assumptions

- Add or Remove Activity from Baseline? Add

- Activity Location
County: Accomack

DETAIL AIR CONFORMITY APPLICABILITY MODEL REPORT

Regulatory Area(s): NOT IN A REGULATORY AREA

- Activity Title: Emergency Generator Tank

- Activity Description:
Emergency Generator Tank

- Activity Start Date
Start Month: 11
Start Year: 2017

- Activity End Date
Indefinite: Yes
End Month: N/A
End Year: N/A

- Activity Emissions:

Pollutant	Emissions Per Year (TONs)
VOC	0.000880
SO_x	0.000000
NO_x	0.000000
CO	0.000000
PM 10	0.000000

Pollutant	Emissions Per Year (TONs)
PM 2.5	0.000000
Pb	0.000000
NH_3	0.000000
CO_2e	0.0

4.2 Tanks Assumptions

- Chemical
Chemical Name: Fuel oil no. 2
Chemical Category: Petroleum Distillates
Chemical Density: 7.1
Vapor Molecular Weight (lb/lb-mole): 130
Stock Vapor Density (lb/ft³): 0.000129553551395334
Vapor Pressure: 0.0055
Vapor Space Expansion Factor (dimensionless): 0.068

- Tank
Type of Tank: Horizontal Tank
Tank Length (ft): 10
Tank Diameter (ft): 10
Annual Net Throughput (gallon/year): 1000

4.3 Tank Formula(s)

- Vapor Space Volume
$VSV = (PI / 4) * D^2 * L / 2$

VSV: Vapor Space Volume (ft^3)
PI: PI Math Constant
D^2: Tank Diameter (ft)
L: Tank Length (ft)
2: Convertion Factor (Vapor Space Volume is assumed to be one-half of the tank volume)

- Vented Vapor Saturation Factor
$VVSF = 1 / (1 + (0.053 * VP * L / 2))$

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VVSF: Vented Vapor Saturation Factor (dimensionless)
0.053: Constant
VP: Vapor Pressure (psia)
L: Tank Length (ft)

- Standing Storage Loss per Year

SSL_{VOC} = 365 * VSV * SVD * VSEF * VVSF / 2000

SSL_{VOC}: Standing Storage Loss Emissions (TONs)
365: Number of Daily Events in a Year (Constant)
VSV: Vapor Space Volume (ft^3)
SVD: Stock Vapor Density (lb/ft^3)
VSEF: Vapor Space Expansion Factor (dimensionless)
VVSF: Vented Vapor Saturation Factor (dimensionless)
2000: Conversion Factor pounds to tons

- Number of Turnovers per Year

NT = (7.48 * ANT) / ((PI / 4.0) * D * L)

NT: Number of Turnovers per Year
7.48: Constant
ANT: Annual Net Throughput
PI: PI Math Constant
D^2: Tank Diameter (ft)
L: Tank Length (ft)

- Working Loss Turnover (Saturation) Factor per Year

WLSF = (18 + NT) / (6 * NT)

WLSF: Working Loss Turnover (Saturation) Factor per Year
18: Constant
NT: Number of Turnovers per Year
6: Constant

- Working Loss per Year

WL_{VOC} = 0.0010 * VMW * VP * ANT * WLSF / 2000

0.0010: Constant
VMW: Vapor Molecular Weight (lb/lb-mole)
VP: Vapor Pressure (psia)
ANT: Annual Net Throughput
WLSF: Working Loss Turnover (Saturation) Factor
2000: Conversion Factor pounds to tons

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Appendix C – Avifauna and Protected Avian Species Information

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Appendix C Contents

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Draft Avifauna and Protected Avian Species Monitoring and Mitigation Plan
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U.S. Fish and Wildlife Service Recommended Best Practices for Communication Tower Design, Siting, Construction, Operation, Maintenance, and Decommissioning, August 2016

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Recommended Best Practices for Communication Tower
Design, Siting, Construction, Operation, Maintenance, and Decommissioning

Division of Migratory Bird Management
U. S. Fish and Wildlife Service
Falls Church, Virginia
August 2016

NOTE: These recommendations replace all previous recommendations for communication tower construction and operation. These recommendations have been modified and updated from previous versions to incorporate the state of the science and the 2015 Federal Aviation Administration *Obstruction Marking and Lighting Advisory Circular AC 70/7460-1L.*

Communication towers are some of the tallest structures across the landscape and birds are regularly found dead around these towers (Longcore et al. 2012a). It is not definitively understood why this mortality occurs, but evidence suggests that night-migrating songbirds are either attracted to or disoriented by tower obstruction warning lighting systems, especially during overcast (i.e., low cloud ceiling), foggy, or other low visibility conditions (Cochran and Graber 1958, Avery et al. 1976, Ball et al. 1995, Erickson et al. 2005, Evans et al. 2007, Manville 2014, Gehring et al. 2009 and 2011, Longcore et al. 2012a). Birds aggregate in larger numbers at towers with non-flashing lights compared to those with flashing lights, although birds aggregate at flashing lights during the "on" phase, they disperse during the "off" phase (Larkin and Frase 1988; Gauthreaux and Belser 1999, 2006; Evans et al. 2007; Poot et al. 2008). Additionally, birds moving across the landscape at night (e.g., owls and seabirds) can collide with communication tower wires when they are placed in high movement areas.

Given the height, structural engineering needs (i.e., guy wires), and obstruction lighting requirements, communication towers may cause direct and indirect bird mortality through:

1. Collisions - Birds that are attracted to tower lights and aggregate in the lighting zone, circle the tower and collide with the tower, guy wires, other birds, or fall to the ground from exhaustion (Longcore et al. 2012b, Gauthreaux and Belser 2006, Erickson et al. 2005).
2. Construction, operation, and maintenance activities - Adults, eggs, or nestlings can experience direct mortality through:
   a. Trauma or death during vegetation removal;
   b. Trauma or death during tower maintenance; and
   c. Death of eggs or nestlings when actions or activities cause adults to abandon nests.
3. Significant loss of fat reserves in adults due to the energy expenditure of circling towers, leading to reduced survival during long migrations (Norris and Taylor 2006, Gehring and Walker 2012).

The following avoidance and minimization measures, when used comprehensively, reduce the risk of bird mortality at communication towers:

SITING AND CONSTRUCTION OF NEW TOWERS

1. *Collocation*. Co-locate communications equipment on existing communication towers or other structures (e.g., billboard, water and transmission tower, distribution pole, or building mounts). This recommendation is intended to reduce the number of towers across the landscape.
2. *Contact with USFWS Field Office*. Communicate project plans to nearest USFWS Field Office. www.fws.gov/offices/index.html

3. *Placement*. All new towers should be sited to minimize environmental impacts to the maximum extent practicable.
   a. Place new towers within existing "antenna farms" (i.e., clusters of towers) when possible;
   b. Select already degraded areas for tower placement;
   c. Towers should not be sited in or near wetlands, other known bird concentration areas (e.g., state or federal refuges, staging areas, rookeries, and Important Bird Areas), or in known migratory bird movement routes, daily movement flyways, areas of breeding concentration, in habitat of threatened or endangered species, key habitats for Birds of Conservation Concern, or near the breeding areas ("leks") of prairie grouse;
   d. Towers should avoid ridgelines, coastal areas, wetlands or other known bird concentration areas; and
   e. Towers and associated facilities should be designed, sited, and constructed so as to avoid or minimize habitat loss within and adjacent to the tower "footprint". In addition, several shorter, un-guyed towers may be preferable to one, tall guyed, lit tower.
4. *Construction*. During construction, the following considerations can reduce the risk of take of birds:
   a. Schedule all vegetation removal and maintenance (e.g., general landscaping activities, trimming, grubbing) activities outside of the peak bird breeding season to reduce the risk of bird take. Breeding seasons can be determined using online tools (e.g., Avian Knowledge Network [AKN], Information for Planning and Conservation system [IPaC], Birds of North America Online) or by contacting qualified experts (e.g., local Audubon or birding groups);
   b. When vegetation removal activities cannot avoid the bird breeding season, conduct nest clearance surveys:
      i. Surveys should be conducted no more than five days prior to the scheduled activity to ensure recently constructed nests are identified;
      ii. Timing and dimensions of the area to be surveyed vary and will depend on the nature of the project, location, and expected level of vegetation disturbance; and
      iii. If active nests are identified within or in the vicinity of the project site, avoid the site until nestlings have fledged or the nest fails. If the activity must occur, establish a buffer zone around the nest and no activities will occur within that zone until nestlings have fledged. The dimension of the buffer zone will depend on the proposed activity, habitat type, and species present. The buffer should be a distance that does not elicit a flight response by the adult birds and can be 0.5 – 1 mile for hawks and eagles.
   c. Prevent the introduction of invasive plants during construction to minimize vegetation community degradation by:
      i. Use only native and local (when possible) seed stock for all temporary and permanent vegetation establishment; and
      ii. Use vehicle wash stations prior to entering sensitive habitat areas to prevent accidental introduction of non-native plants.
5. *Tower Design*. Tower design should consider the following attributes:
   a. Tower Height. It is recommended that new towers should be not more than 199 ft. above ground level (AGL). This height increases the mean free airspace between the top of the tower and average bird flight height, even in weather conditions with reduced cloud ceiling;

b. Guy Wires. We recommend using free standing towers such as lattice towers or monopole structures. If guy wires are required for tower design:
    i. The minimum number of guy wires necessary should be used; and
    ii. Guy wired towers that are proposed to be located in known raptor or waterbird concentrations areas, daily movement routes, major daytime migratory bird movement routes, staging areas, or stopover sites should have daytime visual markers or bird flight diverters installed on the guy wires to attempt to prevent daytime collisions.
c. Lighting System. Lights are a primary source of bird aggregation around towers, thus minimizing all light is recommended:
    i. No tower lighting is the preferred option if Federal Aviation Administration (FAA) regulations and lighting standards (FAA 2015, Patterson 2012) permit.
    ii. For some towers, the FAA can permit an Aircraft Detection Lighting System (ADLS), which maintains a communication tower of any height to be unlit until the ADLS radars detect nearby aircraft, at which time the tower lighting system is triggered to illuminate until the aircraft is out of radar range.
    iii. If taller (> 199 ft. AGL) towers requiring lights for aviation safety must be constructed, the minimum amount of pilot warning and obstruction avoidance lighting required by the FAA should be used. Unless otherwise required by the FAA, only white or red flashing lights should be used at night, and these should follow FAA obstruction and marking standards with regards to the minimum number of lights, minimum intensity (< 2,000 candela), and minimum number of flashes per minute (i.e., longest duration between flashes and "dark phase"). Avoid using non-flashing warning lights at night (FAA 2015, Patterson 2012). Owners of existing towers lit with lighting systems that include non-flashing lights should submit plans to the FAA explaining how and when they will transition to the new standards.
    iv. Security lighting for on-ground facilities, equipment, and infrastructure should be motion- or heat-sensitive, down-shielded, and of a minimum intensity to reduce nighttime bird attraction and eliminate constant nighttime illumination while still allowing safe nighttime access to the site.

OPERATION AND MAINTENANCE OF ALL TOWERS

1. *Existing Tower Lighting*. We recommend that towers be unlit, when allowed by FAA regulations. Light impacts can be minimized by:
    a. Extinguishing L-810 non-flashing red lights (USFWS 2007, 2011) on towers >350 ft. AGL or reconfiguring L-810 non-flashing red lights to flash at 30 FPM in synchrony with other flashing obstruction lights on towers 150-350 ft. AGL (FAA 2015);
    b. Extinguishing L-810 red lights and reprogramming LED L-810 lights; this can be done from the tower transmission building or remotely and does not require climbing the tower (FCC 2015).

    Currently, an FAA lighting deviation is required to implement both of these proposed light standards, but the abbreviated FAA review and approval process is typically completed within one week (FCC 2015).

2. *Infrastructure Lighting*. We recommend that existing infrastructure be unlit. If associated buildings require security or operational lighting, minimize light trespass using motion sensors and down-shielding with minimum intensity light (USFWS 2011; Poot et al. 2008; Manville 2013; FCC 2014).
3. *Vegetation Management*. When management of facility infrastructure is required:
    a. Schedule all vegetation removal and maintenance (e.g., general landscaping activities, trimming, grubbing, etc.) activities outside of the peak bird breeding season to reduce the risk of bird take. Breeding seasons can be determined using online tools (e.g., Avian Knowledge Network [AKN], Information for Planning and Conservation system [IPaC], Birds of North America Online) or by contacting qualified experts (e.g., local Audubon or birding groups);
    b. When vegetation removal activities cannot avoid the bird breeding season, conduct nest clearance surveys:
        i. Surveys should be conducted no more than five days prior to the scheduled activity to ensure recently constructed nests are identified;
        ii. Timing and dimensions of the area to be surveyed should depend on the nature of the project, location, and expected level of vegetation disturbance; and
        iii. If active nests are identified within or in the vicinity of the project site, the site should be avoided until nestlings have fledged or the nest fails. If the activity must occur, a buffer zone should be established around the nest and no activities should occur within that zone until nestlings have fledged. The dimension of the buffer zone depends on the proposed activity, habitat type, and species present. The buffer should be a distance that does not elicit a flight response by the adult birds and can be 0.5 – 1 mile for hawks and eagles.
4. *Birds Nesting on Towers*: If birds are nesting on communication towers that require maintenance activities, contact the state natural resource protection agency and/or the USFWS for permits, recommendations, and requirements. Schedule construction and maintenance activities around the nesting and activity schedule of protected birds. Minimize excess wires and securely attach wires to the tower structure to reduce the likelihood of birds becoming entangled on the tower. Consider installing a bird nest exclusion device on the towers where birds frequently nest.
5. *Tower Access*: Representatives from the USFWS or researchers should be allowed access to the site to evaluate bird use, conduct dead-bird searches, and conduct other research, as necessary.

DECOMMISSIONING

1. *Tower Removal*. Towers no longer in use, not re-licensed by the FCC for use, or determined to be obsolete should be removed from the site within 12 months of cessation of use, preferably sooner.

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Table C-1: Birds Recorded in Accomack County that Are Likely to Occur at WFF

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Table C-1: Birds Recorded in Accomack County that Are Likely to Occur* at WFF (eBird 2007)

Biological Family		Status[1]	Tier[2]	Watch List[3]	BCC
Common Name	**Scientific Name**				
Anatidae (Ducks, Geese, and Waterfowl)					
Snow Goose	*Chen caerulescens*				
Ross's Goose	*Chen rossii*				
Brant	*Branta bernicla*		III		
Cackling Goose	*Branta hutchinsii*				
Canada Goose	*Branta canadensis*				
Mute Swan	*Cygnus olor*				
Tundra Swan	*Cygnus columbianus*				
Wood Duck	*Aix sponsa*				
Gadwall	*Anas strepera*				
American Wigeon	*Anas americana*				
American Black Duck	*Anas rubripes*		II	Yes	
Mallard	*Anas platyrhynchos*				
Blue-winged Teal	*Anas discors*				
Northern Shoveler	*Anas clypeata*				
Northern Pintail	*Anas acuta*		IV		
Green-winged Teal	*Anas crecca*				
Canvasback	*Aythya valisineria*				
Redhead	*Aythya americana*				
Ring-necked Duck	*Aythya collaris*				
Greater Scaup	*Aythya marila*		IV		
Lesser Scaup	*Aythya affinis*				
King Eider	*Somateria spectabilis*			Yes	
Common Eider	*Somateria mollissima*			Yes	
Harlequin Duck	*Histrionicus histrionicus*				
Surf Scoter	*Melanitta perspicillata*			Yes	
White-winged Scoter	*Melanitta fusca*			Yes	
Black Scoter	*Melanitta americana*			Yes	
Long-tailed Duck	*Clangula hyemalis*				
Bufflehead	*Bucephala albeola*				
Common Goldeneye	*Bucephala clangula*				
Hooded Merganser	*Lophodytes cucullatus*				
Common Merganser	*Mergus merganser*				
Red-breasted Merganser	*Mergus serrator*				
Ruddy Duck	*Oxyura jamaicensis*				
Odontophoridae (New World Quail)					
Northern Bobwhite	*Colinus virginianus*		III		

Biological Family		Status[1]	Tier[2]	Watch List[3]	BCC
Common Name	**Scientific Name**				
Phasianidae (Pheasants, Grouse, and Allies)					
Ring-necked Pheasant	*Phasianus colchicus*				
Wild Turkey	*Meleagris gallopavo*				
Gaviidae (Loons)					
Red-throated Loon	*Gavia stellata*		IV		Yes
Common Loon	*Gavia immer*				
Podicipedidae (Grebes)					
Pied-billed Grebe	*Podilymbus podiceps*				Yes
Horned Grebe	*Podiceps auritus*			Yes	Yes
Red-necked Grebe	*Podiceps grisegena*				
Sulidae (Boobies and Gannets)					
Northern Gannet	*Morus bassanus*		IV		
Phalacrocoracidae (Cormorants)					
Great Cormorant	*Phalacrocorax carbo*				
Double-crested Cormorant	*Phalacrocorax auritus*				
Pelecanidae (Pelicans)					
American White Pelican	*Pelecanus erythrorhynchos*				
Brown Pelican	*Pelecanus occidentalis*				
Ardeidae (Herons, Egrets, and Bitterns)					
American Bittern	*Botaurus lentiginosus*				Yes
Least Bittern	*Ixobrychus exilis*		III		Yes
Great Blue Heron	*Ardea herodias*				
Great Egret	*Ardea alba*				
Snowy Egret	*Egretta thula*		II		Yes
Little Blue Heron	*Egretta caerulea*		II	Yes	
Tricolored Heron	*Egretta tricolor*				
Cattle Egret	*Bubulcus ibis*				
Green Heron	*Butorides virescens*		IV		
Black-crowned Night-Heron	*Nycticorax nycticorax*		III		
Yellow-crowned Night-Heron	*Nyctanassa violacea*		II		
Threskiornithidae (Ibises and Spoonbills)					
White Ibis	*Eudocimus albus*				
Glossy Ibis	*Plegadis falcinellus*		I		
Cathartidae (New World Vultures)					
Black Vulture	*Coragyps atratus*				
Turkey Vulture	*Cathartes aura*				
Pandionidae (Osprey)					
Osprey	*Pandion haliaetus*				

Biological Family		Status[1]	Tier[2]	Watch List[3]	BCC
Common Name	**Scientific Name**				
Accipitridae (Hawks, Eagles, and Kites)					
Northern Harrier	*Circus cyaneus*		III		
Sharp-shinned Hawk	*Accipiter striatus*				
Cooper's Hawk	*Accipiter cooperii*				
Bald Eagle	*Haliaeetus leucocephalus*				Yes
Red-shouldered Hawk	*Buteo lineatus*				
Broad-winged Hawk	*Buteo platypterus*				
Red-tailed Hawk	*Buteo jamaicensis*				
Rough-legged Hawk	*Buteo lagopus*				
Rallidae (Rails, Gallinules, and Coots)					
Yellow Rail	*Coturnicops noveboracensis*			Yes	
Black Rail	*Laterallus jamaicensis*	SE	I	Yes	Yes
King Rail	*Rallus elegans*		II	Yes	
Clapper Rail	*Rallus crepitans*		IV		
Virginia Rail	*Rallus limicola*		IV		
Sora	*Porzana carolina*				
Common Gallinule	*Gallinula galeata*				
American Coot	*Fulica americana*				
Gruidae (Cranes)					
Sandhill Crane	*Antigone canadensis*				
Recurvirostridae (Stilts and Avocets)					
Black-necked Stilt	*Himantopus mexicanus*				
American Avocet	*Recurvirostra americana*				
Haematopodidae (Oystercatchers)					
American Oystercatcher	*Haematopus palliatus*		II	Yes	Yes
Charadriidae (Plovers)					
Black-bellied Plover	*Pluvialis squatarola*		IV		
American Golden-Plover	*Pluvialis dominica*				
Wilson's Plover	*Charadrius wilsonia*	SE	I	Yes	Yes
Semipalmated Plover	*Charadrius semipalmatus*				
Piping Plover	*Charadrius melodus*	FTST	II	Yes	
Killdeer	*Charadrius vociferus*				
Scolopacidae (Sandpipers and Allies)					
Upland Sandpiper	*Bartramia longicauda*				Yes
Whimbrel	*Numenius phaeopus*		IV		Yes
Hudsonian Godwit	*Limosa haemastica*			Yes	Yes
Marbled Godwit	*Limosa fedoa*		IV	Yes	Yes
Ruddy Turnstone	*Arenaria interpres*				
Red Knot	*Calidris canutus*	FTST	I		Yes

Biological Family		Status[1]	Tier[2]	Watch List[3]	BCC
Common Name	**Scientific Name**				
Stilt Sandpiper	*Calidris himantopus*				
Sanderling	*Calidris alba*		IV		
Dunlin	*Calidris alpina*		IV		
Purple Sandpiper	*Calidris maritima*		IV		Yes
Baird's Sandpiper	*Calidris bairdii*				
Least Sandpiper	*Calidris minutilla*				
White-rumped Sandpiper	*Calidris fuscicollis*				
Pectoral Sandpiper	*Calidris melanotos*			Yes	
Semipalmated Sandpiper	*Calidris pusilla*			Yes	Yes
Western Sandpiper	*Calidris mauri*				
Short-billed Dowitcher	*Limnodromus griseus*		IV	Yes	Yes
Long-billed Dowitcher	*Limnodromus scolopaceus*				
Wilson's Snipe	*Gallinago delicata*				
American Woodcock	*Scolopax minor*		II	Yes	
Wilson's Phalarope	*Phalaropus tricolor*				
Spotted Sandpiper	*Actitis macularius*				
Solitary Sandpiper	*Tringa solitaria*				Yes
Greater Yellowlegs	*Tringa melanoleuca*				
Willet	*Tringa semipalmata*		III	Yes	
Lesser Yellowlegs	*Tringa flavipes*			Yes	Yes
Stercorariidae (Skuas and Jaegers)					
Pomarine Jaeger	*Stercorarius pomarinus*				
Parasitic Jaeger	*Stercorarius parasiticus*				
Laridae (Gulls, Terns, and Skimmers)					
Bonaparte's Gull	*Chroicocephalus philadelphia*				
Laughing Gull	*Leucophaeus atricilla*		IV		
Ring-billed Gull	*Larus delawarensis*				
Herring Gull	*Larus argentatus*				
Iceland Gull	*Larus glaucoides*				
Lesser Black-backed Gull	*Larus fuscus*				
Glaucous Gull	*Larus hyperboreus*				
Great Black-backed Gull	*Larus marinus*				
Least Tern	*Sternula antillarum*		III	Yes	Yes
Gull-billed Tern	*Gelochelidon nilotica*	ST	I		Yes
Caspian Tern	*Hydroprogne caspia*				
Black Tern	*Chlidonias niger*				
Roseate Tern	*Sterna dougallii*	FESE		Yes	
Common Tern	*Sterna hirundo*		II		
Arctic Tern	*Sterna paradisaea*				

Biological Family		Status[1]	Tier[2]	Watch List[3]	BCC
Common Name	**Scientific Name**				
Forster's Tern	*Sterna forsteri*		III		
Royal Tern	*Thalasseus maximus*		IV		
Sandwich Tern	*Thalasseus sandvicensis*				
Black Skimmer	*Rynchops niger*		II		Yes
Columbidae (Pigeons and Doves)					
Rock Pigeon	*Columba livia*				
Eurasian Collared-Dove	*Streptopelia decaocto*				
Mourning Dove	*Zenaida macroura*				
Cuculidae (Cuckoos)					
Yellow-billed Cuckoo	*Coccyzus americanus*		III		
Black-billed Cuckoo	*Coccyzus erythropthalmus*		II	Yes	
Tytonidae (Barn-Owls)					
Barn Owl	*Tyto alba*		III		
Strigidae (Owls)					
Eastern Screech-Owl	*Megascops asio*				
Great Horned Owl	*Bubo virginianus*				
Snowy Owl	*Bubo scandiacus*			Yes	
Barred Owl	*Strix varia*				
Long-eared Owl	*Asio otus*			Yes	
Short-eared Owl	*Asio flammeus*				Yes
Northern Saw-whet Owl	*Aegolius acadicus*		I		
Caprimulgidae (Nightjars and Allies)					
Common Nighthawk	*Chordeiles minor*				
Chuck-will's-widow	*Antrostomus carolinensis*				
Eastern Whip-poor-will	*Antrostomus vociferus*		III	Yes	Yes
Apodidae (Swifts)					
Chimney Swift	*Chaetura pelagica*		IV		
Trochilidae (Hummingbirds)					
Ruby-throated Hummingbird	*Archilochus colubris*				
Alcedinidae (Kingfishers)					
Belted Kingfisher	*Megaceryle alcyon*		III		
Picidae (Woodpeckers)					
Red-headed Woodpecker	*Melanerpes erythrocephalus*			Yes	Yes
Red-bellied Woodpecker	*Melanerpes carolinus*				
Yellow-bellied Sapsucker	*Sphyrapicus varius*				
Downy Woodpecker	*Picoides pubescens*				
Hairy Woodpecker	*Picoides villosus*				
Northern Flicker	*Colaptes auratus*		IV		
Pileated Woodpecker	*Dryocopus pileatus*				

Biological Family		Status[1]	Tier[2]	Watch List[3]	BCC
Common Name	Scientific Name				
Falconidae (Falcons and Caracaras)					
American Kestrel	*Falco sparverius*				
Merlin	*Falco columbarius*				
Peregrine Falcon	*Falco peregrinus*	ST	I		Yes
Tyrannidae (Tyrant Flycatchers)					
Olive-sided Flycatcher	*Contopus cooperi*			Yes	
Eastern Wood-Pewee	*Contopus virens*		IV		
Acadian Flycatcher	*Empidonax virescens*				
Willow Flycatcher	*Empidonax traillii*				
Least Flycatcher	*Empidonax minimus*				
Eastern Phoebe	*Sayornis phoebe*				
Great Crested Flycatcher	*Myiarchus crinitus*				
Eastern Kingbird	*Tyrannus tyrannus*		IV		
Laniidae (Shrikes)					
Loggerhead Shrike[4]	*Lanius ludovicianus*	ST	I		Yes
Vireonidae (Vireos)					
White-eyed Vireo	*Vireo griseus*				
Yellow-throated Vireo	*Vireo flavifrons*				
Blue-headed Vireo	*Vireo solitarius*				
Philadelphia Vireo	*Vireo philadelphicus*				
Warbling Vireo	*Vireo gilvus*				
Red-eyed Vireo	*Vireo olivaceus*				
Corvidae (Crows and Jays)					
Blue Jay	*Cyanocitta cristata*				
American Crow	*Corvus brachyrhynchos*				
Fish Crow	*Corvus ossifragus*				
Alaudidae (Larks)					
Horned Lark	*Eremophila alpestris*				
Hirundinidae (Swallows)					
Northern Rough-winged Swallow	*Stelgidopteryx serripennis*		IV		
Purple Martin	*Progne subis*				
Tree Swallow	*Tachycineta bicolor*				
Bank Swallow	*Riparia riparia*		III		
Barn Swallow	*Hirundo rustica*				
Cliff Swallow	*Petrochelidon pyrrhonota*				
Cave Swallow	*Petrochelidon fulva*				
Paridae (Chickadees, and Titmice)					
Carolina Chickadee	*Poecile carolinensis*				
Tufted Titmouse	*Baeolophus bicolor*				

Biological Family		Status[1]	Tier[2]	Watch List[3]	BCC
Common Name	**Scientific Name**				
Sittidae (Nuthatches)					
Red-breasted Nuthatch	*Sitta canadensis*				
White-breasted Nuthatch	*Sitta carolinensis*				
Brown-headed Nuthatch	*Sitta pusilla*				Yes
Certhiidae (Treecreepers)					
Brown Creeper	*Certhia americana*				
Troglodytidae (Wrens)					
House Wren	*Troglodytes aedon*				
Winter Wren	*Troglodytes hiemalis*				
Sedge Wren	*Cistothorus platensis*				Yes
Marsh Wren	*Cistothorus palustris*		IV		
Carolina Wren	*Thryothorus ludovicianus*				
Polioptilidae (Gnatcatchers)					
Blue-gray Gnatcatcher	*Polioptila caerulea*				
Regulidae (Kinglets)					
Golden-crowned Kinglet	*Regulus satrapa*				
Ruby-crowned Kinglet	*Regulus calendula*				
Turdidae (Thrushes and Allies)					
Eastern Bluebird	*Sialia sialis*				
Veery	*Catharus fuscescens*				
Gray-cheeked Thrush	*Catharus minimus*				
Swainson's Thrush	*Catharus ustulatus*				
Hermit Thrush	*Catharus guttatus*				
Wood Thrush	*Hylocichla mustelina*		IV	Yes	Yes
American Robin	*Turdus migratorius*				
Mimidae (Mockingbirds and Thrashers)					
Gray Catbird	*Dumetella carolinensis*		IV		
Brown Thrasher	*Toxostoma rufum*		IV		
Northern Mockingbird	*Mimus polyglottos*				
Sturnidae (Starlings)					
European Starling	*Sturnus vulgaris*				
Motacillidae (Pipits)					
American Pipit	*Anthus rubescens*				
Bombycillidae (Waxwings)					
Cedar Waxwing	*Bombycilla cedrorum*				
Calcariidae (Longspurs and Snow Buntings)					
Lapland Longspur	*Calcarius lapponicus*				
Snow Bunting	*Plectrophenax nivalis*				

Biological Family		Status[1]	Tier[2]	Watch List[3]	BCC
Common Name	Scientific Name				
Parulidae (New World Warblers)					
Ovenbird	*Seiurus aurocapilla*				
Worm-eating Warbler	*Helmitheros vermivorum*				Yes
Louisiana Waterthrush	*Parkesia motacilla*				
Northern Waterthrush	*Parkesia noveboracensis*				
Golden-winged Warbler	*Vermivora chrysoptera*			Yes	Yes
Blue-winged Warbler	*Vermivora cyanoptera*				Yes
Black-and-white Warbler	*Mniotilta varia*		IV		
Prothonotary Warbler	*Protonotaria citrea*			Yes	
Tennessee Warbler	*Oreothlypis peregrina*				
Orange-crowned Warbler	*Oreothlypis celata*				
Nashville Warbler	*Oreothlypis ruficapilla*				
Connecticut Warbler	*Oporornis agilis*			Yes	
Kentucky Warbler	*Geothlypis formosa*		III	Yes	Yes
Common Yellowthroat	*Geothlypis trichas*				
Hooded Warbler	*Setophaga citrina*				
American Redstart	*Setophaga ruticilla*				
Cape May Warbler	*Setophaga tigrina*			Yes	
Cerulean Warbler[3]	*Setophaga cerulea*		II	Yes	Yes
Northern Parula	*Setophaga americana*				
Magnolia Warbler	*Setophaga magnolia*				
Bay-breasted Warbler	*Setophaga castanea*				
Blackburnian Warbler	*Setophaga fusca*				
Yellow Warbler	*Setophaga petechia*				
Chestnut-sided Warbler	*Setophaga pensylvanica*				
Blackpoll Warbler	*Setophaga striata*				
Black-throated Blue Warbler	*Setophaga caerulescens*				
Palm Warbler	*Setophaga palmarum*				
Pine Warbler	*Setophaga pinus*				
Yellow-rumped Warbler	*Setophaga coronata*				
Yellow-throated Warbler	*Setophaga dominica*				
Prairie Warbler	*Setophaga discolor*			Yes	Yes
Black-throated Green Warbler	*Setophaga virens*				
Canada Warbler	*Cardellina canadensis*		IV	Yes	
Wilson's Warbler	*Cardellina pusilla*				
Yellow-breasted Chat	*Icteria virens*		IV		
Emberizidae (New World Sparrows)					
Grasshopper Sparrow	*Ammodramus savannarum*		IV		
Henslow's Sparrow	*Ammodramus henslowii*	ST	I	Yes	Yes

Biological Family		Status[1]	Tier[2]	Watch List[3]	BCC
Common Name	**Scientific Name**				
Nelson's Sparrow	*Ammodramus nelsoni*		III	Yes	Yes
Saltmarsh Sparrow	*Ammodramus caudacutus*		III	Yes	Yes
Seaside Sparrow	*Ammodramus maritimus*		IV	Yes	Yes
American Tree Sparrow	*Spizelloides arborea*				
Chipping Sparrow	*Spizella passerina*				
Field Sparrow	*Spizella pusilla*		IV		
Fox Sparrow	*Passerella iliaca*				
Dark-eyed Junco	*Junco hyemalis*				
White-crowned Sparrow	*Zonotrichia leucophrys*				
White-throated Sparrow	*Zonotrichia albicollis*				
Vesper Sparrow	*Pooecetes gramineus*				
Savannah Sparrow	*Passerculus sandwichensis*				
Song Sparrow	*Melospiza melodia*				
Lincoln's Sparrow	*Melospiza lincolnii*				
Swamp Sparrow	*Melospiza georgiana*				
Eastern Towhee	*Pipilo erythrophthalmus*		IV		
Cardinalidae (Cardinals and Allies)					
Summer Tanager	*Piranga rubra*				
Scarlet Tanager	*Piranga olivacea*				
Northern Cardinal	*Cardinalis cardinalis*				
Rose-breasted Grosbeak	*Pheucticus ludovicianus*				
Blue Grosbeak	*Passerina caerulea*				
Indigo Bunting	*Passerina cyanea*				
Dickcissel	*Spiza americana*				
Icteridae (Troupials and Allies)					
Bobolink	*Dolichonyx oryzivorus*			Yes	
Red-winged Blackbird	*Agelaius phoeniceus*				
Eastern Meadowlark	*Sturnella magna*		IV		
Rusty Blackbird	*Euphagus carolinus*				Yes
Common Grackle	*Quiscalus quiscula*				
Boat-tailed Grackle	*Quiscalus major*				
Brown-headed Cowbird	*Molothrus ater*				
Orchard Oriole	*Icterus spurius*				
Baltimore Oriole	*Icterus galbula*				
Fringillidae (Finches and Allies)					
House Finch	*Haemorhous mexicanus*				
Purple Finch	*Haemorhous purpureus*				
Red Crossbill	*Loxia curvirostra*		III		
White-winged Crossbill	*Loxia leucoptera*				

Biological Family		Status[1]	Tier[2]	Watch List[3]	BCC
Common Name	**Scientific Name**				
Common Redpoll	*Acanthis flammea*				
Pine Siskin	*Spinus pinus*				
American Goldfinch	*Spinus tristis*				
Passeridae (Old World Sparrows)					
House Sparrow	*Passer domesticus*				

[1]FE=Federal Endangered; FT=Federal Threatened; SE=State Endangered; ST=State Threatened; FP=Federal Proposed; FC=Federal Candidate; CC=Collection Concern

[2]I=VA Wildlife Action Plan - Tier I - Critical Conservation Need; II=VA Wildlife Action Plan - Tier II - Very High Conservation Need; III=VA Wildlife Action Plan - Tier III - High Conservation Need; IV=VA Wildlife Action Plan - Tier IV - Moderate Conservation Need. Birds on this list not necessarily special-status species.

[3]North American Bird Conservation Initiative 2016. Birds on this list not necessarily special-status species.

[4]Not recorded in Accomack County in eBird through January 2017

*Birds that could be considered vagrants to the mid-Atlantic (e.g., that do not normally occur there, such as those from the western US, or Europe) and truly pelagic species (e.g., bird that do not normally forage within sight of shore) are excluded from this list. Bird ranges based on range maps in Rodewald (2015).

Table C-2: Landbird Species Expected to Overlap with the Alternative Sites Evaluated in the EA

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Table C-2: Landbird Species Expected to Overlap with the Alternative Sites Evaluated in the EA (Adapted from Appendix 5 from Paxton and Wilson 2015)

Common Name	Species/subspecies	B[1]	W[1]	M[1]	Conservation Concern[2]	Population Exposure[3]	Population Vulnerability
Acadian Flycatcher	*Empidonax virescens*			x		High	Low
Alder Flycatcher	*Empidonax alnorum*			x		High	Low
American Crow	*Corvus brachyrhynchos*	x	x	x		High	Low
American Goldfinch	*Spinus tristis*	x	x	x		High	Low
American Redstart	*Setophaga ruticilla*			x		High	Moderate-High
American Robin	*Turdus migratorius*	x	x	x		High	Low
American Tree Sparrow	*Spizelloides arborea*		x	x		High	Low
Baltimore Oriole	*Icterus galbula*			x		High	Low
Bank Swallow	*Riparia riparia*			x		High	Low
Barn Swallow	*Hirundo rustica*	x		x		High	Low
Bay-breasted Warbler	*Setophaga castanea*			x	14	High	Low
Belted Kingfisher	*Megaceryle alcyon*	x	x	x		High	Low
Bicknell's Thrush	*Catharus bicknelli*			x	14	High	High
Black-and-white Warbler	*Mniotilta varia*			x		High	Low
Black-billed Cuckoo	*Coccyzus erythropthalmus*			x		High	Low
Blackburnian Warbler	*Setophaga fusca*			x		High	Low
Blackpoll Warbler	*Setophaga striata*			x		High	Low
Black-throated Blue Warbler	*Setophaga caerulescens*			x		High	Moderate-High
Black-throated Green Warbler	*Setophaga virens*			x		High	Low
Blue Grosbeak	*Passerina caerulea*	x		x		High	Low
Blue Jay	*Cyanocitta cristata*	x	x	x		High	Low
Blue-gray Gnatcatcher	*Polioptila caerulea*	x		x		High	Low

Common Name	Species/subspecies	B[1]	W[1]	M[1]	Conservation Concern[2]	Population Exposure[3]	Population Vulnerability
Blue-headed Vireo	*Vireo solitarius*			x		High	Low
Blue-winged Warbler	*Vermivora cyanoptera*			x	14, 28, 29, 30	High	High
Boat-tailed Grackle	*Quiscalus major*		x			High	Low
Bobolink	*Dolichonyx oryzivorus*			x		High	Low
Brown Creeper	*Certhia americana*		x	x		High	Low
Brown Thrasher	*Toxostoma rufum*	x	x	x		High	Low
Brown-headed Cowbird	*Molothrus ater*	x		x		High	Low
Brown-headed Nuthatch	*Sitta pusilla*	x	x		29	Low	Low
Canada Warbler	*Cardellina canadensis*			x	14, 28	High	Low
Cape May Warbler	*Setophaga tigrina*			x		High	Low
Carolina Chickadee	*Poecile carolinensis*	x	x			Low	Low
Carolina Wren	*Thryothorus ludovicianus*	x	x			Low	Low
Cedar Waxwing	*Bombycilla cedrorum*	x	x	x		High	Low
Cerulean Warbler	*Setophaga cerulea*			x	28, 29, 30	High	Low
Chestnut-sided Warbler	*Setophaga pensylvanica*			x		High	Low
Chimney Swift	*Chaetura pelagica*			x		High	Low
Chipping Sparrow	*Spizella passerina*	x	x	x		High	Low
Chuck-will's-widow	*Antrostomus carolinensis*	x		x	30	High	High
Cliff Swallow	*Petrochelidon pyrrhonota*			x		High	Low
Coastal Plain Swamp Sparrow	*Melospiza georgiana nicgrescens*		x	x	30	High	High
Common Grackle	*Quiscalus quiscula*	x	x	x		High	Low
Common Nighthawk	*Chordeiles minor*	x		x		High	Low
Common Redpoll	*Acanthis flammea*			x		Low	Low
Common Yellowthroat	*Geothlypis trichas*	x	x	x		High	Low
Connecticut Warbler	*Oporornis agilis*			x		High	Low

Common Name	Species/subspecies	B[1]	W[1]	M[1]	Conservation Concern[2]	Population Exposure[3]	Population Vulnerability
Dark-eyed Junco	*Junco hyemalis*		x	x		High	Low
Dickcissel	*Spiza americana*			x		Low	Low
Downy Woodpecker	*Picoides pubescens*	x	x			Low	Low
Eastern Bluebird	*Sialia sialis*	x	x	x		High	Low
Eastern Kingbird	*Tyrannus tyrannus*	x		x		High	Low
Eastern Meadowlark	*Sturnella magna*	x	x			High	Low
Eastern Phoebe	*Sayornis phoebe*	x	x	x		High	Low
Eastern Towhee	*Pipilo erythrophthalmus*		x			Low	Low
Eastern Whip-poor-will	*Antrostomus vociferus*			x	29, 30	High	Low
Eastern Wood-Pewee	*Contopus virens*	x		x		High	Low
European Starling	*Sturnus vulgaris*	x	x	x		Low	Low
Evening Grosbeak	*Coccothraustes vespertinus*			x		Low	Low
Field Sparrow	*Spizella pusilla*	x	x	x		High	Low
Fish Crow	*Corvus ossifragus*	x	x	x		High	Low
Fox Sparrow	*Passerella iliaca*		x	x		High	Low
Golden-crowned Kinglet	*Regulus satrapa*		x	x		High	Low
Golden-winged Warbler	*Vermivora chrysoptera*			x	28, 30	High	High
Grasshopper Sparrow	*Ammodramus savannarum*			x		High	Low
Gray Catbird	*Dumetella carolinensis*	x	x	x		High	Low
Gray-cheeked Thrush	*Catharus minimus*			x		High	Low
Hairy Woodpecker	*Picoides villosus*	x	x			Low	Low
Henslow's Sparrow	*Ammodramus henslowii*	x	x	x	28, 29	High	High
Hermit Thrush	*Catharus guttatus*			x		High	Low
Hooded Warbler	*Setophaga citrina*			x		High	Low
Horned Lark	*Eremophila alpestris*	x	x	x		High	Low
House Finch	*Haemorhous mexicanus*		x			Low	Low

Common Name	Species/subspecies	B[1]	W[1]	M[1]	Conservation Concern[2]	Population Exposure[3]	Population Vulnerability
House Sparrow	*Passer domesticus*	x	x			Low	Low
House Wren	*Troglodytes aedon*	x		x		High	Low
Indigo Bunting	*Passerina cyanea*	x		x		High	Low
Ipswich Sparrow	*Passerculus sandwichensis princepeps*		x	x		High	High
Kentucky Warbler	*Geothlypis formosa*			x	28, 29, 30	High	Moderate-High
Kirtland's Warbler	*Setophaga kirtlandii*			x		Low	Low
Le Conte's Sparrow	*Ammodramus leconteii*			x		High	Low
Least Flycatcher	*Empidonax minimus*			x		High	Low
Loggerhead Shrike	*Lanius ludovicianus*		x	x	7, 29, 30	Low	High
Louisiana Waterthrush	*Parkesia motacilla*			x	28	High	Moderate-High
Magnolia Warbler	*Setophaga magnolia*			x		High	Low
Marsh Wren	*Cistothorus palustris*	x	x	x		High	Low
Mourning Dove	*Zenaida macroura*	x	x	x		High	Low
Mourning Warbler	*Geothlypis philadelphia*			x		High	Low
Nashville Warbler	*Oreothlypis ruficapilla*			x		High	Low
Nelson's Sparrow	*Ammodramus nelsoni*		x	x	14, 30	High	Low
Northern Bobwhite	*Colinus virginianus*	x	x			Low	Low
Northern Cardinal	*Cardinalis cardinalis*	x	x			Low	Low
Northern Flicker	*Colaptes auratus*	x	x	x		High	Low
Northern Mockingbird	*Mimus polyglottos*	x	x			Low	Low
Northern Parula	*Setophaga americana*			x		High	Low
Northern Rough-winged Swallow	*Stelgidopteryx serripennis*			x		High	Low
Northern Waterthrush	*Parkesia noveboracensis*			x	30	High	Low
Olive-sided Flycatcher	*Contopus cooperi*			x		Low	Low
Orange-crowned Warbler	*Oreothlypis celata*		x	x		High	Low

Common Name	Species/subspecies	B[1]	W[1]	M[1]	Conservation Concern[2]	Population Exposure[3]	Population Vulnerability
Orchard Oriole	*Icterus spurius*	x		x		High	Low
Ovenbird	*Seiurus aurocapilla*			x		High	Low
Painted Bunting	*Passerina ciris*			x		Low	Low
Palm Warbler	*Setophaga palmarum*		x	x		High	Low
Philadelphia Vireo	*Vireo philadelphicus*			x		High	Low
Pileated Woodpecker	*Dryocopus pileatus*	x	x			Low	Low
Pine Siskin	*Spinus pinus*		x	x		Low	Low
Pine Warbler	*Setophaga pinus*	x	x	x		High	Low
Prairie Warbler	*Setophaga discolor*	x		x	28, 29, 30	High	Low
Prothonotary Warbler	*Protonotaria citrea*			x		High	Low
Purple Finch	*Haemorhous purpureus*		x	x		High	Low
Purple Martin	*Progne subis*	x	x	x		High	Low
Red Crossbill	*Loxia curvirostra*			x	28	Low	Low
Red-bellied Woodpecker	*Melanerpes carolinus*	x	x			Low	Low
Red-breasted Nuthatch	*Sitta canadensis*		x	x		High	Low
Red-eyed Vireo	*Vireo olivaceus*	x		x		High	Low
Red-headed Woodpecker	*Melanerpes erythrocephalus*	x	x	x	28, 30	High	Low
Red-winged Blackbird	*Agelaius phoeniceus*	x	x	x		Low	Low
Rock Pigeon	*Columba livia*		x			High	Low
Rose-breasted Grosbeak	*Pheucticus ludovicianus*			x		Low	Low
Ruby-crowned Kinglet	*Regulus calendula*		x	x		High	Low
Ruby-throated Hummingbird	*Archilochus colubris*			x		High	Low
Rusty Blackbird	*Euphagus carolinus*		x	x	14, 28, 29, 30	High	Low
Saltmarsh Sparrow	*Ammodramus caudacutus*	x	x	x	14, 30	High	Low
Savannah Sparrow	*Passerculus sandwichensis*		x	x		High	Low

Common Name	Species/subspecies	B[1]	W[1]	M[1]	Conservation Concern[2]	Population Exposure[3]	Population Vulnerability
Scarlet Tanager	*Piranga olivacea*			x		High	Low
Seaside Sparrow	*Ammodramus maritimus*	x	x	x	30	High	Low
Sedge Wren	*Cistothorus platensis*	x	x	x	28, 29, 30	High	Low
Song Sparrow	*Melospiza melodia*	x	x	x		High	Low
Summer Tanager	*Piranga rubra*	x		x		High	Low
Swainson's Thrush	*Catharus ustulatus*			x		High	Low
Swainson's Warbler	*Limnothlypis swainsonii*			x	28, 29	High	Low
Swamp Sparrow	*Melospiza georgiana*		x	x		High	Low
Tennessee Warbler	*Oreothlypis peregrina*			x		High	Low
Tree Swallow	*Tachycineta bicolor*	x		x		High	Low
Tufted Titmouse	*Baeolophus bicolor*	x	x			Low	Low
Veery	*Catharus fuscescens*			x		High	Low
Vesper Sparrow	*Pooecetes gramineus*		x	x		High	Low
Warbling Vireo	*Vireo gilvus*			x		High	Low
White-breasted Nuthatch	*Sitta carolinensis*	x	x			Low	Low
White-eyed Vireo	*Vireo griseus*	x		x		High	Low
White-throated Sparrow	*Zonotrichia albicollis*		x	x		High	Low
White-winged Crossbill	*Loxia leucoptera*			x		Low	Low
Wild Turkey	*Meleagris gallopavo*	x	x			Low	Low
Willow Flycatcher	*Empidonax traillii*	x		x		High	Low
Wilson's Warbler	*Cardellina pusilla*			x		High	Low
Winter Wren	*Troglodytes hiemalis*		x	x		High	Low
Wood Thrush	*Hylocichla mustelina*	x		x	14, 28, 29, 30	High	High
Worm-eating Warbler	*Helmitheros vermivorum*			x	28, 30	High	Moderate-High
Yellow Warbler	*Setophaga petechia*			x		High	Low
Yellow-bellied Flycatcher	*Empidonax flaviventris*			x		High	Low

Common Name	Species/subspecies	B[1]	W[1]	M[1]	Conservation Concern[2]	Population Exposure[3]	Population Vulnerability
Yellow-bellied Sapsucker	*Sphyrapicus varius*		x	x		High	Low
Yellow-billed Cuckoo	*Coccyzus americanus*	x		x		High	Low
Yellow-breasted Chat	*Icteria virens*	x		x		High	Low
Yellow-rumped Warbler	*Setophaga coronata*		x	x		High	Low
Yellow-throated Vireo	*Vireo flavifrons*			x		High	Low
Yellow-throated Warbler	*Setophaga dominica*	x		x		High	Low

[1] B = breeding, W = winter, M = migration

[2] Bird Conservation Regions: 7 = Taiga Shield and Hudson Plains, 14 = North Atlantic Forest, 28 = Appalachian Mountains, 29 = Piedmont, 30 = Mid-Atlantic Coastal Plain

[3] Population exposure indicates the relative level a population is expected to overlap with the proposed sites and population vulnerability indicates the level in which a population may respond negatively to a demographic disturbance.

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Table C-3: Collision and Population Risk Assessment for All Threatened, Endangered and Species of Special Concern in the North American Bird Conservation Initiative's (NABCI) Bird Conservation Region (BCR) 30 New England/Mid-Atlantic Coast

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Table C-3: Collision and Population Risk Assessment for All Threatened, Endangered and Species of Special Concern in the North American Bird Conservation Initiative's (NABCI) Bird Conservation Region (BCR) 30 New England/Mid-Atlantic Coast
(Adapted from Appendix 4 from Paxton and Wilson 2015)

Common Name	Species/Subspecies (population)	Collision Risk	Population Risk	Specific Information for Risk Class
American Bittern	*Botaurus lentiginosus*	Medium	Low	Very little information. Ungraceful flight. Often active at night. Likely uses rivers and coats lines for migration routes. Broad range across North America. Likely migrates over a broad range. Typically uses fresh water habitats but occasionally uses brackish coastal marshes. Lowther 2009
American Oystercatcher	*Haematopus palliatus*	High	Medium	Form large tight flocks. Immediate vicinity is and important breeding, stopover, and wintering site. 525 breeding pairs on the seaside of Virginia in 2005. 3,600 wintering individuals counted in December, 2015. Populations from the northern Atlantic breeding range by bypass the mid-Atlantic to winter on the northwest coast of Florida. Migrant populations from the mid-Atlantic that winter on the southeast Atlantic and Florida gulf coast use a coastal migratory route. Nol and Humphrey 2012, Watts 2006, Wilke 2015
Audubon's Shearwater	*Puffinus lherminieri*	Low	Low	Pelagic species. Very uncommon on the coast. eBird 2012

Common Name	Species/Subspecies (population)	Collision Risk	Population Risk	Specific Information for Risk Class
Bald Eagle	*Haliaeetus leucocephalus*	Low	Low	Five nests located on island and the peninsula within 10km of the hazard during the last comprehensive survey in 2011. Two small roosts located on the peninsula within 10km of the hazard. Complex migration pattern. Maximum season total for Kiptopeke Hawkwatch is 462 south bound migrants in 2009. Diurnal migrant. Buehler 2000, CCB Mapping Portal 2015, HMANA Hawkcount.org 2015
Black Rail	*Laterallus jamaicensis*	High	High	High load/low aspect wings. Known to strike towers and other objects. Migrates at night. Coastal populations have declined dramatically. One of the most imperiled bird species on the Atlantic coast. Little migration information. Tower kills indicate a broad migration front. If migration is concentrated along the coast a significant portion of the population could be exposed to this hazard. Eddleman 1994, Wilson et al 2015
Black Skimmer	*Rynchops niger niger*	High	Medium	Often forages at night. Migrates in flocks along the coast and offshore. Breeds in the immediate vicinity of this hazard (1135 pairs on the seaside of Virginia in 2013). With many breeding populations to the south of Virginia, a moderate proportion of the North American population could be exposed to this hazard. Gochfeld and Burger 1994, Watts and Paxton 2014
Buff-breasted Sandpiper	*Tryngites subruficollis*	Low	Low	Most migration occurs through the central part of the continent. Small numbers may move east towards the Atlantic coast during fall migration. Mainly associated with short grass pastures and damp margins of freshwater bodies. Not typically associated with beaches or saltmarshes. Lancton and Laredo 1994, eBird 2012

Common Name	Species/Subspecies (population)	Collision Risk	Population Risk	Specific Information for Risk Class
Greater Shearwater	*Puffinus gravis*	Low	Low	Pelagic species. Very uncommon on the coast. eBird 2012
Gull-billed Tern	*Gelochelidon nilotica aranea*	Medium	Low	Agile flyers with high aspect/low loading wings. Breeds in the immediate vicinity of this hazard (255 pairs on the seaside of Virginia in 2013). Virginia is near the northern limit of the breeding range. With most breeding populations to the south of Virginia, a relative small proportion of the North American population could be exposed to this hazard. Bevanger 1998, Molina et al 2014, Raynor 1988, Watts and Paxton 2014
Horned Grebe	*Podiceps auritus cornutus*	Medium	Low	Migrates at night in flocks. High load/High aspect wings. Migrates over a broad front across the continent. Migrates and winters in moderate number in the immediate vicinity (recent reports of hundreds of individual wintering near Chincoteague NWR). Relative small portion of the North American population would be exposed to this hazard. Bevanger 1998, Raynor 1988, Stedman 2000, eBird 2012
Hudsonian Godwit	*Limosa Haemastica (James Bay)*	Low	Low	Most individual migrate non-stop from James Bay to South America. Not a species commonly found in Virginia. Walker et al 2011, eBird 2012
Least Bittern	*Ixobrychus exilis exilis*	High	Medium	Little information. Low ungraceful flight. Known to strike fences, and power lines. Often active at night. Most of the breeding range is associated with the Mississippi Valley. Low density breeding population in the east. May use brackish marshes more frequently that American bittern. With much of the breeding populations to the west of Virginia, a moderate proportion of the North. American population could be exposed to this hazard. Poole 2009

Common Name	Species/Subspecies (population)	Collision Risk	Population Risk	Specific Information for Risk Class
Least Tern	*Sternula antillarum antillarum*	Medium	Medium	Agile flyers with high aspect/low loading wings. Breeds in the immediate vicinity of this hazard (533 pairs on the seaside of Virginia in 2013). Coastal population uses Atlantic coast a migration route. Species often migrates over open water. With many breeding populations to the south and west of Virginia, a moderate proportion of the North American population could be exposed to this hazard. Bevanger 1998, Thompson et al 1997, Raynor 1988, Watts and Paxton 2014
Lesser Yellowlegs	*Tringa flavipes*	Medium	Low	Broad migration front. Primary migration corridors are within the middle of the continent. Most common on the Atlantic coast during fall migration. Fall migrants often make short flight south to stopover areas along Atlantic coast. Nocturnal migrant. Forms small tight flocks. Tibbitts and Moskogg 2014
Marbled Godwit	*Limosa fedoa fedoa* (James Bay)	Medium	High	Small population of James Bay subspecies of about 2000 individuals. Little known about migration for this small population. Likely similar to other James/Hudson bay population, using mid-Atlantic as a terminal stopover area. Winter in small numbers along the coast in Virginia, more common to the south. Gratto-Trevor 2000

Common Name	Species/Subspecies (population)	Collision Risk	Population Risk	Specific Information for Risk Class
Peregrine Falcon	*Falco peregrinus*	Low	Medium	Ten active nest located the seaside of Virginia in 2015, including one associated with Wallops Island. Widespread migration. Clearly defined migratory route along the barrier islands. Maximum season total for Kiptopeke Hawkwatch is 1640 south bound migrants in 1997. Significant proportion of the *tundrius* and eastern *anatum* populations are likely to migrate down the Atlantic coast. Known to strike building and wires, recently fledged young are particularly susceptible. Diurnal Migrant. HMANA Hawkcount.org 2015, Watts and Mojica 2015, White et al 2002
Pied-billed Grebe	*Podilymbus podiceps podiceps*	High	Low	Migrates at night. High load/ Lower aspect than other grebes. Migrates over a broad front across the continent. Migrates and winters in low number in the immediate vicinity. Relative small portion of the North American population would be exposed to this hazard. Known to strike towers, and light houses. Bevanger 1998, Muller and Storer 1999, Raynor 1988, eBird 2012
Piping Plover	*Charadrius melodus melodus*	Medium	High	Federally threatened. Breeds in the immediate vicinity of this hazard (151 pairs on the seaside of Virginia in 2005). Can form large migratory flocks. Uses the Atlantic coast as a migratory route in both spring and fall. Often make short flights to multiple stopover areas along the Atlantic coast during migration. Utilizes a variety of beach habitats. Excellent vision and will forage at night, especially during the pre-nesting and fledging stages of breeding. While localized during breeding season, migrating piping plover populations in Virginia and to the north be could be exposed to this hazard. Elliott-Smith and Haig 2004, Staine and Burger 1994, Watts 2006

Common Name	Species/Subspecies (population)	Collision Risk	Population Risk	Specific Information for Risk Class
Purple Sandpiper	*Calidris maritima belcheri*	High	Low	Migrate in large tight flocks. Known to strike power lines. May become confused by bright lights and inclement weather. Winters mainly to the north of Virginia. The small portion of the population that winters in Virginia and to the south may use Atlantic coast as a migratory route. Payne and Pierce 2002
Red Knot	*Calidris canutus rufa*	High	High	Federally threatened. Migration can occur at night. Can form flocks larger than other shorebird species. Uses immediate vicinity as a stopover area (direct use by up to 30% of the rufa population). Flights between Delaware Bay and Virginia barrier islands documented during stopover. Forages at night during stopover. Uses mid-Atlantic region as a terminally stopover area prior to migrating to the breeding area. Utilizes outer beach as foraging habitat. Baker et al 2013, Cohen 2009, Watts 2006, Watts and Truitt 2015
Red-throated Loon	*Gavia stellata*	Low	Medium	Migrates in flocks. Major migration route down the Atlantic coast, with single day counts of over 8,000 individuals in Virginia. Moderate proportion of the North American population could be exposed to this hazard. Typically migrates over open water, reducing exposure to this hazard. Barr et al 2000, National Audubon Society 2010, eBird 2012
Semipalmated Sandpiper	*Calidris pusilla*	High	Low	Migrates along the Atlantic coast and interior continental US. Nocturnal migration. Greater numbers of individual along the Atlantic coast in the spring. Can form very large flocks. Peak numbers in the mid-Atlantic can reach 115,000 in Delaware Bay. Lower numbers use immediate vicinity as a stopover area. Migration orientation can be confused during inclement weather. Hicklin and Gratto-Trevor 2010, Watts 2006

Common Name	Species/Subspecies (population)	Collision Risk	Population Risk	Specific Information for Risk Class
Short-billed Dowitcher	*Limnodromus griseus griseus* (Hudson Bay)	High	High	Day and night time migration in large flocks. Migrates in calm and inclement weather. Atlantic coast migration route. Uses immediate vicinity as a stopover area (projected use by 46,000 individuals). Nocturnal foraging. Uses mid-Atlantic region as a terminally stopover area prior to migrating to the breeding area. A significant portion of the Hudson Bay population could be exposed to this hazard. Jehl 2001, Watts 2006
Short-eared Owl	*Asio flammeus*	Low	Low	Broad range. Little migration data. Occasionally winters on barrier islands, probably annually in very low numbers. Wiggins et al 2006, eBird 2012
Snowy Egret	*Egretta thula thula*	High	Low	Active at night. Nocturnal migration documented. Heron species document as being susceptible to line strikes. North Atlantic coast breeding populations migratory. Breeds in the immediate vicinity of this hazard (755 pairs on the seaside of Virginia in 2013). Much of the North American breeding populations to the south and west of Virginia, a relative small proportion of the North American population could be exposed to this hazard. APLIC 2006, Parsons and Masters 2000, Watts and Paxton 2014
Solitary Sandpiper	*Tringa solitaria solitaria*	Low	Low	Nocturnal migrant. Forms small flocks. Broad migration front. Small numbers may follow Atlantic coast. Mainly associated with freshwater habitats. Moskoff 2011
Upland Sandpiper	*Bartramia longicauda*	Low	Low	Most migration occurs through the Great Plains. Grassland species not associated with coastal habitats. Houston et al 2011

Common Name	Species/Subspecies (population)	Collision Risk	Population Risk	Specific Information for Risk Class
Whimbrel	*Numenius phaeopus hudsonicus*	High	High	Form large migratory flocks. Nocturnal migration. Uses immediate vicinity as a stopover area (projected use by up to 40,000 individuals). Forages at night during stopover. Major proportion of the James/Hudson Bay population use the mid-Atlantic region as a terminally stopover area prior to migrating to the breeding area. Skeel and Mallory 1996, Smith et al 2011, Watts 2006
Wilson's Plover	*Charadrius wilsonia*	Low	Low	Virginia is at the northern edge of the breeding range. Small population breeds in the immediate vicinity of this hazard (24 pairs on the seaside of Virginia in 2005). Utilizes a variety of beach habitats. Excellent vision and will forage at night. Corbat and Bergstrom 2000, Watts 2006

***Assessment of Potential Impacts to Avian Species from a Proposed 750-foot Guyed Tower* (Paxton and Wilson 2015)**

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Assessment of potential impacts to avian species from a proposed 750 foot guyed tower at NASA's Goddard Space Flight Center's Wallops Flight Facility on Wallops Island, Virginia

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The Center for Conservation Biology is an organization dedicated to discovering innovative solutions to environmental problems that are both scientifically sound and practical within today's social context. Our philosophy has been to use a general systems approach to locate critical information needs and to plot a deliberate course of action to reach what we believe are essential information endpoints.

Summary and Conclusions

- NASA has proposed A 750 foot guyed instrumentation tower to be constructed on Wallops Island, VA at one of two locations.

- Wallops Island is embedded within a critical location along the Atlantic Flyway that supports millions of avian species annually, many of which are of conservation concern. Since this tower has the potential to act as a collision hazard for birds, NASA has requested a synthesis of existing information on the species exposure and relative vulnerability to the proposed construction.

- The proposed tower site and its alternative are relatively identical with respect to location from shoreline or other natural habitats use by birds and are only separated by 2,300 feet. There is no indication from known information that one site or the other poses any greater or lesser risk to collision by birds.

- While the construction of an instrumentation tower on Wallops Island may result in bird mortality collisions, a central question from a population perspective, is not how many individuals would be killed annually but if the focal population would be able to sustain the mortality incurred and still reach conservation and management objectives.

- Information required to make a full assessment on an expected mortality rate from the proposed tower does not exist. Information required for this type of assessment would include full understanding of the distribution of migrant corridors, breeding populations, winter populations and the flight altitudes of many species. In many cases this is only possible through post-construction monitoring. Because this monitoring data does not exist, the best assessment, based on the information available, was undertaken to provide relative levels of risk based on characteristics of broad population overlap with the tower site and species flight and behavioral characteristics.

Introduction

In North America, current estimates of anthropogenic bird mortality total 1 billion birds annually (Banks 1979, Klem 1990, Smithsonian Migratory Bird Center 1997, Manville 2005). In addition to millions killed by power line strikes, vehicle strikes, building strikes, and pesticides, it is estimated that 40-50 million bird deaths occur due to the striking of communication towers and the associated guy lines (Manville 2005). The majority of bird deaths from tower strikes are made up of passerines, due to their high population and large geographic range. However, other groups of birds may by at higher risk of strike due to their breeding, migration, flocking, and feeding habits in relation to tower sites as well as their morphological structure.

Based on current Federal Communications Commissions (2009) data, there are 113,000 towers equal to or greater than 299.9 feet in the United States. Of these towers, 1,800 reach a height of 655.5 ft or greater. Predictably, mortality increases with tower height and the presence of guy lines (Longcore et al., 2012). With the most frequent mortality events occurring when nocturnal passerine migrants are attracted by tower lights (Gauthreaux and Belser 2006).

The purpose of this report is to review current literature and assess, using the current level of understanding, the potential risk of population exposure and vulnerability for avian species to a proposed 750 foot guyed instrumentation tower at NASA's Goddard Space Flight Center's Wallops Flight Facility in Wallops Island, Virginia.

The Proposed Wallops Instrumentation Tower Siting

Construction of a 750 foot tall, guyed, instrumentation tower has been proposed on Wallops Island, Accomack County, Virginia. The tower, as currently proposed, would be constructed on the barrier island between the Atlantic Ocean and the lagoon/saltmarsh complex. The remaining two viable locations for tower construction are located at approximately 37.84300, -75.47858 (Flagpole site) and 37.84793, -75.47374 (Pad 3 site) (figures 1 and 2). These two locations are essentially similar with respect to their positioning on the barrier island and separated by only 2,300 ft. Both sites would require tower guy lines that extend to, or very close to the existing beach. The two proposed sites are so similar that they would not be expected to vary in the relative collision risk to birds.

Potential Population Impacts for Birds Associated with the Wallops Instrumentation Tower

While the construction of an instrumentation tower on Wallops Island may result in bird mortality collisions, from a population perspective, the central question is not how many individuals are anticipated to be killed annually but if the focal population would be able to sustain the mortality incurred and still reach conservation and management objectives. If mortality becomes substantially greater than established limits then the population may be vulnerable to mortality-driven declines and further monitoring, analysis and possible management intervention would be needed to prevent declines. If mortality becomes substantially lower than established limits then it is unlikely that the mortality would be a dominant force in population trends.

Figure 1. Aerial view of remaining tower sites after NASA's site review process.

Figure 2. Three-dimensional rendering of potential tower sites. Guy wires depicted are worst-case and would likely be fewer per tower leg.

At the population level, probability of impact from a specific hazard is determined by the two independent factors 1) exposure and 2) vulnerability. Population exposure to a hazard is the extent to which the population is expected to interact with and be impacted by the hazard. Population vulnerability is the susceptibility of a population to perturbations in vital demographic rates. In the case of the Wallops Instrumentation tower, population exposure includes the extent to which the population spatially overlaps with the hazard and the conditional probability that if it overlaps with the hazard that it will be impacted by the hazard. If a population has no spatial overlap with the hazard, then the likelihood of impact is expected to be 0. There are little to no data available to determine a quantitative level of spatial overlap with the Wallops Instrumentation Tower. Moreover, there is less evidence to provide any indication how a species will be impacted by the Wallops Tower site even if the amount of spatial overlap is entirely known. Information required for this type of assessment would include a full understanding of the distribution of migrant corridors, breeding populations, winter populations and the flight altitudes of many species. Flight altitude is inherently difficult to study in nocturnal migrants without the use of sophisticated radar to determine heights of passing migrants. Because of this, it is impossible to provide explicit guidelines that predict the rate of bird collisions or population impacts that would ensue with the construction of the Wallops Instrumentation Tower at either proposed location. However, it is possible to provide a summary of the populations that are anticipated to interact with the Wallops Tower and to provide a relative ranking of what populations would be more at risk due to any exposure to a newly constructed hazard. This overall assessment can be best achieved by providing more explicit details on populations of bird species included by the United States Fish and Wildlife Service on the list of Birds of Conservation Concern (USFWS 2008) that are expected to broadly overlap with the proposed Wallops Instrumentation Tower sites being proposed. The Birds of Conservation Concern list is an assessment of the species of greatest conservation need across each of the Bird Conservation Regions (BCRs) based on factors of population trend, threats, distribution, abundance, and density.

Waterbird Description

The Virginia barrier island/lagoon system is a critical breeding, migration corridor, and stopover area for numerous waterbird species. The area supports 25-30% of the federally listed *rufa* subspecies of the red knot (*Calidris canutus*) during spring migration. In addition to the proportion of the population supported by the Virginia barrier islands, a much greater proportion of the *rufa* population passes through the Virginia barrier islands during spring migration on their way to the largest stopover area on the Atlantic Coast, Delaware Bay (Watts and Truitt 2015, Watts 2006). Recent telemetry and re-sight studies have shown movement of red knots between Delaware Bay and the Virginia barrier island during spring stopover (Cohen et al 2009). The region also supports nearly the entire Atlantic migrating population of whimbrels (*Numenius phaeopus husonicus*), with a projected 40,000 individuals using the Virginia barrier island/lagoon system in the spring. The population of whimbrels using the Virginia barrier island/lagoon system in the spring is a projection based on 10 aerial transects flown weekly in the springs of 1994-1996. It is believed that this site supports virtually all individuals moving along the Atlantic Coast in spring. The continental estimate for this species was derived from this set of aerial surveys (Watts 2006). Recent satellite tracking has shown that many whimbrels use the barrier island/lagoon system as a terminal staging area during both spring and fall migration to refuel prior to making direct flights to breeding and wintering grounds (Figure 3) (Smith et al 2011).

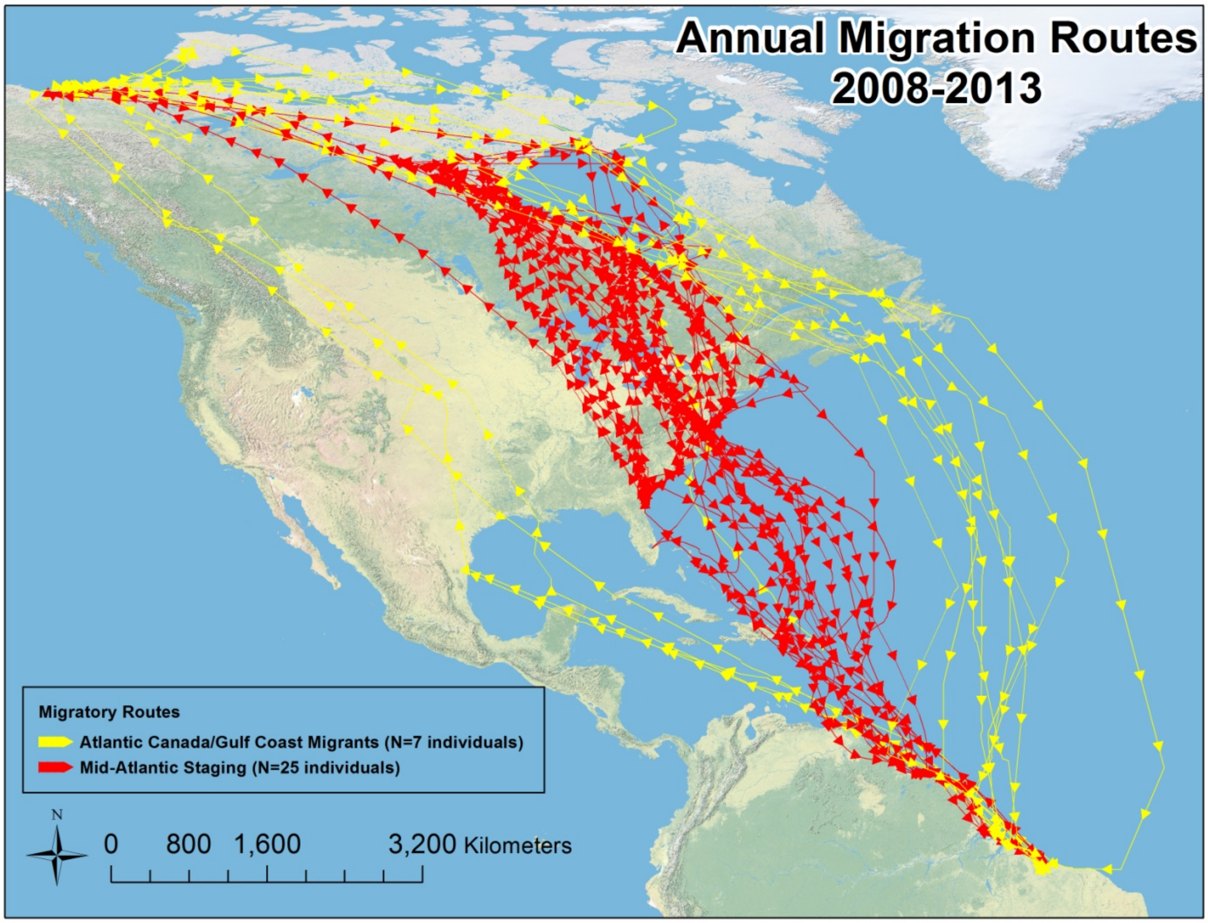

Figure 3. Annual migration routes of whimbrels equipped with satellite tracking units.

In addition to migration, the region is the most important breeding area for waterbirds and shorebirds in Virginia. The barrier island/lagoon system supports over 54% of all breeding colonial waterbirds in Virginia. Including 100% of the Virginia breeding population of white ibis and caspian terns, and over 75% of the Virginia breeding population of glossy ibis, snowy egret, tricolored heron, little blue heron, cattle egret, black-crowned night heron, herring gull, laughing gull, gull-billed tern, and black skimmer (Watts and Paxton 2014). The barrier island/lagoon system supports 100% of the Virginia breeding population of Wilson's plovers and the federally listed piping plover, and 90% of the Virginia breeding population of American oystercatchers (Watts 2006).

The coastal habitats immediately adjacent to the proposed tower site are utilized by numerous birds of multiple species at all times of the year (Table 1). Within 15km of the proposed tower site, there are over 20,000 colonial water bird nests comprised of 16 different species (Watts and Paxton 2014). Red knots, a federally threatened species, use the area as a staging during migration, especially during the spring (Cohen et. al. 2009). Multiple pairs of piping plovers, a federally threatened species, nest in close proximity to the proposed tower site (Boettcher et. al. 2007)

Species specific data is listed it the following appendices:

Appendix 1: List of all species of waterbirds that regularly occur near the proposed tower site during the winter, breeding or migration seasons. Each species is designated if it falls into the categories of wing/body morphology, fast flight characteristics, flocking habits, nocturnal movements, and high population near hazards that may make the species more susceptible to collisions.

Appendix 2: List of all species of raptors that regularly occur near the proposed tower site during the winter, breeding or migration seasons are listed. Each species is designated if it falls into the categories of wing/body morphology, fast flight characteristics, flocking habits, nocturnal movements, and high population near hazards that may make the species more susceptible to collisions.

Appendix 3: Population estimates for all threatened, endangered and species of special concern in the North American Bird Conservation Initiative's (NABCI) Bird Conservation Region (BCR) 30 New England/Mid-Atlantic Coast (Watts 2010).\

Appendix 4: Collision and population risk assessment for all threatened, endangered and species of special concern in the North American Bird Conservation Initiative's (NABCI) Bird Conservation Region (BCR) 30 New England/Mid-Atlantic Coast.

Landbird Description

Landbirds on the lower Delmarva Peninsula and Virginia barrier island lagoon system includes those that use upland habitats such as grasslands, shrublands, and forest and wetland habitats such as emergent marsh. This area is of high conservation importance for breeding and wintering marsh birds such as saltmarsh sparrows and seaside sparrows, and for all landbirds during the migratory seasons. Although the region does support upland breeding and wintering landbirds, most species are considered a relatively lower conservation concern compared to their marsh dwelling counterparts. Within this focal region, there are approximately 65 breeding species of landbirds including 9 species of conservation concern (Appendix 5). In winter, there are approximately 70 landbird species that are regularly found with 10 species considered of high conservation concern. Marsh breeding landbirds overlap the region in all seasons and are composed of populations that are of high conservation concern in this region, year round, as well as populations from northern latitudes that winter here.

Table 1. Summary of colonial waterbird colonies within the barrier island/lagoon system from the 2013 colonial waterbird survey (Watts and Paxton 2014)

Species	Colonies	Pairs	% of Virginia Population
Waders			
White Ibis	2	369	100.0
Glossy Ibis	4	384	79.3
Great Blue Heron	1	52	0.7
Great Egret	9	692	23.9
Snowy Egret	7	755	83.6
Tricolored Heron	7	688	95.8
Little Blue Heron	4	150	84.3
Cattle Egret	2	48	85.7
Green Heron	-----	-----	-----
Black-crowned Night Heron	5	277	77.4
Yellow-crowned Night Heron	1	2	0.7
Gulls			
Great Black-backed Gull	20	868	74.1
Herring Gull	19	2945	88.5
Laughing Gull	30	21414	88.6
Terns			
Gull-billed Tern	8	255	86.7
Caspian Tern	2	9	100.0
Royal Tern	4	62	1.2
Sandwich Tern	1	5	17.9
Forster's Tern	45	1137	46.8
Common Tern	22	694	35.0
Least Tern	25	533	57.6
Others			
Black Skimmer	14	1135	75.4
Double-crested Cormorant	4	67	2.3
Brown Pelican	3	597	24.3
Total	**135**	**33138**	**54.7**

The Atlantic Flyway and the Importance of the Region to Avian Species

The Atlantic Flyway supports hundreds of millions of birds annually including 233 species of landbirds and 135 species of waterbirds, many of which are of conservation concern. The Flyway represents one of the largest near shore movement corridors of birds in the world. Much of the bird activity along the flyway occurs within a thin ribbon along the coastline. Birds funnel through the flyway from a broad geographic area and their relationships to the Atlantic Coast are diverse. In addition to using the coastline as a movement corridor, many species use portions of the Atlantic Coast as migratory staging areas, breeding grounds or wintering grounds. Of particular conservation significance are taxonomic forms or populations that depend exclusively on the Atlantic Coast for some portion of their life cycle.

Waterbirds regularly found in the Atlantic Flyway include species such as herons, terns, gulls, shorebirds such as plovers/sandpipers/oystercatchers and others. Landbirds regularly found in the Atlantic Flyway include 78 species of raptors (vultures, owls, hawks, falcons, and eagles), 155 species of passerines (warblers, vireos, swallows, sparrows, and others), and a smaller proportion of other species (e.g., woodpeckers, doves, nightjars). The vast majority of these species are believed to be declining and 52 species (25 waterbirds and 27 landbirds) are specifically listed under the United States Fish and Wildlife Species of Special Concern (USFWS 2008). The assemblage of birds that utilize the flyway is diverse and their relationships to the Atlantic Coast are varied. The diversity of habitats supported in the flyway provides breeding, wintering, and migratory habitats by species that require open water, tidal mudflats, beaches, dunes, marshes, grasslands, shrublands, and/or forests.

The greatest volume of birds uses the flyway as a movement corridor between breeding and wintering grounds. Birds funnel through the flyway from a broad geographic area ranging from the high latitudes of the boreal zone of North America, the Northeastern Atlantic slope, the Great Lakes, the Appalachian Mountains, the Piedmont, and the Mid-Atlantic Coastal Plain. Avian species using the region are represented by three functional groups: 1) Neotropical migrants, 2) Temperate migrants, and 3) Resident species. Neotropical migrants are species that breed in northern latitudes of North America and winter in the Caribbean and South America. Temperate migrants include species that also breed at northern latitudes but migrate short distance in winter to have the bulk of their populations remain in North America. Finally, resident species are those that do not migrate and typically breed and winter in the same location. All individuals from entire populations or species may move through the flyway or be maintained throughout the entire annual cycle in one location making the area particularly significant for their survival. In addition to using the coastline as a movement corridor, many species use portions of the Atlantic Coast as migratory staging areas, breeding grounds or wintering grounds. Of particular conservation significance are taxonomic forms or populations that depend exclusively on the Atlantic Coast for some portion of their life cycle.

Due to the fact that the region is of such great avian and ecological importance, it has been given special designations by several organizations. In 1979 the region was designated as a United Nations Educational, Scientific and Cultural Organization (UNESCO) Biosphere Reserve, in 1990 it was added to the Western Hemisphere Shorebird Reserve Network, and in 2006 it was designated as an Audubon Important Bird Area.

The greatest diversity of landbirds within the lower Delmarva Peninsula region can be found in the Atlantic Flyway during migration. Approximately 136 species regularly use the area for stopover during migration including 25 species that are of high conservation concern (Appendix 5). These may include species where a dominant portion of their global population pass through this coastal region, such as Bicknell's thrush, and other species where much smaller portions of their global population pass through.

Much of the bird activity along the Atlantic Flyway occurs within a thin ribbon of space along the coastline with landbirds using a wide corridor between the shoreline and tens of kilometers inland. During migration, landbirds may overlap with land or water and extend out considerable distances but the highest volume and diversity is centered on the shoreline. During the breeding and winter season, the distribution of landbirds is constrained by nesting or wintering substrate along the immediate coast or on offshore islands. This may include forests, grasslands, marshes, and open dunes.

The lower Delmarva is one of the most significant migration bottlenecks in eastern North America, concentrating large numbers of birds within relatively small land areas. Habitats on these peninsulas receive extremely high use by migrant landbirds during the fall months and are considered to have some of the highest conservation values on the continent. Along the lower Delmarva Peninsula, fall migrants "fall out" in the early morning hours as they reach the mouth of the Chesapeake Bay and form a steep density gradient extending south to north within the lower 20 km (Watts and Mabey 1993, 1994). A typical pattern of nocturnal migration is for birds to be distributed over the peninsula land surface, near shore over the water of the barrier island lagoon, and over the Atlantic Ocean. During this time migrants may be equally distributed over land or water. As daylight nears, birds pushed out over the water will re-orient themselves on a heading towards land (Figure 4). The Chesapeake Bay acts as a migration barrier to concentrate birds near the tip of the Delmarva Peninsula. Birds near the peninsula tip are often reflected with short northward flights before they settle in their respective habitats to rest or refuel by foraging. When birds settle, they become distributed along a strong density gradient where birds are more concentrated near the tip and on the bayside compared to the seaside. Overall, this pattern suggests that lands on the Delmarva Peninsula are of very high conservation value. Research has documented significant levels of resource depression within this concentration area (Watts et al., unpublished) suggesting that habitat availability/quality may directly influence the condition of migrants during stopover periods and presumably their likelihood of surviving migration. Because of its unique geographic position, the lower Delmarva contains some of the most critical habitats for migrant birds within the Atlantic Flyway.

The daily number of migrants observed on the lower Delmarva varies greatly between during autumn. Migration is an episodic event where a string of many days with a low migrant bird presence can suddenly be punctuated by large volume fall outs of birds. The turnover in migrant bird density during fall out events is a result of a favorable weather and wind that essentially push birds to the shore. Migrant birds often rely on the passage of cold fronts to take advantage of tail winds to help reduce energy expenditure of flight. In the case of the lower Delmarva, moderate northwest winds following the passage of cold fronts produce the largest migrant fall out events as these winds push birds to the coast. The implications of this weather induced migration phenomena is that migration numbers, and hence, the number of dead birds detected at communication towers can fluctuate remarkably between nights.

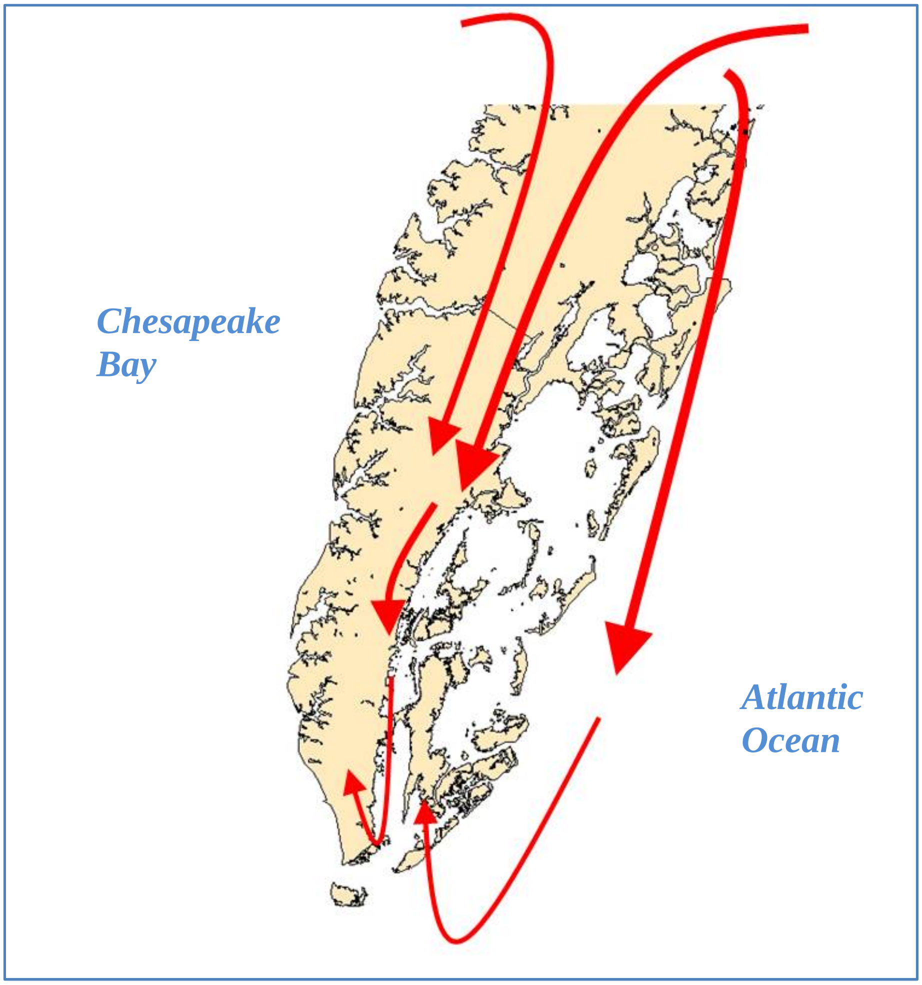

Figure 4. General flight patterns of nocturnal landbird migrants that are funneled southward on the lower Delmarva Peninsula. Birds will discontinue migratory flight as daylight approaches to "fallout" into habitats used for resting and refueling. The Chesapeake Bay and Atlantic Ocean act as a migration barrier and reflects birds northward near the tip during fallout creating a distribution pattern where a greater density of birds is found near the tip and bayside of the peninsula.

Most species of migrant landbirds during autumn migration on the lower Delmarva Peninsula are dominated by hatch year (young of the year) birds (Kiptopeke Banding Station 1963-2012, unpublished data). Age-related differences in distribution patterns between inland and coastal sites are common phenomena throughout North America (Sykes 1986). Although the reason for this general pattern is unknown, it has often been suggested that adult birds maintain a more inland route after one or more years' experience with migration to avoidPeninsula that subsequently lead to greater mortality rates of hatch year birds may have far reaching demographic consequences for most migratory songbirds and less so for species like raptors.

Collision Risk of Birds and Towers and other Aerial Obstructions

Collisions with aerial obstructions such as communication towers, wind turbines, and buildings are considered to contribute a significant source of mortality for landbirds. Among these, communication towers may specifically contribute to the death of 6.6 million birds annually (Longcore et al. 2012). Migratory landbirds are particularly susceptible to collisions with communication towers and other obstructions because they actively migrate at night and are assumed to have difficulty recognizing and avoiding an obstruction. Moreover, pilot warning lights are often required for tall communication towers and are believed to attract birds thereby acting as a trap (PNAWPPM-IV, 2001, Longcore et al. 2008). There are several factors that specifically influence the risk of collision for migratory landbirds that primarily include; 1) Location, 2) Height, 3) Lighting, and 4) Guy wires. Additional factors such as wind and other weather patterns can have influence the disposition of migrant birds' use of space on geographic and altitudinal levels to vary their risk of mortality in relation to the aforementioned principal factors.

Large concentrations of birds in the immediate vicinity of hazardous sites increase the risk of strike. The rarity of tower sites adjacent to beaches and wetlands, and in proximity of large waterbird concentrations, results in very little information for tower strikes of these species. However power lines are often found bisecting these habitats and could be used as an analog to tower guy lines. A study in Australia observing power lines adjacent to a colonial water bird breeding site, documented collision rates of 0.53 collisions/1000 flights transecting power lines. Collision mortality rates ranged from 0.103 deaths/1000 flights for cattle egrets to 0.63 deaths/1000 flights for little black cormorant (Winning and Murray 1997).

Nearly all species of migratory landbirds have been documented to collide with communication towers along their migratory path (Shire et al 2000, Longcore et al., 2012). The vast majority of tower mortality events involve passerines, due to their high population, large geographic range and attraction to lights during nocturnal migration (Gauthreaux and Belser, 2006). The species collected represent nearly all forms of landbirds such as warblers, vireos, tanagers, flycatchers, thrushes, and sparrows. There is not likely any species among these groups that are less susceptible to collision compared to others. A general review of migrant landbird collisions with communication towers describes a relationship where the proportion of individuals collected is relatively commensurate with their migration volume through that area. In other words, species migrating through a geographic area with the greatest density are among those most represented in samples of birds found dead under towers. Similarly, the number of migrant birds collected under towers is positively correlated with nightly migrant volume. Bird migration can be episodic, with many low volume nights during the season punctuated by large movement nights after the passage of cold fronts. Many birds embark on migratory trips after cold front passage to take advantage of favorable tail winds. Taken together, the correlation between bird mortality with location and nightly migration volume indicates that the location of communication towers can significantly influence the number of collisions in relation to the numbers of migrants. Towers placed in high volume migrant corridors are expected to kill many more birds than towers places in lower volume migrant corridors. Moreover, towers placed in areas where large portions of single species populations pass during migration represent significant population threats. Annual average mortality of birds at communication towers can range from a few birds to several thousand birds (summarized in Longcore et al. 2006). Although some of the variation in bird mortality can be attributed to the physical characteristics of the tower (e.g., height, lighting), there would be pronounced variation in relation to migratory bird volume.

Tower height and the presence of tower guy wires are positively correlated with the number of bird collision moralities (Gehring et al, 2011, Longcore et al. 2012). Taller towers take additional vertical space compared to smaller towers and the use of guys on larger towers can increase collision rates by orders of magnitude compared to smaller towers without guys. Gehring et al (2011) demonstrated guyed towers > 305 m can cause increase mortality rates up to 5 times the number detected for smaller towers. Longcore et al. (2012) showed a positive exponential relationship between tower height and bird mortality. Longcore et al. (2008) also considered the inter-relationship with taller towers, guy wires and tower lighting. Most tall towers have guy wires and a large number of bird collisions may likely be with the guy wires rather than the tower itself. Also, taller towers are guyed and equipped with different lighting systems compared to smaller towers. Smaller towers were generally found to utilize constant burning lights and taller towers use blinking lights. Longcore et al suggested that the guy wires supporting larger towers were responsible for greater mortality rates than the tower itself. Kruse (1996) supported this notion by suggesting that the locations of dead birds near communication towers were more likely a result of collisions with guy wires. Towers with guy wires in close vicinity to towers without guy wires have also been shown to produce greater numbers of dead birds by collision (Weise 1971).

Guy wires may also increase collision risk in combination with tower lighting due to the effect of lights on towers attracting circling behavior in birds that eventually collide with guy wires (Gathreaux and Besler 2006). Tower lighting may be considered by some as the most important factor influencing collision rates of birds. Burning lights are believed to aggregate or disorient nocturnal migrants (PNAWPPM-IV, 2001, Longcore et al. 2008). Birds are also believed to be particularly attracted to tower lights during fog or other inclement weather. General observations at lighthouses suggest that birds may be more attracted to continuously illuminated lights compared to pulsing ("blinking") lights. Avery and Gauthreax suggested that pulsing lights with relatively longer dark phases were less likely to attract birds (PNAWPPM-IV, 2001). However, this hypothesis has never been scientifically tested. The use of white strobes compared to red strobe lights has also been suggested but it is unclear at this time of how lighting color actually influences bird attraction.

Risk of collision is greater when visibility is reduced especially due to darkness and inclement weather conditions. Neotropical passerine migrants are especially vulnerable when their navigation systems are confused by lighted towers (Shire 2000, Longcore et al 2012). Nearly all species or waterbirds, especially shore birds during migration, are active at night to take advantage of tide dependent foraging opportunities or undergo migration flights (Burger and Gochfeld 1991, Alerstam et al 1992, McNeil and Rompre 1995, Dougan 1981). Even shore birds with good night vision are less likely to avoid hazards such as mist nets on dark nights Burger et al 2010). For this reason, most researchers capture shorebirds at night when they are less likely to avoid nets. Many tower kills are associated with inclement weather when visibility is reduced (Longcore et al 2013). While not considered especially prone to extreme reduced visibility conditions, Wallops Island does experience foggy conditions. WFF's air traffic control tower tracks various events on the airfield. From 1997 through 2012 a total of 252 instrument flight rule (IFR) aircraft events occurred. IFR events occur with the greatest frequency from late fall through the spring, with 18.8% of IFR events occurring during the spring migration months of April and May (Bundick 2015)

Of the 1,800 towers registered with the FCC that are 655.5 ft or greater, the proposed 750 ft guyed tower, at NASA's Goddard Space Flight Center's Wallops Flight Facility in Wallops Island, Virginia, would be in the top 1.3% in terms of height. The location of the proposed tower on Wallops Island would require guy lines extending very close to both the current Atlantic beach coastline and the saltmarsh.

With the placement of this tower being unique (i.e., no current towers are placed on a barrier island adjacent to a beach and wetland [FCC 2009]), and complex factors that make tower kill comparisons difficult to quantify (Shire et al 2000), it is not possible to project mortality events or numbers for this proposed tower. However, it is well documented that towers kill birds. Shire (2000) summarized documents describing tower kills in the United States and found that in the 121 reports that provided mortality numbers, 545,250 bird mortalities were documented; 47 of the 121 studies provided data on both numbers and species of birds killed and documented 184,797 birds of 230 different species, including 10 on the Partners in Flight "Extremely High Priority" list. While the majority of birds killed in these studies were neotropical migratory songbirds, 54 species of waterbirds and raptors accounted for 1,452 deaths. The 5 most commonly encounter species other than passerines were sora rails (657 killed), Virginia rail (144), pied-billed grebe (123), yellow rail (67) and ring-necked duck (61).

While the placement of the proposed tower along the coast, in the heart of the Atlantic Flyway, would add a hazard to migration by itself, multiple biological and morphological aspects of several bird species that utilize this region increase the risk of tower or guy line strikes. Factors such as wing/body morphology, flight characteristics, flocking habits, nocturnal movements, and high population near hazards add to strike risk. Comparing the numbers of birds killed by striking power lines to their relative population size, birds in the orders of Galliformes (grouse, pheasant, etc.), Gruiformes (rails and cranes), Pelecaniformes (pelicans, herons, ibis, etc.), and Ciconiiformes (storks) are often over represented in the mortality count. This disproportionate number of mortalities is likely due to wing morphology making many species in these orders "poor flyers" Typically birds that have high load/low aspect wings are much less agile than bird species with low load/high aspect wings. Rails, coots, and cranes, which have high load/low aspect wings, are among the most common collision victims in North America and Europe. Many ducks have high load wings and are frequently killed by collision. Herons and egrets typically have lower loading large wings; however, they are still quite low aspect resulting in the species being more susceptible to collision (Bevanger 1997, Rayner 1988). However power lines are often found bisecting these habitats and could be used as an analog to tower guy lines. A combination of over 50 studies worldwide lists grebes, ducks, wading birds, shorebirds, raptors, and upland game birds as most vulnerable to power line collision mortality (SAIC 2000).

Flight characteristic is another factor that plays into relative risk of strike. Fast flying birds (birds with strong, fast, direct flight) such as ducks and shorebirds are much more susceptible to striking towers than slower flying birds. This is even further compounded by the fact that many “fast flyers” also aggregate in large flocks. Species of birds that move in large flocks are at greater risk of strike (Winning and Murry 1997). While the lead birds in the flock may successfully avoid hazards, there is a steady lag in the avoidance maneuvers toward the back of the flock. Often individuals in the back of the flock will not be able to avoid hazards (Savereno et. al. 1996). In addition, some species of ducks and shorebird have longer bills and eyes set higher on the skull that result in excellent vision above the hemisphere of the head, but results in blind spots below (Martin and Shaw 2010), thereby increasing the risk of collision.

While large numbers of raptors frequent the proposed tower site, overall collision risk is deemed low. Raptors typically have low load wing and are more maneuverable in flight. Raptors are much more susceptible to electrocution on lines that have not been constructed or retrofitted with devices to minimize bird electrocution (Bevanger 1997). Most literature suggests that raptors are generally more prone strikes with wind turbines than stationary structures (Erickson et al 2005)

Assessment of Breeding Populations

In general, landbirds maintain territories throughout the breeding season and are relatively sedentary within that territory space. Depending on the species, territory size may range from a few hectares to a few hundred hectares. Landbirds such as songbirds, flycatchers, and others will move about their territory during daylight hours and roost at night. They often remain in the same habitat type throughout daily activities (e.g., remain in marsh, or remain in forest). Because of this limited space use, territorial species of landbirds are less likely to collide with a tower hazard during the breeding season compared to any other time in their annual cycle. This pattern is in stark contrast to waterbirds that often forage at night and use much greater amounts of space including traversing across multiple different habitats. There are a few species that breed within the vicinity of the proposed Wallops Tower sites that are of high conservation concern. However, population risks for these breeding species are more likely to occur for individuals during their migratory phase, such as when first arriving in the spring or departing in autumn. Migratory individuals of these species that emanate from breeding and wintering populations outside of those than the vicinity of Wallops Island could be at a higher risk of collision in one nocturnal migration night than over many months of exposure for a sedentary breeding population.

Species that breed in tidal marshes are among the highest conservation concern among all breeding species within the vicinity of the proposed Wallops Instrumentation Tower. Among these species, the saltmarsh sparrow and the seaside sparrow (Paxton 2007) rely exclusively on tidal saltmarsh and brackish marsh for breeding, wintering, and migration; therefore, spending their entire annual cycle within the thin ribbon of marsh habitats directly along the Atlantic coast or coastal Bays (Wilson et al., 2007). Both of these species are declining throughout their range due to loss and degradation of their required breeding habitat. Marsh habitats are geographically constrained within tidal areas and cannot exist elsewhere. Therefore, the construction of a hazard that causes direct bird mortality through collision or degrades marsh habitat has no alternative management solution. However, the Wallops Instrumentation tower does not likely represent a significant collision hazard to the populations during the breeding season due to the sedentary behavior of breeding individuals. The greater risk to breeding populations at the proposed tower sites could be destruction or degradation of their breeding habitat from tower construction. This can include direct take of their habitat or possible alteration of hydrology that degrades the marsh. Collision risk for these breeding populations is greatest when these birds are actively migrating at night to arrive in the spring or depart in the autumn. Populations of the saltmarsh sparrow and the seaside sparrow that breed to the north of Wallops Island are also among the highest conservation concern species along the Atlantic Coast. Migratory populations of both species overlap greatly with any collision hazard constructed within the salinity zones of tidal salt and brackish marshes whether they are located on Wallops Island, somewhere else in the barrier island or lagoon system, or elsewhere in the Chesapeake Bay.

Other habitats embedded within Wallops Island include scrub/shrub thickets, open dune, and secondary forest. There are several species which are considered of conservation concern that likely breed within these habitats on Wallops Island including the brown-headed nuthatch, prairie warbler and the chuck-will's-widow. The brown-headed nuthatch is a non-migratory permanent resident species that breeds within maritime pine forests that contain snags for nest cavity excavation (Wilson and Watts 1999). Prairie Warblers require dense shrub habitats for breeding and the chuck-will's-widow requires forest habitats for breeding but open habitats such as marshes, dunes, or scrub for foraging. Like other breeding species, tower construction is not likely to cause a significant collision hazard for breeding individuals. Unlike species that require marsh habitats, forest and shrub bird species are using habitats that are not geographically limited and exist elsewhere. Therefore, tower construction does not represent a situation of high population vulnerability due to either collision mortality or habitat loss or degradation. Both prairie warbler and chuck-will's-widow populations are at a much greater risk to collision mortality during spring and autumn migration than during the breeding season.

Assessment of Autumn Migratory Populations

The autumn migration period represents the greatest collision risk for landbirds at the proposed tower sites on Wallops Island due to the high volume of migrant birds passing through and the fact that most are migrating at night and have difficulty avoiding collision hazards. There are a number of species with high conservation concerns that could be expected to overlap with the proposed Wallops tower during migration. These species can be functionally divided into qualitative ranked groups based on risk and vulnerability that summarizes the relative conservation concern of their populations and the degree to which these populations might overlap with a coastal collision hazard. These functional groups can be divided into; 1) Species with the highest risk of collision and population vulnerability because they are represented by species with small populations of high conservation concern that are expected to greatly overlap with the proposed tower, 2) Species with high collision risk but lower population vulnerability because they consist of large populations of high conservation concern and also are expected to greatly overlap with the proposed tower, 3) Species with low risk of collision but high population vulnerability because the species has small populations of high conservation concern but are not expected to overlap greatly with the proposed tower, and 4) Species with low collision risk and low vulnerability because of large populations that are not expected to overlap greatly with the proposed tower. It is important to understand that the term, “expected to overlap”, is a broad description that does not define a spatially explicit relationship with the exact geographic coordinates of a tower location, but rather describes the extent that a migrant bird population will be found along the coastline of the Delmarva Peninsula. It is likely that many places selected for tower construction would have equal probability of overlapping the migratory corridors of landbirds because birds are distributed widely along the peninsula and are not focused in any one specific location. The first three functional groups are discussed in more detail below.

Migratory Species with a high risk of collision and greatest population vulnerability

A special subgroup of species in this risk and vulnerability category are species that have a broad geographic distribution but contain subpopulations that remain spatially segregated during all phases of breeding, migration, and wintering. For these species, distinct subpopulations vary in the level of population exposure and population vulnerability to a collision hazard at any one location. For many species, a global population estimate is assumed to represent the underlying resilience to population vulnerability when in reality the population being exposed to a hazard may be much smaller and less resilient to population loss.

Establishing migratory connectivity is fundamental for assigning an appropriate level or exposure and vulnerability to species with distinct subpopulations. Connecting populations for hazard assessment is the greatest challenge and demand for bird conservation (Hobson et al. 2014). Despite this importance, there is very little information to actually connect populations of landbirds between their breeding and wintering grounds. However, there are a number of species that are believed to contain populations that remain spatially segregated between breeding and wintering grounds and likely undertake different migration routes. Among these are the group of species that have populations that winter in the Caribbean and populations that winter in either Central or South America. The lower Delmarva Peninsula supports a large volume of migrants that are known to winter in the Caribbean. There is no supporting evidence where many of the populations that pass along the Atlantic Flyway and then eventually winter in the Caribbean may emanate from during the breeding season. However, there has been a general, anecdotal belief that many of the Neotropical Migrants that winter in the Caribbean may emanate from Northeastern U.S. breeding populations, and that populations of these same species that winter in Central or South America may emanate from their breeding populations further west. This notion suggests that northeastern breeding individual may take an Atlantic coastal route towards Caribbean wintering grounds while more westerly breeding individuals may take a more central or inland continental route to Central and South America. Obviously, scientifically derived data are needed to support this notion, but is a critical concept to introduce for the call of such information to support hazard assessments.

Landbirds that migrate to the Caribbean for winter dominate the total number of all neotropical migrants found on the lower Delmarva Peninsula (Watts and Mabey 1994, Kiptopeke Banding Station 1963-2012, unpublished data). The two most prevalent neotropical migratory songbirds detected within this group are the American redstart and the black-throated blue warbler. These species can be found in high densities throughout late August to early October. Both of these species have broad geographic distributions during both the breeding season and wintering seasons and have migration corridors along both the Atlantic Coast and Appalachian Mountains. However, the possibility that different subpopulations utilize separate migratory routes signifies the need to connect populations before a final assessment can be made. Other species of conservation concern with large breeding populations in decline that may exhibit patterns of northeast U.S. to Caribbean connectivity and are found with relative abundance on the lower Delmarva during migration include the wood thrush, worm-eating warbler, Kentucky warbler, Louisiana waterthrush, and prairie warbler.

Species with the greatest overall risk and vulnerability to a collision hazard includes those with relatively small populations of high conservation concern that are expected to overlap greatly with the proposed Wallops Tower. The bicknell's thrush ranks very high among the most at risk and most vulnerable within this category. The bicknell's thrush is represented by a population of less than 125,000 birds that breeds in the northeastern United States and southeastern Canada, and then migrates exclusively along the Atlantic Coast to its wintering grounds in the Caribbean (Oullet 1993, Wilson and Watts 1997, Townsend et al, 2006). The bicknell's Thrush is considered one of the greatest conservation priorities among land birds within its breeding range due to its small population size that is declining by several reports (Lambert and King 2008). This species appears to be geographically restricted during all portions of its annual cycle. It is believed that 90 % of its winter population is centered in the island of Hispanolia (Townsend et al, 2006). It is also likely that nearly 100% of the entire Bicknell's Thrush global population can be found within the outermost coastal portion of the Atlantic Flyway during autumn migration with birds rarely found inland (Wilson and Watts

1997). This is consistent with a direct route between its breeding and winter biogeography. Population hazards within the narrow migration corridor place this species at high risk of collision that could also accumulate for a high level of population vulnerability.

Species that rely on tidal salt marsh and brackish marsh habitats have a high collision risk during their migration because their movement corridor is so spatially restricted with a narrow longitudinal range. Due to their small, declining populations, species such as the saltmarsh sparrow, nelson's sparrow, and seaside sparrow are of high conservation concern over their breeding grounds and throughout their breeding range in the Mid-Atlantic and Atlantic Forest Bird Conservation Regions (Wilson and Watts 2006). These species spend most of their annual life cycle within the narrow ribbon of available habitat along the Atlantic Coast. Nearly 100% of their populations that migrate southward from areas to the north of Virginia pass over marshes of the Virginia barrier island lagoon system and salt and brackish portions of the Chesapeake Bay. An unknown proportion of these populations remain within the Mid-Atlantic throughout the winter period while others continue to the South Atlantic region. Populations of the saltmarsh sparrow, nelson's sparrow, and seaside sparrow do remain relatively high throughout winter in the barrier island lagoon system and lower Chesapeake Bay indicating the value of this region to all phases of their annual cycle (Center for Conservation Biology, unpublished data).

The coastal plain swamp sparrow is a unique form of swamp sparrow that breeds in brackish to fresh water marshes in the mid-Atlantic region (Beadell et al. 2003). This species has undergone dramatic declines and has reached low population sizes. This short-distant migrant breeds from Delaware south to Virginia and winters from Virginia to North Carolina (Greenberg et al. 2007) so its entire life history is spent within the mid-Atlantic coastal zone. Individuals of this geographically restricted species are at a high risk of collision because of spatial overlap and a high level of vulnerability due to the species small population size.

Both the golden-winged warbler and blue-winged warbler are of high conservation concern across multiple bird conservation regions. These species are found in relatively small numbers during autumn migration on the lower Delmarva Peninsula (Kiptopeke Banding Station 1963-2012, unpublished data). The breeding distribution of golden-winged warblers is primarily supported in the Appalachian Mountains but sparsely distributed populations in eastern Pennsylvania, New Jersey, and New York (Confer et al. 2011) may contribute individuals found on the lower Delmarva Peninsula. Likewise, blue-winged warblers are sparsely distributed across the northeastern U.S. but may represent populations of high vulnerability from a coastal hazard.

Waterbirds that are considered to have a high risk of collision and greatest population vulnerability include black rail, and the rufa subspecies of the red knot. The black rail is one of the most imperiled bird species on the Atlantic Coast. It has a very small declining population and is a candidate for threatened and endangered listing (Wilson et al 2015). It utilizes coastal habitats, migrates at night and is highly prone to striking artificial structures (Eddleman 1994)

The rufa subspecies of the red knot is a federally threatened species. The beach habitat, along the Virginia Barrier Islands, has been shown to support a significant portion of the overall population of red knots known to stage along the Atlantic Coast. Proportions of the Atlantic red knot population supported by the Virginia Barrier Islands have declined from approximately 32%, from 2007 to 2010, to approximately 17%, from 2011 to 2014 (USFWS 2013, USFWS 2014). In addition to the proportion of the population directly using the immediate habitat, a much larger proportion of the population would be exposed to the tower while migrating north to stopover at Delaware Bay on their way to the breeding grounds. Red knots are agile fliers but may form large migration flocks, and are known to migrate at night.

Migratory species with a high risk of collision but low population vulnerability

Species with a high conservation concern in this category have a high spatial overlap with the lower Delmarva Peninsula during migration but potentially low population vulnerability due to their relatively larger population sizes. This group could potentially include some of the Caribbean migrants previously mentioned including the American redstart, black-throated blue warbler, worm-eating warbler, Kentucky warbler, Louisiana waterthrush, and prairie warbler, depending on the origination of the populations that use the lower Delmarva as a migration corridor. Additional species to include here are the chuck-will's-widow and whip-poor-will. Both of these species are nocturnally active nightjars (Caprimulgiformes) that likely have moderate to high population sizes that are expected to be in decline. Despite the fact that both species are nocturnal, they are still represented in samples of communication tower kills (Shire et al. 2000). The proposed Wallops tower is located near the northern end of the range limit for chuck-will's-widow. This species likely migrates southward into Virginia on or near the coast so the tower has the potential to affect this species range limits. Whip-poor-will populations are more broadly distributed in areas north of Wallops Island so would have lower overlap with the tower.

Several species of waterbirds that are of conservation concern fall into this class of high collision risk/low population vulnerability. Pied-billed grebes are a species that are typically over represented in tower kill studies. This species migrates at night and its wing morphology makes it extremely vulnerable to striking artificial objects (Bevanger 1998). However, pied-billed grebes migrate over an extremely large area across the continent; therefore, only a small proportion of the population would be exposed to the hazard (Muller and Storer 1999)

Snowy egrets and purple sandpipers are also examples of waterbirds of special concern that may be at higher risk of strike due to morphological features and behaviors but whose range limits exposure to this particular hazard. While 755 pairs of snowy egrets bred on the seaside of Virginia in 2013 (Watts and Paxton 2014), the vast majority of the population occurs to the south and west of Virginia (Parsons and Masters 2000). The purple sandpiper is a regular winter resident and migrant down the coast. However, only a small proportion of the population ventures this far south. Most of the population winters to the north of Virginia and would never be exposed to the proposed tower (Payne and Pierce 2002)

Migratory species with a low risk of collision but high population vulnerability

This group contains species that have very low populations that are of high conservation concern but not believed to migrate regularly though the Lower Delmarva Peninsula. The Kirtland's warbler is an endangered species with one of the highest conservation concerns among neotropical migratory landbirds. This species breeds in Michigan and winters throughout the Bahamas (Mayfield 1992). Despite this connection it is generally believed that this species may take an Appalachian route from breeding to wintering grounds. However, all three historical records of this species in Virginia are from the central piedmont (Rottenborn and Brinkley 2005). The loggerhead shrike is another species of conservation concern throughout the northeastern U.S. Although it is possible for migrants to be found on the lower Delmarva, the species breeding and non-breeding distribution in Virginia is primarily found in the ridge and valley and the piedmont (Rotternborn and Brinkley 2005) so the level of overlap with the tower is low.

The red-throated loon could be considered in this risk class. While this species in not threated or endangered, it is a species of concern and has experienced population declines (Watts 2010). This species migrates down the coast in great numbers, but typically migrates over open water (Barr et al 2000). Migration routes over the Atlantic would not typically expose this species to hazards on land.

USFWS Recommendations for tower siting

The fact that towers are a great risk to birds prompted the U. S. Fish and Wildlife Service to recommend guidelines for tower siting, construction, operation, and decommissioning in 2000. Current recommended guidelines include, but are not limited to: 1) collocation of devices on existing towers; 2) limit tower height to 199 feet; 3) construction techniques that do not require guy lines; 4) if lights are required, use the minimum required by the Federal Aviation Administration; 5) if guy lines are required, mark with daytime visual markers, especially near raptor, waterbird, and migrant concentration areas, movement routes, and stopover sites; and 5) avoid construction near breeding, feeding, and roosting areas (USFWS 2000). Manville (2001) states that a worst case scenario would be an 1000+ foot tower, multiple-guyed, with multiple solid or pulsating lights, in a bird migratory corridor, near or next to a wetland.

The proposed tower fits many criteria of the worst case scenario. If built it should be equipped with the minimum number and intensity of white strobe lights (Gehring et al 2009). Guy wires should be well marked with daytime visual markers/bird diverter devices (APLIC 2006). Research and monitoring of the tower site is strongly encouraged.

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Appendix 1. All species of waterbirds that regularly occur near the proposed tower site during the winter, breeding or migration seasons. Each species is designated if it falls into the categories of wing/body morphology, fast flight characteristics, flocking habits, nocturnal movements, and high population near hazards that may make the species more susceptible to collisions.

		Seasonal Occurrence					Additional Risk Factors				
Species/Subspecies	**Common Name**	**Breeding**	**Summering**	**Wintering**	**Fall Migration**	**Spring Migration**	**Wing Morphology**	**Fast Flight Characteristics**	**Flocking Habits**	**Nocturnal Movement**	**High Population Near Hazard**
Podiceps grisegena holboellii	Red-necked Grebe			X	X	X		X	X	X	
Podiceps auritus cornutus	Horned Grebe			X	X	X		X	X	X	X
Podilymbus podiceps podiceps	Pied-billed Grebe	X		X	X	X		X		X	X
Gavia immer	Common Loon			X	X	X		X	X	X	X
Gavia stellata	Red-throated Loon			X	X	X		X	X	X	X
Larus hyperboreus leucereles	Glaucous Gull			X	X	X				X	
Larus glaucoides kumlieni	Iceland Gull			X	X	X				X	
Larus marinus	Great Black-backed Gull	X	X	X	X	X				X	X
Larus fuscus fraellsii	Lesser Black-backed Gull			X	X	X				X	
Larus argentatus smithsoniaunus	Herring Gull	X	X	X	X	X				X	X
Larus delawarensis	Ring-billed Gull		X	X	X	X				X	X
Larus ridibundus ridibundus	Black-headed Gull	X	X	X	X	X				X	
Larus atricilla megalopterus	Laughing Gull	X	X	X	X	X				X	X
Larus philadelphia	Bonaparte's Gull			X	X	X				X	
Gelochelidon nilotica aranea	Gull-billed Tern	X			X	X				X	X
Hydroprogne caspia	Caspian Tern	X	X	X	X	X				X	

		Seasonal Occurrence					Additional Risk Factors				
Species/Subspecies	**Common Name**	**Breeding**	**Summering**	**Wintering**	**Fall Migration**	**Spring Migration**	**Wing Morphology**	**Fast Flight Characteristics**	**Flocking Habits**	**Nocturnal Movement**	**High Population Near Hazard**
Thalasseus maximus maxima	Royal Tern	X	X	X	X	X				X	X
Thalasseus sandvicensis acuflavidus	Sandwich Tern	X	X	X	X	X				X	X
Sterna forsteri litoricola	Forster's Tern	X		X	X	X				X	X
Sterna hirundo hirundo	Common Tern	X			X	X				X	X
Sternula antillarum antillarum	Least Tern	X			X	X				X	X
Chlidonias niger surinamensis	Black Tern		X		X	X				X	
Rynchops niger niger	Black Skimmer	X		X	X	X			X	X	X
Morus bassanus	Northern Gannet	X	X	X	X	X					X
Phalacrocorax carbo carbo	Great Cormorant	X	X	X	X	X	X		X		X
Phalacrocorax auritus auritus	Double-crested Cormorant	X	X	X	X	X	X		X		X
Pelecanus occidentalis carolinensis	Brown Pelican	X	X	X	X	X			X		X
Mergus merganser americanus	Common Merganser	X		X	X	X		X	X	X	
Mergus serrator	Red-breasted Merganser	X		X	X	X		X	X	X	X
Lophodytes cucullatus	Hooded Merganser	X		X	X	X		X	X	X	X
Anas platyrhynchos platyrhynchos	Mallard	X		X	X	X		X	X	X	X
Anas rubripes	American Black Duck	X		X	X	X		X	X	X	X
Anas strepera	Gadwall	X		X	X	X		X	X	X	X
Anas americana	American Wigeon			X	X	X		X	X	X	X
Anas discors	Blue-winged Teal	X		X	X	X		X	X	X	X
Anas crecca carolinensis	Green-winged Teal			X	X	X		X	X	X	X

		Seasonal Occurrence					Additional Risk Factors				
Species/Subspecies	**Common Name**	**Breeding**	**Summering**	**Wintering**	**Fall Migration**	**Spring Migration**	**Wing Morphology**	**Fast Flight Characteristics**	**Flocking Habits**	**Nocturnal Movement**	**High Population Near Hazard**
Anas acuta acuta	Northern Pintail			X	X	X		X	X	X	
Aix sponsa	Wood Duck	X		X	X	X		X	X	X	
Aythya americana	Redhead			X	X	X		X	X	X	
Anas clypeata	Northern Shoveler			X	X	X		X	X	X	X
Aythya valisineria	Canvasback			X	X	X		X	X	X	
Aythya marila mariloides	Greater Scaup			X	X	X		X	X	X	
Aythya affinis	Lesser Scaup			X	X	X		X	X	X	X
Aythya collaris	Ring-necked Duck	X		X	X	X		X	X	X	X
Bucephala clangula americana	Common Goldeneye	X		X	X	X		X	X	X	
Bucephala islandica	Barrow's Goldeneye			X	X	X		X	X	X	
Bucephala albeola	Bufflehead			X	X	X		X	X	X	X
Clangula hyemalis	Long-tailed Duck			X	X	X		X	X	X	X
Histrionicus histrionicus	Harlequin Duck			X	X	X		X	X	X	
Somateria mollissima	Common Eider	X		X	X	X		X	X	X	
Somateria spectabilis	King Eider			X	X	X		X	X	X	
Melanitta nigra americana	Black Scoter			X	X	X		X	X	X	X
Melanitta fusca deglandi	White-winged Scoter			X	X	X		X	X	X	X
Melanitta perspicillata	Surf Scoter			X	X	X		X	X	X	X
Oxyura jamaicensis jamaicensis	Ruddy Duck			X	X	X		X	X	X	
Dendrocygna bicolor	Fulvous Whistling Duck	X	X	X				X	X	X	
Chen caerulescens atlanticus	Snow Goose (Greater)			X	X	X		X	X	X	X

		Seasonal Occurrence					Additional Risk Factors				
Species/Subspecies	Common Name	Breeding	Summering	Wintering	Fall Migration	Spring Migration	Wing Morphology	Fast Flight Characteristics	Flocking Habits	Nocturnal Movement	High Population Near Hazard
Chen rossii	Ross's Goose			X	X	X		X	X	X	
Anser albifrons gambelli	Greater White-fronted Goose			X	X	X		X	X	X	
Branta canadensis canadensis	Canada Goose	X	X	X	X	X		X	X	X	X
Branta bernicla hrota	Atlantic Brant			X	X	X		X	X	X	X
Eudocimus albus	White Ibis	X	X	X	X	X	X		X	X	X
Plegadis falcinellus falcinellus	Glossy Ibis	X	X	X	X	X	X		X	X	X
Ajaia ajaja	Roseate Spoonbill	X			X	X	X			X	
Cygnus olor	Mute Swan	X	X	X						X	
Cygnus columbianus	Tundra Swan			X	X	X			X	X	X
Botaurus lentiginosus	American Bittern	X		X	X	X	X			X	
Ixobrychus exilis exilis	Least Bittern	X		X	X	X	X			X	
Ardea herodias herodias	Great Blue Heron	X	X	X	X	X	X			X	X
Ardea alba egretta	Great Egret	X	X	X	X	X	X			X	X
Egretta thula thula	Snowy Egret	X	X	X	X	X	X			X	X
Egretta tricolor ruficolis	Tricolored Heron	X	X	X	X	X	X			X	X
Egretta rufescens	Reddish Egret	X	X	X	X	X	X			X	
Egretta caerulea	Little Blue Heron	X	X	X	X	X	X			X	X
Bubulcus ibis ibis	Cattle Egret	X	X	X	X	X	X			X	X
Butorides virescens virescens	Green Heron	X	X	X	X	X	X			X	
Nycticorax nycticorax hoactii	Black-crowned Night Heron	X	X	X	X	X	X			X	X
Nyctanassa violacea violacea	Yellow-crowned Night Heron	X	X	X	X	X	X			X	X

		Seasonal Occurrence					Additional Risk Factors				
Species/Subspecies	**Common Name**	**Breeding**	**Summering**	**Wintering**	**Fall Migration**	**Spring Migration**	**Wing Morphology**	**Fast Flight Characteristics**	**Flocking Habits**	**Nocturnal Movement**	**High Population Near Hazard**
Porphyrio martinica	Purple Gallinule	X		X	X	X	X			X	
Gallinula chloropus cachinnans	Common Moorhen	X		X	X	X	X			X	
Fulica americana americana	American Coot	X		X	X	X	X			X	
Grus canadensis	Sandhill Crane	X	X	X			X			X	
Rallus elegans	King Rail	X		X	X	X	X			X	
Rallus longirostris	Clapper Rail	X		X	X	X	X			X	X
Rallus limicola	Virginia Rail	X		X	X	X	X			X	
Porzana carolina	Sora	X		X	X	X	X			X	
Coturnicops noveboracensis	Yellow Rail	X		X	X	X	X			X	
Laterallus jamaicensis	Black Rail	X		X	X	X	X			X	
Phalaropus fulicaria	Red Phalarope			X	X	X		X	X	X	
Phalaropus lobatus	Red-necked Phalarope		X		X	X		X	X	X	
Phalaropus tricolor	Wilson's Phalarope				X	X		X	X	X	
Recurvirostra americana	American Avocet			X	X	X		X	X	X	
Himantopus mexicanus	Black-necked Stilt	X		X	X	X		X	X	X	
Scolopax minor	American Woodcock	X		X	X	X		X	X	X	
Gallinago gallinago	Common Snipe	X		X	X	X		X	X	X	
Limnodromus griseus	Short-billed Dowitcher			X	X	X		X	X	X	X
Limnodromus scolopaceus	Long-billed Dowitcher			X	X	X		X	X	X	
Calidrisa himantopus	Stilt Sandpiper			X	X	X		X	X	X	
Calidris canutus	Red Knot			X	X	X		X	X	X	X

		Seasonal Occurrence					Additional Risk Factors				
Species/Subspecies	**Common Name**	**Breeding**	**Summering**	**Wintering**	**Fall Migration**	**Spring Migration**	**Wing Morphology**	**Fast Flight Characteristics**	**Flocking Habits**	**Nocturnal Movement**	**High Population Near Hazard**
Calidris maritima	Purple Sandpiper			X	X	X		X	X	X	X
Calidris melanotos	Pectoral Sandpiper				X	X		X	X	X	
Calidris fuscicollis	White-rumped Sandpiper				X	X		X	X	X	
Calidris bairdii	Baird's Sandpiper				X	X		X	X	X	
Calidris minutilla	Least Sandpiper			X	X	X		X	X	X	
Calidris alpina	Dunlin			X	X	X		X	X	X	X
Calidris pusilla	Semipalmated Sandpiper				X	X		X	X	X	X
Calidris mauri	Western Sandpiper			X	X	X		X	X	X	X
Calidris alba	Sanderling			X	X	X		X	X	X	X
Limosa fedoa	Marbled Godwit			X	X	X		X	X	X	X
Limosa haemastica	Hudsonian Godwit					X		X	X	X	
Tringa melanoleuca	Greater Yellowlegs			X	X	X		X	X	X	X
Tringa flavipes	Lesser Yellowlegs			X	X	X		X	X	X	X
Tringa solitaria	Solitary Sandpiper				X	X		X	X	X	
Tringa semipalmata	Willet	X		X	X	X		X	X	X	X
Bartramia longicauda	Upland Sandpiper	X			X	X		X	X	X	
Tryngites subruficollis	Buff-breasted Sandpiper				X	X		X	X	X	
Actitis macularius	Spotted Sandpiper	X		X	X	X		X	X	X	
Numenius americanus	Long-billed Curlew			X	X	X		X	X	X	
Numenius phaeopus	Whimbrel			X	X	X		X	X	X	X
Pluvialis squatarola	Black-bellied Plover		X	X	X	X		X	X	X	X

		Seasonal Occurrence					Additional Risk Factors				
Species/Subspecies	**Common Name**	**Breeding**	**Summering**	**Wintering**	**Fall Migration**	**Spring Migration**	**Wing Morphology**	**Fast Flight Characteristics**	**Flocking Habits**	**Nocturnal Movement**	**High Population Near Hazard**
Pluvialis domimica	American Golden Plover				X	X		X	X	X	
Charadrius vociferus	Killdeer	X		X	X	X		X	X	X	
Charadrius semipalmatus	Semipalmated Plover	X		X	X	X		X	X	X	X
Charadrius melodus	Piping Plover	X		X	X	X		X	X	X	X
Charadrius wilsonia	Wilson's Plover	X		X	X	X		X	X	X	X
Arenaria interpres	Ruddy Turnstone		X	X	X	X		X	X	X	X
Haematopus palliatus	American Oystercatcher	X	X	X	X	X		X	X	X	X

Appendix 2. All species of raptors that regularly occur near the proposed tower site during the winter, breeding or migration seasons. Each species is designated if it falls into the categories of wing/body morphology, fast flight characteristics, flocking habits, nocturnal movements, and high population near hazards that may make the species more susceptible to collisions.

		Seasonal Occurrence					Additional Risk Factors				
Species/Subspecies	**Common Name**	**Breeding**	**Summering**	**Wintering**	**Fall Migration**	**Spring Migration**	**Wing Morphology**	**Fast Flight Characteristics**	**Flocking Habits**	**Nocturnal Movement**	**High Population Near Hazard**
Coragyps atratus	Black Vulture	X	X	X	X	X					X
Cathartes aura	Turkey Vulture	X	X	X	X	X					X
Pandion haliaetus	Osprey	X	X		X	X					X
Elanoides forficatus	Swallow-tailed Kite					X					
Ictinia mississippiensis	Mississippi Kite					X					
Haliaeetus leucocephalus	Bald Eagle	X	X	X	X	X					X
Circus cyaneus	Northern Harrier	X	X	X	X	X					X
Accipiter striatus	Sharp-shinned Hawk			X	X	X					X
Accipiter cooperii	Cooper's Hawk			X	X	X					X
Accipiter gentilis	Northern Goshawk			X	X	X					
Buteo lineatus	Red-shouldered Hawk	X	X	X	X	X					X
Buteo platypterus	Broad-winged hawk				X	X					X
Buteo swainsoni	Swainson's Hawk				X	X					
Buteo jamaicensis	Red-tailed Hawk	X	X	X	X	X					X
Buteo lagopus	Rough-legged Hawk			X	X	X					
Aquila chrysaetos	Golden Eagle			X	X	X					
Falco sparverius	American Kestrel	X	X	X	X	X					X

		Seasonal Occurrence					Additional Risk Factors				
Species/Subspecies	**Common Name**	**Breeding**	**Summering**	**Wintering**	**Fall Migration**	**Spring Migration**	**Wing Morphology**	**Fast Flight Characteristics**	**Flocking Habits**	**Nocturnal Movement**	**High Population Near Hazard**
Falco columbarius	Merlin			X	X	X					X
Falco peregrinus	Peregrine Falcon	X	X	X	X	X					X
Tyto alba	Barn Owl	X	X	X	X	X				X	
Megascops asio	Eastern Screech Owl	X								X	
Bubo virginianus	Great Horned Owl	X								X	
Bubo scandiaca	Snowy Owl			X	X	X				X	
Strix varia	Barred Owl	X								X	
Asio otus	Long-eared Owl			X	X	X				X	
Asio flammeus	Short-eared Owl			X	X	X				X	
Aegolius acadicus	Northern Saw-whet Owl			X	X	X				X	X

Appendix 3. Population estimates for all threatened, endangered and species of special concern in the North American Bird Conservation Initiative's (NABCI) Bird Conservation Region (BCR) 30 New England/Mid-Atlantic Coast (Watts 2010). Units include total individuals (t) and breeding individuals (b). Species in bold indicate unique taxonomic forms

Species/Subspecies (population)	Common Name	AOU	Global Population	N. A . Population	Reference Population	Trend
Podiceps auritus cornutus	Horned Grebe	30	160,000-2,100,000t	>100,000t	100,000t	Declining
Podilymbus podiceps podiceps	Pied-billed Grebe	60	110,000-130,000t	125,000t	125,000t	Declining
Gavia stellata	Red-throated Loon	110	490,000-1,500,000t	375,000t	70,000t	Declining
Gelochelidon nilotica aranea (w.A. breeding)	Gull-billed Tern	630	79,000-310,000t	6,000-8,000b	2,418b	Declining
Sternula antillarum antillarum (w.A. breeding)	Least Tern	740	65,000-70,000t	unknown	16,018b	Declining
Rynchops niger niger (w.A. breeding)	Black Skimmer	800	120,000-210,000t	65,000-70,000b	10,058b	Declining
Puffinus gravis	Greater Shearwater	890	16,500,000t	unknown	unknown	Stable/unknown
Puffinus lherminieri lherminieri	Audubon's Shearwater	920	60,000t	6,000-10,000b	6,000b	Declining
Botaurus lentiginosus	American Bittern	1900	3,000,000t	3,000,000t	3,000,000t	Declining
Ixobrychus exilis exilis	Least Bittern	1910	>130,000t	128,000t	128,000t	Declining
Egretta thula thula	Snowy Egret	1970	unknown	143,555b	15,774b	Declining
Laterallus jamaicensis	Black Rail	2160	unknown	unknown	unknown	Declining
Limnodromus griseus griseus (Hudson Bay)	Short-billed Dowitcher	2310	153,000t	153,000t	78,000t	Declining
Calidris canutus rufa	Red Knot	2340	120,000t	120,000t	20,000t	Declining
Calidris maritima belcheri	Purple Sandpiper	2350	95,000t	15,000t	15,000t	Stable/Unknown
Calidris pusilla	Semipalmated Sandpiper	2460	2,000,000t	2,000,000t	1,500,000t	Declining
Limosa fedoa fedoa (Hudson Bay)	Marbled Godwit	2490	175,000t	175,000t	2,226t	Declining
Limosa Haemastica (James Bay)	Hudsonian Godwit	2510	70,000t	70,000t	10,000t	Declining
Tringa flavipes	Lesser Yellowlegs	2550	400,000t	400,000t	20,100t	Declining

Species/Subspecies (population)	Common Name	AOU	Global Population	N. A . Population	Reference Population	Trend
Tringa solitaria solitaria	Solitary Sandpiper	2560	150,000t	150,000t	21,000t	Declining
Bartramia longicauda	Upland Sandpiper	2610	350,000t	350,000t	350,000t	Declining
Tryngites subruficollis	Buff-breasted Sandpiper	2620	30,000t	30,000t	30,000t	declining
Numenius phaeopus hudsonicus	Whimbrel	2650	2,000,000t	66,000t	40,000t	Declining
Charadrius melodus melodus	Piping Plover	2770	5,945t	5,945t	2,953t	Increasing
Charadrius wilsonia	Wilson's Plover	2800	unknown	6,000t	6,000t	Stable/Unknown
Haematopus palliatus	American Oystercatcher	2860	11,650t	11,000t	11,000t	Stable/unknown

Appendix 4. Collision and population risk assessment for all threatened, endangered and species of special concern in the North American Bird Conservation Initiative's (NABCI) Bird Conservation Region (BCR) 30 New England/Mid-Atlantic Coast. Collision risk based on assessment of wing/body morphology, flight characteristics, flocking habits, nocturnal movements, habitat use, and population exposed to hazard. Population risk based on assessment proportion of population exposed to hazard.

Species/Subspecies (population)	Common Name	Collision Risk	Population Risk	Specific Information for risk class
Podiceps auritus cornutus	Horned Grebe	Medium	Low	Migrates at night in flocks. High load/High aspect wings. Migrates over a broad front across the continent. Migrates and winters in moderate number in the immediate vicinity (recent reports of hundreds of individual wintering near Chincoteague NWR). Relative small portion of the North American population would be exposed to this hazard. Bevanger 1998, Raynor 1988, Stedman 2000, eBird 2012
Podilymbus podiceps podiceps	Pied-billed Grebe	High	Low	Migrates at night. High load/ Lower aspect than other grebes. Migrates over a broad front across the continent. Migrates and winters in low number in the immediate vicinity. Relative small portion of the North American population would be exposed to this hazard. Known to strike towers, and light houses. Bevanger 1998,Muller and Storer 1999, Raynor 1988, eBird 2012
Gavia stellata	Red-throated Loon	Low	Medium	Migrates in flocks. Major migration route down the Atlantic coast, with single day counts of over 8,000 individuals in Virginia. Moderate proportion of the North American population could be exposed to this hazard. Typically migrates over open water, reducing exposure to this hazard. Barr et al 2000, National Audubon Society 2010, eBird 2012
Gelochelidon nilotica aranea	Gull-billed Tern	Medium	Low	Agile flyers with high aspect/low loading wings. Breeds in the immediate vicinity of this hazard (255 pairs on the seaside of Virginia in 2013) Virginia is near the northern limit of the breeding range. With most breeding populations to the south of Virginia, a relative small proportion of the North American population could be exposed to this hazard. Bevanger 1998, Molina et al 2014, Raynor 1988, Watts and Paxton 2014

Species/Subspecies (population)	Common Name	Collision Risk	Population Risk	Specific Information for risk class
Sternula antillarum antillarum	Least Tern	Medium	Medium	Agile flyers with high aspect/low loading wings. Breeds in the immediate vicinity of this hazard (533 pairs on the seaside of Virginia in 2013) Coastal population uses Atlantic coast a migration route. Species often migrates over open water. With many breeding populations to the south and west of Virginia, a moderate proportion of the North American population could be exposed to this hazard. Bevanger 1998, Thompson et al 1997, Raynor 1988, Watts and Paxton 2014
Rynchops niger niger	Black Skimmer	High	Medium	Often forages at night. Migrates in flocks along the coast and offshore. Breeds in the immediate vicinity of this hazard (1135 pairs on the seaside of Virginia in 2013). With many breeding populations to the south of Virginia, a moderate proportion of the North American population could be exposed to this hazard. Gochfeld and Burger 1994, Watts and Paxton 2014
Puffinus gravis	Greater Shearwater	Low	Low	Pelagic species. Very uncommon on the coast. eBird 2012
Puffinus lherminieri lherminieri	Audubon's Shearwater	Low	Low	Pelagic species. Very uncommon on the coast. eBird 2012
Botaurus lentiginosus	American Bittern	Medium	Low	Very little information. Ungraceful flight. Often active at night Likely uses rivers and coats lines for migration routes. Broad range across North America. Likely migrates over a broad range. Typically uses fresh water habitats but occasionally uses brackish coastal marshes. Lowther 2009
Ixobrychus exilis exilis	Least Bittern	High	Medium	Little information. Low ungraceful flight. Known to strike fences, and power lines. Often active at night. Most of the breeding range is associated with the Mississippi Valley Low density breeding population in the east. May use brackish marshes more frequently that American bittern. With much of the breeding populations to the west of Virginia, a moderate proportion of the North

Species/Subspecies (population)	Common Name	Collision Risk	Population Risk	Specific Information for risk class
				American population could be exposed to this hazard. Poole 2009
Egretta thula thula	Snowy Egret	High	Low	Active at night. Nocturnal migration documented. Heron species document as being susceptible to line strikes. North Atlantic coast breeding populations migratory. Breeds in the immediate vicinity of this hazard (755 pairs on the seaside of Virginia in 2013). Much of the North American breeding populations to the south and west of Virginia, a relative small proportion of the North American population could be exposed to this hazard. APLIC 2006, Parsons and Masters 2000, Watts and Paxton 2014
Laterallus jamaicensis	Black Rail	High	High	High load/low aspect wings. Known to strike towers and other objects. Migrates at night. Coastal populations have declined dramatically. One of the most imperiled bird species on the Atlantic coast. Little migration information. Tower kills indicate a broad migration front. If migration is concentrated along the coast a significant portion of the population could be exposed to this hazard. Eddleman 1994, Wilson et al 2015
Limnodromus griseus griseus (Hudson Bay)	Short-billed Dowitcher	High	High	Day and night time migration in large flocks. Migrates in calm and inclement weather. Atlantic coast migration route. Uses immediate vicinity as a stopover area (projected use by 46,000 individuals). Nocturnal foraging. Uses mid-Atlantic region as a terminally stopover area prior to migrating to the breeding area. A significant portion of the Hudson Bay population could be exposed to this hazard. Jehl 2001, Watts 2006
Calidris canutus rufa	Red Knot	High	High	Federally threatened. Migration can occur at night. Can form flocks larger than other shorebird species. Uses immediate vicinity as a stopover area (direct use by up to 30% of the rufa population). Flights between Delaware Bay and Virginia barrier islands documented during stopover. Forages at night during stopover. Uses mid-Atlantic region as a terminally stopover area prior to migrating to the breeding area.

Species/Subspecies (population)	Common Name	Collision Risk	Population Risk	Specific Information for risk class
				Utilizes outer beach as foraging habitat. Baker et al 2013, Cohen 2009, Watts 2006, Watts and Truitt 2015
Calidris maritima belcheri	Purple Sandpiper	High	Low	Migrate in large tight flocks. Known to strike power lines. May become confused by bright lights and inclement weather. Winters mainly to the north of Virginia. The small portion of the population that winters in Virginia and to the south may use Atlantic coast as a migratory route. Payne and Pierce 2002
Calidris pusilla	Semipalmated Sandpiper	High	Low	Migrates along the Atlantic coast and interior continental US. Nocturnal migration. Greater numbers of individual along the Atlantic coast in the spring. Can form very large flocks. Peak numbers in the mid-Atlantic can reach 115,000 in Delaware Bay. Lower numbers use immediate vicinity as a stopover area. Migration orientation can be confused during inclement weather. Hicklin and Gratto-Trevor 2010, Watts 2006
Limosa fedoa fedoa (James Bay)	Marbled Godwit	Medium	High	Small population of James Bay subspecies of about 2000 individuals. Little known about migration for this small population. Likely similar to other James/Hudson bay population, using mid-Atlantic as a terminal stopover area. Winter in small numbers along the coast in Virginia, more common to the south. Gratto-Trevor 2000
Limosa Haemastica (James Bay)	Hudsonian Godwit	Low	Low	Most individual migrate non-stop from James Bay to South America. Not a species commonly found in Virginia. Walker et al 2011, EBird 2012
Tringa flavipes	Lesser Yellowlegs	Medium	Low	Broad migration front. Primary migration corridors are within the middle of the continent. Most common on the Atlantic coast during fall migration. Fall migrants often make short flight south to stopover areas along Atlantic coast. Nocturnal migrant. Forms small tight flocks. Tibbitts and Moskogg 2014
Tringa solitaria solitaria	Solitary Sandpiper	Low	Low	Nocturnal migrant.

Species/Subspecies (population)	Common Name	Collision Risk	Population Risk	Specific Information for risk class
				Forms small flocks. Broad migration front. Small numbers may follow Atlantic coast. Mainly associated with freshwater habitats. Moskoff 2011
Bartramia longicauda	Upland Sandpiper	Low	Low	Most migration occurs through the Great Plains. Grassland species not associated with coastal habitats. Houston et al 2011
Tryngites subruficollis	Buff-breasted Sandpiper	Low	Low	Most migration occurs through the central part of the continent. Small numbers may move east towards the Atlantic coast during fall migration. Mainly associated with short grass pastures and damp margins of freshwater bodies. Not typically associated with beaches or saltmarshes. Lancton and Laredo 1994, eBird 2012
Numenius phaeopus hudsonicus	Whimbrel	High	High	Form large migratory flocks. Nocturnal migration. Uses immediate vicinity as a stopover area (projected use by up to 40,000 individuals). Forages at night during stopover. Major proportion of the James/Hudson Bay population use the mid-Atlantic region as a terminally stopover area prior to migrating to the breeding area. Skeel and Mallory 1996, Smith et al 2011, Watts 2006
Charadrius melodus melodus	Piping Plover	Medium	High	Federally threatened. Breeds in the immediate vicinity of this hazard (151 pairs on the seaside of Virginia in 2005) Can form large migratory flocks. Uses the Atlantic coast as a migratory route in both spring and fall. Often make short flights to multiple stopover areas along the Atlantic coast during migration. Utilizes a variety of beach habitats. Excellent vision and will forage at night, especially during the pre-nesting and fledging stages of breeding. While localized during breeding season, migrating piping plover populations in Virginia and to the north be could be exposed to this hazard. Elliott-Smith and Haig 2004, Staine and Burger 1994, Watts 2006
Charadrius wilsonia	Wilson's Plover	Low	Low	Virginia is at the northern edge of the breeding range. Small population breeds in the immediate vicinity of this hazard (24 pairs on the seaside of Virginia in 2005). Utilizes a variety of beach habitats. Excellent vision and will forage at night.

Species/Subspecies (population)	Common Name	Collision Risk	Population Risk	Specific Information for risk class
				Corbat and Bergstrom 2000, Watts 2006
Haematopus palliatus	American Oystercatcher	High	Medium	Form large tight flocks. Immediate vicinity is and important breeding, stopover, and wintering site. 525 breeding pairs on the seaside of Virginia in 2005 3,600 wintering individuals counted in December, 2015. Populations from the northern Atlantic breeding range by bypass the mid-Atlantic.to winter on the northwest coast of Florida. Migrant populations from the mid-Atlantic that winter on the southeast Atlantic and Florida gulf coast use a coastal migratory route. Nol and Humphrey 2012, Watts 2006, Wilke 2015
Haliaeetus leucocephalus	Bald Eagle	Low	Low	Five nests located on island and the peninsula within 10km of the hazard during the last comprehensive survey in 2011. Two small roosts located on the peninsula within 10km of the hazard. Complex migration pattern. Maximum season total for Kiptopeke Hawkwatch is 462 south bound migrants in 2009. Diurnal migrant. Buehler 2000, CCB Mapping Portal 2015, HMANA Hawkcount.org 2015
Falco peregrinus	Peregrine Falcon	Low	Medium	Ten active nest located the seaside of Virginia in 2015, including one associated with Wallops Island. Widespread migration. Clearly defined migratory route along the barrier islands. Maximum season total for Kiptopeke Hawkwatch is 1640 south bound migrants in 1997. Significant proportion of the *tundrius* and eastern *anatum* populations are likely to migrate down the Atlantic coast. Known to strike building and wires, recently fledged young are particularly susceptible. Diurnal Migrant HMANA Hawkcount.org 2015, Watts and Mojica 2015, White et al 2002
Asio flammeus	Short-eared Owl	Low	Low	Broad range. Little migration data. Occasionally winters on barrier islands, probably annually in very low numbers. Wiggins et al 2006, eBird 2012

Appendix 5. List of landbird species and season (breeding, wintering, migratory) expected to overlap with the proposed Wallops Instrumentation Tower site. Bird conservation regions listed as conservation concern for as a species taken from the USFWS Bird Species of Concern 2008. Populations of bird species expected to overlap with the proposed site may emanate from these various Bird Conservation Regions. Population exposure indicates the relative level a population is expected to overlap with the proposed sites and population vulnerability indicates the level in which a population may respond negatively to a demographic disturbance.

Species/subspecies	**Common Name**	**Breeding**	**Wintering**	**Migratory**	**Conservation Concern***	**Population Exposure**	**Population Vulnerability**
Colinus virginianus	Northern Bobwhite	x	x			Low	Low
Meleagris gallopavo	Wild Turkey	x	x			Low	Low
Columba livia	Rock Pigeon		x			High	Low
Zenaida macroura	Mourning Dove	x	x	x		High	Low
Coccyzus americanus	Yellow-billed Cuckoo	x		x		High	Low
Coccyzus erythropthalmus	Black-billed Cuckoo			x		High	Low
Chordeiles minor	Common Nighthawk	x		x		High	Low
Antrostomus carolinensis	Chuck-will's-widow	x		x	30	High	High
Antrostomus vociferus	Eastern Whip-poor-will			x	29, 30	High	Low
Chaetura pelagica	Chimney Swift			x		High	Low
Archilochus colubris	Ruby-throated Hummingbird			x		High	Low
Megaceryle alcyon	Belted Kingfisher	x	x	x		High	Low
Melanerpes erythrocephalus	Red-headed Woodpecker	x	x	x	28, 30	High	Low
Melanerpes carolinus	Red-bellied Woodpecker	x	x			Low	Low
Sphyrapicus varius	Yellow-bellied Sapsucker		x	x		High	Low
Picoides pubescens	Downy Woodpecker	x	x			Low	Low
Picoides villosus	Hairy Woodpecker	x	x			Low	Low
Colaptes auratus	Northern Flicker	x	x	x		High	Low
Dryocopus pileatus	Pileated Woodpecker	x	x			Low	Low

Species/subspecies	Common Name	Breeding	Wintering	Migratory	Conservation Concern*	Population Exposure	Population Vulnerability
Contopus cooperi	Olive-sided Flycatcher			x		Low	Low
Contopus virens	Eastern Wood-Pewee	x		x		High	Low
Empidonax flaviventris	Yellow-bellied Flycatcher			x		High	Low
Empidonax virescens	Acadian Flycatcher			x		High	Low
Empidonax alnorum	Alder Flycatcher			x		High	Low
Empidonax traillii	Willow Flycatcher	x		x		High	Low
Empidonax minimus	Least Flycatcher			x		High	Low
Sayornis phoebe	Eastern Phoebe	x	x	x		High	Low
Tyrannus tyrannus	Eastern Kingbird	x		x		High	Low
Lanius ludovicianus	Loggerhead Shrike		x	x	7, 29, 30	Low	High
Vireo griseus	White-eyed Vireo	x		x		High	Low
Vireo flavifrons	Yellow-throated Vireo			x		High	Low
Vireo solitarius	Blue-headed Vireo			x		High	Low
Vireo gilvus	Warbling Vireo			x		High	Low
Vireo philadelphicus	Philadelphia Vireo			x		High	Low
Vireo olivaceus	Red-eyed Vireo	x		x		High	Low
Cyanocitta cristata	Blue Jay	x	x	x		High	Low
Corvus brachyrhynchos	American Crow	x	x	x		High	Low
Corvus ossifragus	Fish Crow	x	x	x		High	Low
Eremophila alpestris	Horned Lark	x	x	x		High	Low
Progne subis	Purple Martin	x	x	x		High	Low
Tachycineta bicolor	Tree Swallow	x		x		High	Low
Stelgidopteryx serripennis	Northern Rough-winged Swallow			x		High	Low
Riparia riparia	Bank Swallow			x		High	Low
Petrochelidon pyrrhonota	Cliff Swallow			x		High	Low

Species/subspecies	Common Name	Breeding	Wintering	Migratory	Conservation Concern*	Population Exposure	Population Vulnerability
Hirundo rustica	Barn Swallow	x		x		High	Low
Poecile carolinensis	Carolina Chickadee	x	x			Low	Low
Baeolophus bicolor	Tufted Titmouse	x	x			Low	Low
Sitta canadensis	Red-breasted Nuthatch		x	x		High	Low
Sitta carolinensis	White-breasted Nuthatch	x	x			Low	Low
Sitta pusilla	Brown-headed Nuthatch	x	x		29	Low	Low
Certhia americana	Brown Creeper		x	x		High	Low
Troglodytes aedon	House Wren	x		x		High	Low
Troglodytes hiemalis	Winter Wren		x	x		High	Low
Cistothorus platensis	Sedge Wren	x	x	x	28, 29, 30	High	Low
Cistothorus palustris	Marsh Wren	x	x	x		High	Low
Thryothorus ludovicianus	Carolina Wren	x	x			Low	Low
Polioptila caerulea	Blue-gray Gnatcatcher	x		x		High	Low
Regulus satrapa	Golden-crowned Kinglet		x	x		High	Low
Regulus calendula	Ruby-crowned Kinglet		x	x		High	Low
Sialia sialis	Eastern Bluebird	x	x	x		High	Low
Catharus fuscescens	Veery			x		High	Low
Catharus minimus	Gray-cheeked Thrush			x		High	Low
Catharus bicknelli	Bicknell's Thrush			x	14	High	High
Catharus ustulatus	Swainson's Thrush			x		High	Low
Catharus guttatus	Hermit Thrush			x		High	Low
Hylocichla mustelina	Wood Thrush	x		x	14, 28, 29, 30	High	High
Turdus migratorius	American Robin	x	x	x		High	Low
Dumetella carolinensis	Gray Catbird	x	x	x		High	Low
Toxostoma rufum	Brown Thrasher	x	x	x		High	Low

Species/subspecies	Common Name	Breeding	Wintering	Migratory	Conservation Concern*	Population Exposure	Population Vulnerability
Mimus polyglottos	Northern Mockingbird	x	x			Low	Low
Sturnus vulgaris	European Starling	x	x	x		Low	Low
Bombycilla cedrorum	Cedar Waxwing	x	x	x		High	Low
Seiurus aurocapilla	Ovenbird			x		High	Low
Helmitheros vermivorum	Worm-eating Warbler			x	28, 30	High	Moderate-High
Parkesia motacilla	Louisiana Waterthrush			x	28	High	Moderate-High
Parkesia noveboracensis	Northern Waterthrush			x	30	High	Low
Vermivora chrysoptera	Golden-winged Warbler			x	28, 30	High	High
Vermivora cyanoptera	Blue-winged Warbler			x	14, 28, 29, 30	High	High
Mniotilta varia	Black-and-white Warbler			x		High	Low
Protonotaria citrea	Prothonotary Warbler			x		High	Low
Limnothlypis swainsonii	Swainson's Warbler			x	28, 29	High	Low
Oreothlypis peregrina	Tennessee Warbler			x		High	Low
Oreothlypis celata	Orange-crowned Warbler		x	x		High	Low
Oreothlypis ruficapilla	Nashville Warbler			x		High	Low
Oporornis agilis	Connecticut Warbler			x		High	Low
Geothlypis philadelphia	Mourning Warbler			x		High	Low
Geothlypis formosa	Kentucky Warbler			x	28, 29, 30	High	Moderate-High
Geothlypis trichas	Common Yellowthroat	x	x	x		High	Low
Setophaga citrina	Hooded Warbler			x		High	Low
Setophaga ruticilla	American Redstart			x		High	Moderate-High
Setophaga kirtlandii	Kirtland's Warbler			x		Low	Low
Setophaga tigrina	Cape May Warbler			x		High	Low
Setophaga cerulea	Cerulean Warbler			x	28, 29, 30	High	Low
Setophaga americana	Northern Parula			x		High	Low

Species/subspecies	Common Name	Breeding	Wintering	Migratory	Conservation Concern*	Population Exposure	Population Vulnerability
Setophaga magnolia	Magnolia Warbler			x		High	Low
Setophaga castanea	Bay-breasted Warbler			x	14	High	Low
Setophaga fusca	Blackburnian Warbler			x		High	Low
Setophaga petechia	Yellow Warbler			x		High	Low
Setophaga pensylvanica	Chestnut-sided Warbler			x		High	Low
Setophaga striata	Blackpoll Warbler			x		High	Low
Setophaga caerulescens	Black-throated Blue Warbler			x		High	Moderate-High
Setophaga palmarum	Palm Warbler		x	x		High	Low
Setophaga pinus	Pine Warbler	x	x	x		High	Low
Setophaga coronata	Yellow-rumped Warbler		x	x		High	Low
Setophaga dominica	Yellow-throated Warbler	x		x		High	Low
Setophaga discolor	Prairie Warbler	x		x	28, 29, 30	High	Low
Setophaga virens	Black-throated Green Warbler			x		High	Low
Cardellina canadensis	Canada Warbler			x	14, 28	High	Low
Cardellina pusilla	Wilson's Warbler			x		High	Low
Icteria virens	Yellow-breasted Chat	x		x		High	Low
Pipilo erythrophthalmus	Eastern Towhee		x			Low	Low
Spizelloides arborea	American Tree Sparrow		x	x		High	Low
Spizella passerina	Chipping Sparrow	x	x	x		High	Low
Spizella pusilla	Field Sparrow	x	x	x		High	Low
Pooecetes gramineus	Vesper Sparrow		x	x		High	Low
Passerculus sandwichensis	Savannah Sparrow		x	x		High	Low
Passerculus sandwichensis princepeps	Ipswich Sparrow		x	x		High	High
Ammodramus savannarum	Grasshopper Sparrow			x		High	Low
Ammodramus henslowii	Henslow's Sparrow	x	x	x	28, 29	High	High

Species/subspecies	Common Name	Breeding	Wintering	Migratory	Conservation Concern*	Population Exposure	Population Vulnerability
Ammodramus leconteii	Le Conte's Sparrow			x		High	Low
Ammodramus nelsoni	Nelson's Sparrow		x	x	14, 30	High	Low
Ammodramus caudacutus	Saltmarsh Sparrow	x	x	x	14, 30	High	Low
Ammodramus maritimus	Seaside Sparrow	x	x	x	30	High	Low
Passerella iliaca	Fox Sparrow		x	x		High	Low
Melospiza melodia	Song Sparrow	x	x	x		High	Low
Melospiza georgiana nicgrescens	Coastal Plain Swamp Sparrow		x	x	30	High	High
Melospiza georgiana	Swamp Sparrow		x	x		High	Low
Zonotrichia albicollis	White-throated Sparrow		x	x		High	Low
Junco hyemalis	Dark-eyed Junco		x	x		High	Low
Piranga rubra	Summer Tanager	x		x		High	Low
Piranga olivacea	Scarlet Tanager			x		High	Low
Cardinalis cardinalis	Northern Cardinal	x	x			Low	Low
Pheucticus ludovicianus	Rose-breasted Grosbeak			x		Low	Low
Passerina caerulea	Blue Grosbeak	x		x		High	Low
Passerina cyanea	Indigo Bunting	x		x		High	Low
Passerina ciris	Painted Bunting			x		Low	Low
Spiza americana	Dickcissel			x		Low	Low
Dolichonyx oryzivorus	Bobolink			x		High	Low
Agelaius phoeniceus	Red-winged Blackbird	x	x	x		Low	Low
Sturnella magna	Eastern Meadowlark	x	x			High	Low
Euphagus carolinus	Rusty Blackbird		x	x	14, 28, 29, 30	High	Low
Quiscalus quiscula	Common Grackle	x	x	x		High	Low
Quiscalus major	Boat-tailed Grackle		x			High	Low
Molothrus ater	Brown-headed Cowbird	x		x		High	Low

Species/subspecies	Common Name	Breeding	Wintering	Migratory	Conservation Concern*	Population Exposure	Population Vulnerability
Icterus spurius	Orchard Oriole	x		x		High	Low
Icterus galbula	Baltimore Oriole			x		High	Low
Haemorhous mexicanus	House Finch		x			Low	Low
Haemorhous purpureus	Purple Finch		x	x		High	Low
Loxia curvirostra	Red Crossbill			x	28	Low	Low
Loxia leucoptera	White-winged Crossbill			x		Low	Low
Acanthis flammea	Common Redpoll			x		Low	Low
Spinus pinus	Pine Siskin		x	x		Low	Low
Spinus tristis	American Goldfinch	x	x	x		High	Low
Coccothraustes vespertinus	Evening Grosbeak			x		Low	Low
Passer domesticus	House Sparrow	x	x			Low	Low

*Bird Conservation Regions: 7 = Taiga Shield and Hudson Plains, 14 = North Atlantic Forest, 28 = Appalachian Mountains, 29 = Piedmont, 30 = Mid-Atlantic Coastal Plain

Appendix D – Technical Studies and Background Information

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Appendix D Contents

Preliminary Engineering Drawings for the Proposed USAF Instrumentation Tower
Geotechnical Study
Wetlands Delineation and U.S. Army Corps of Engineers Preliminary Jurisdictional Determination
Draft Final Environmental Baseline Survey (EBS) for the Alternative 1 (Preferred Alternative) Site (Executive Summary and Figure 2 only)

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Preliminary Engineering Drawings for the Proposed USAF Instrumentation Tower

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NOTES:

1. PLAN PREPARED WITHOUT THE BENEFIT OF A TITLE REPORT.

2. PLAN DOES NOT REPRESENT AN ALTA/NSPS LAND TITLE SURVEY.

3. BASIS OF THE BEARINGS AND COORDINATES IS THE VIRGINIA STATE PLANE SOUTH ZONE COORDINATE SYSTEM, NORTH AMERICAN DATUM (NAD 83/2011) BASED ON DIFFERENTIAL GPS OBSERVATIONS PERFORMED ON JULY 13, 2016; TIED TO THE NATIONAL SPATIAL REFERENCE SYSTEM VIA CORS STATIONS AND OPUS.

4. VERTICAL INFORMATION BASED ON THE NORTH AMERICAN VERTICAL DATUM OF 1988 (NAVD '88).

5. DISTANCES ARE HORIZONTAL GROUND UNLESS OTHERWISE NOTED.

6. PROPERTY LOCATED IN FLOOD ZONE "AE" (EL 8), AREA DETERMINED TO BE INSIDE 1% CHANCE OF ANNUAL FLOOD BASED UPON FEMA COMMUNITY PANEL #51001C0480G, EFFECTIVE MAY 18, 2015.

7. TOWER OWNER:
US AIR FORCE

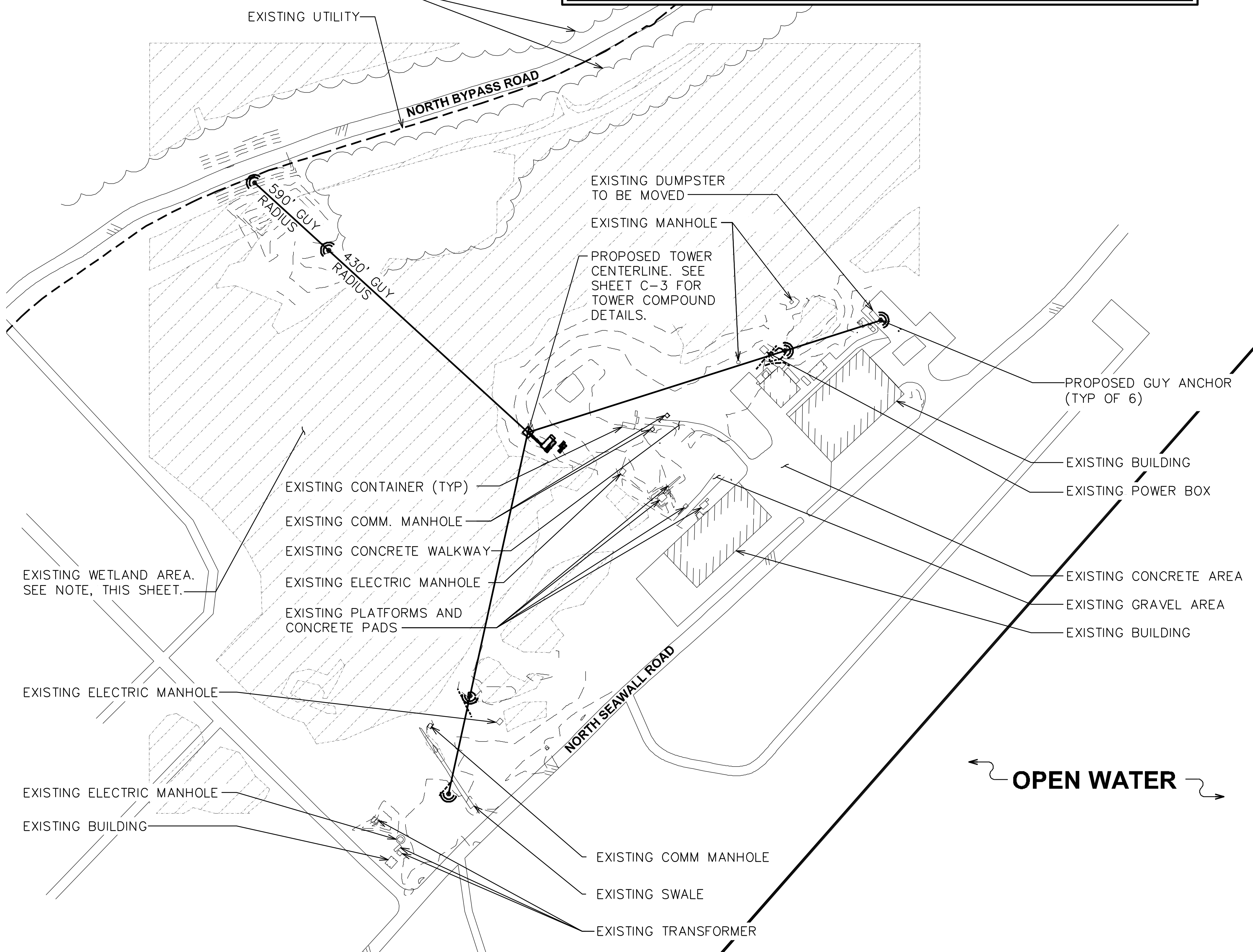
8. PROPERTY INFORMATION:
NASA
WALLOPS ISLAND SPACE LAUNCH FACILITY
WALLOPS ISLAND, VA 23337

9. THE DELINEATED WETLAND AREA SHOWN WAS PROVIDED BY NASA AND WAS NOT VERIFIED BY TEP.

TOWER AND ANCHOR LOCATIONS

POINT	LATITUDE	LONGITUDE	GROUND ELEVATION	TOP OF FOUNDATION	RELATIVE ELEVATION
TOWER CL	37° 50' 30.59"	75° 28' 54.06"	4.4'±	9.4'±	–
NW INNER ANCHOR	37° 50' 33.55"	75° 28' 57.91"	1.2'±	6.2'±	−3.2'±
NW OUTER ANCHOR	37° 50' 34.65"	75° 28' 59.34"	5.6'±	10.6'±	+1.2'±
ENE INNER ANCHOR	37° 50' 31.74"	75° 28' 48.90"	4.3'±	9.3'±	−0.1'±
ENE OUTER ANCHOR	37° 50' 32.17"	75° 28' 46.99"	7.0'±	12.0'±	+2.6'±
SSW INNER ANCHOR	37° 50' 26.47"	75° 28' 55.38"	2.9'±	7.9'±	−1.5'±
SSW OUTER ANCHOR	37° 50' 24.93"	75° 28' 55.88"	4.0'±	9.0'±	−0.4'±

VA GRID (NAD 83/2011)



LEGEND

—··—··—	LEASE/EASEMENT LINE
———	PARENT PROPERTY LINE
●	LEASE/EASEMENT CORNER
⊙	PROPERTY CORNER
IPF●	IRON PIPE (FOUND)
IRF●	IRON ROD (FOUND)
	TELCO PEDESTAL
	TRANSFORMER
	UTILITY POLE
	GUY ANCHOR
///	EDGE OF PAVEMENT
---R/W---	RIGHT-OF-WAY
—— X ——	CHAIN LINK FENCE

SITE PLAN

SCALE: 1" = 200'

0 200 400
SCALE IN FEET

PLANS PREPARED FOR:

Sabre Industries™
Towers and Poles
7101 SOUTHBRIDGE DRIVE
SIOUX CITY, IA 51111
(712) 258-6690

PROJECT INFORMATION:

GABLE VIII TOWER
WALLOPS ISLAND, VA

NORTH SEAWALL ROAD
WALLOPS ISLAND, VA 23359
(ACCOMACK COUNTY)

PLANS PREPARED BY:

TOWER ENGINEERING PROFESSIONALS
326 TRYON ROAD
RALEIGH, NC 27603
OFFICE: (919) 661-6351
www.tepgroup.net

SEAL:

PRELIMINARY
DO NOT USE FOR CONSTRUCTION

REV	DATE	ISSUED FOR:
2	02-13-17	CLIENT COMMENTS
1	02-09-17	CLIENT COMMENTS
0	09-09-16	PRELIMINARY CONSTRUCTION

DRAWN BY: LES | CHECKED BY: JBG

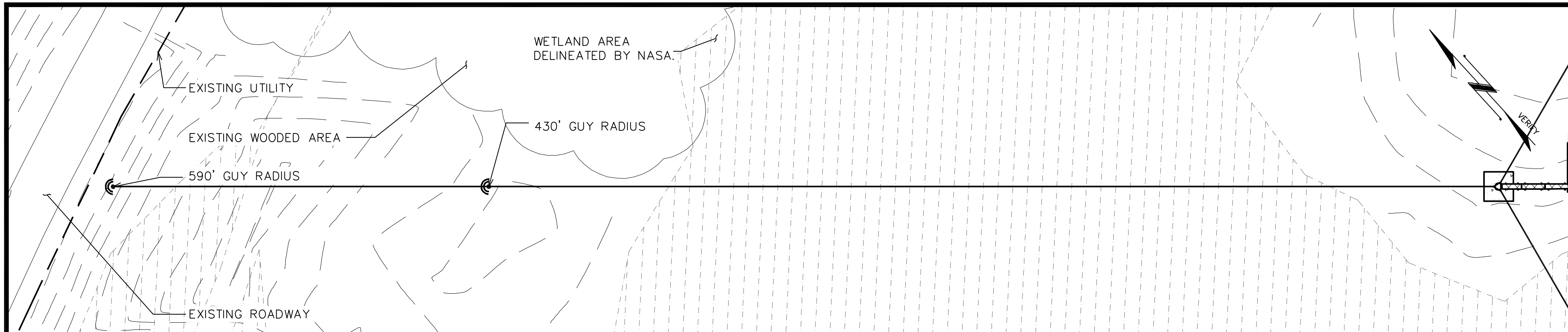
SHEET TITLE:

SITE PLAN

SHEET NUMBER: **C-1**

REVISION: 2

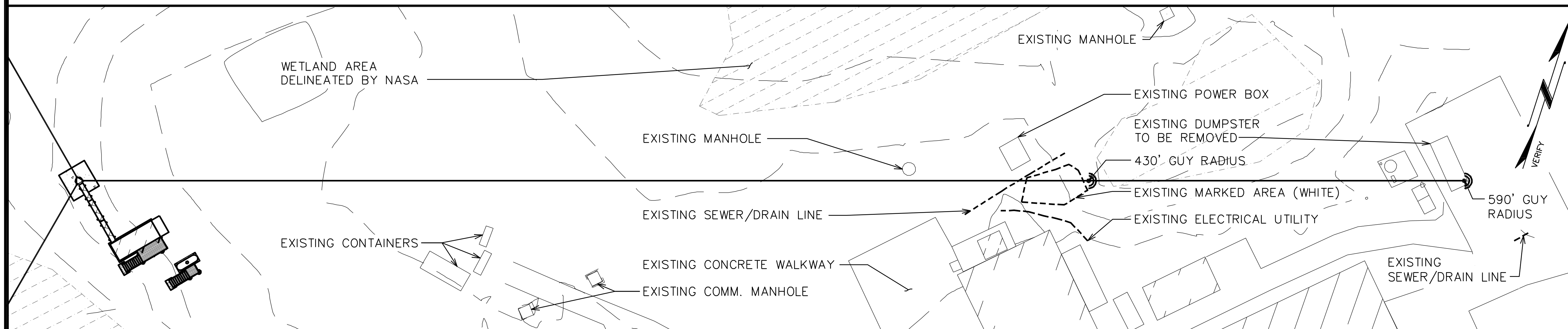
TEP #:70373.87669



A LEG ANCHORS

SCALE: 1" = 50'

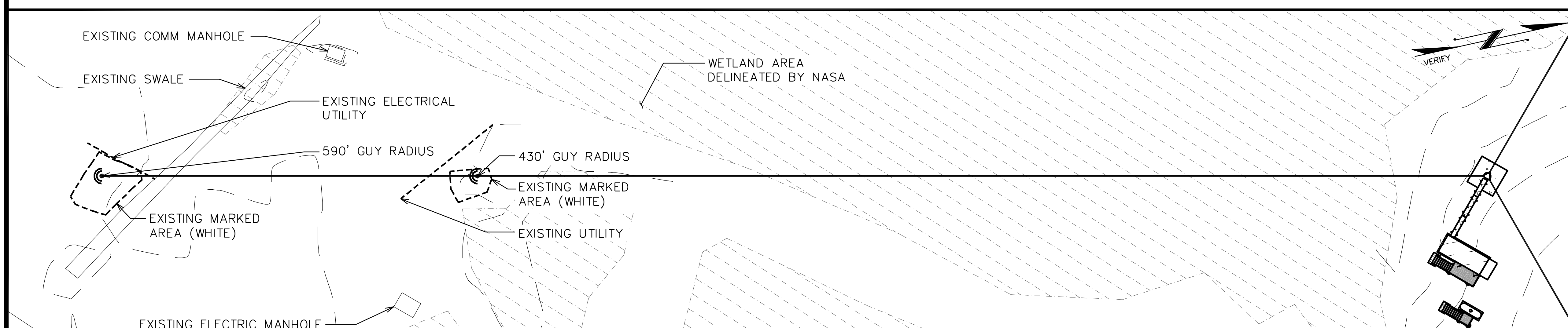
0 50 100
SCALE IN FEET



B LEG ANCHORS

SCALE: 1" = 50'

0 50 100
SCALE IN FEET



C LEG ANCHORS

SCALE: 1" = 50'

0 50 100
SCALE IN FEET

PLANS PREPARED FOR:

Sabre Industries™
Towers and Poles
7101 SOUTHBRIDGE DRIVE
SIOUX CITY, IA 51111
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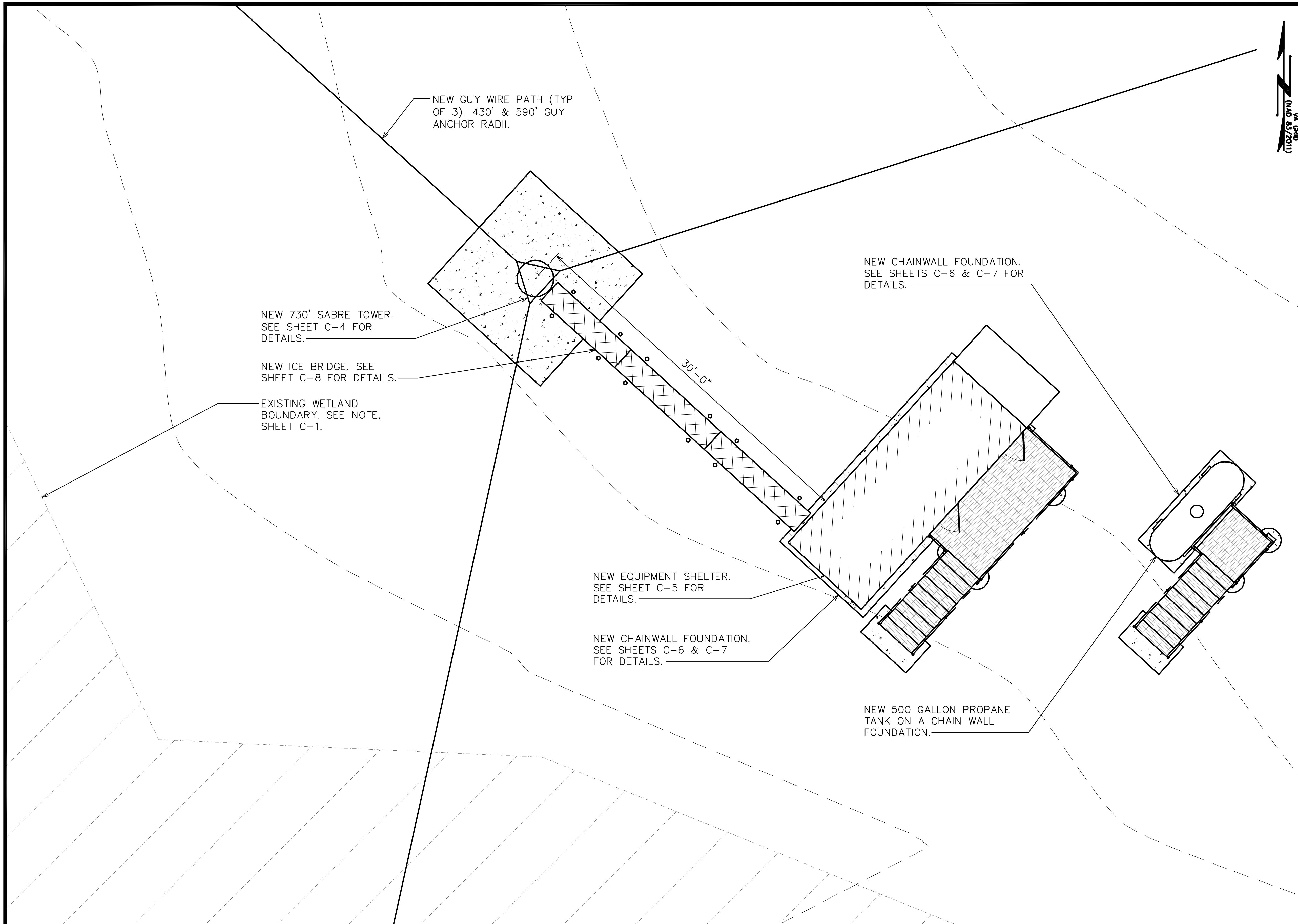
SHEET TITLE:

GUY ANCHOR DETAILS

SHEET NUMBER: **C-2**

REVISION: 2

TEP #: 70373.87669



COMPOUND DETAIL

SCALE: ⅛" = 1'-0"

0 8 16
SCALE IN FEET

PLANS PREPARED FOR:

Sabre Industries
Towers and Poles
7101 SOUTHBRIDGE DRIVE
SIOUX CITY, IA 51111
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PROJECT INFORMATION:

GABLE VIII TOWER
WALLOPS ISLAND, VA

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SHEET TITLE:

COMPOUND DETAIL

SHEET NUMBER: **C-3**

REVISION: 2

TEP #: 70373.87669

ANSI/TIA-222-G DESIGN NOTE:

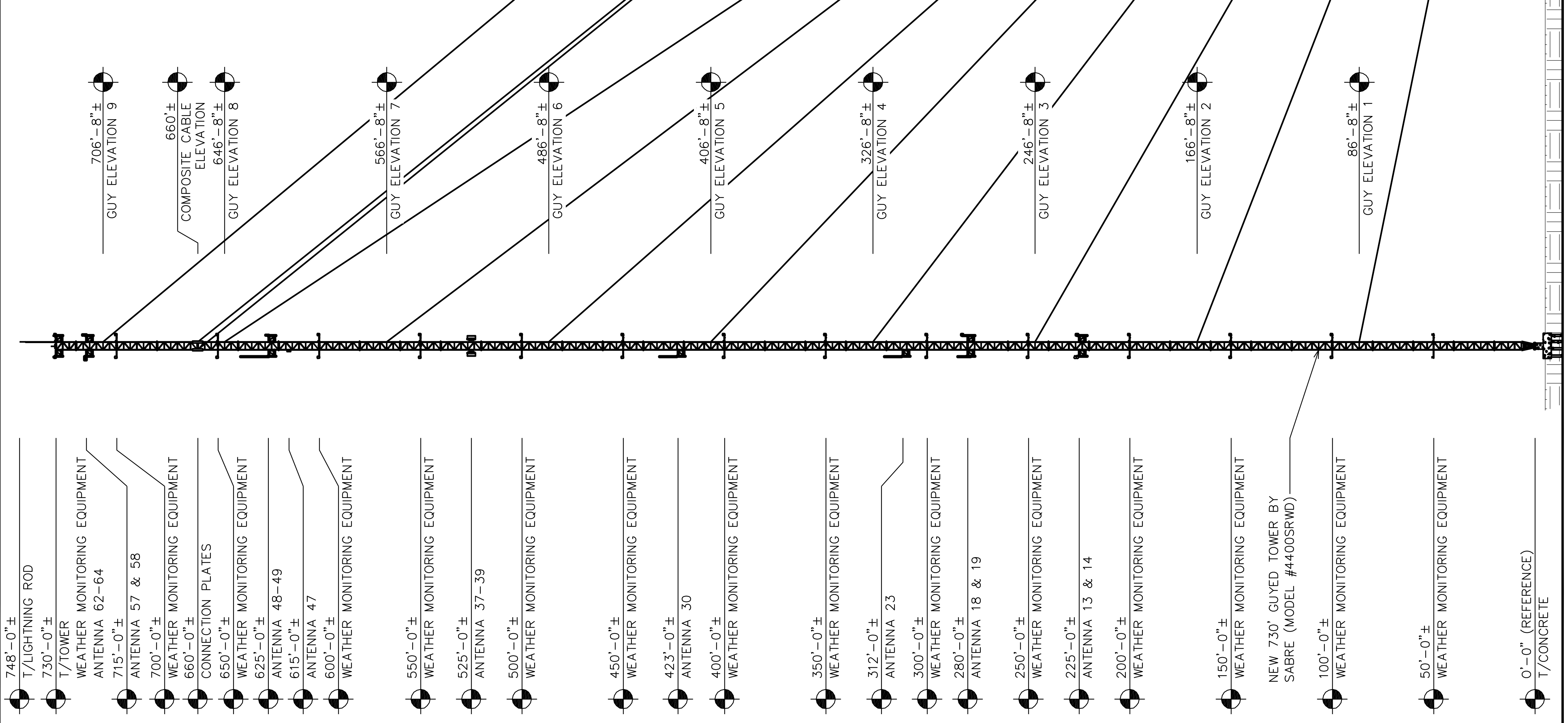
THE PROPOSED TOWER SHALL BE DESIGNED PER THE FOLLOWING PARAMETERS:

STRUCTURE CLASSIFICATION: III
EXPOSURE CATEGORY: D
TOPOGRAPHIC CATEGORY: 1

** DESIGN WIND SPEED:
138mph

LIGHTING NOTE:

LIGHTING SYSTEM TO COMPLY WITH FAA CIRCULAR AC 70 7460-1L, "FAA STYLE F3". TOWER SHALL BE ILLUMINATED ONLY AS REQUIRED BY THE FEDERAL COMMUNICATIONS COMMISSION (FCC), THE FEDERAL AVIATION ADMINISTRATION (FAA), OR OTHER STATE OR FEDERAL AGENCY WITH JURISDICTION.



TOWER ELEVATION
SCALE: 1" = 60'

PLANS PREPARED FOR:
Sabre Industries™
Towers and Poles
7101 SOUTHBRIDGE DRIVE
SIOUX CITY, IA 51111
(712) 258-6690

PROJECT INFORMATION:
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1	02-09-17	CLIENT COMMENTS
0	09-09-16	PRELIMINARY CONSTRUCTION

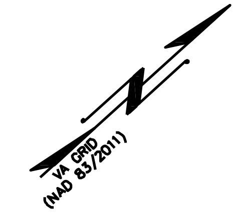
DRAWN BY: LES | CHECKED BY: JBG

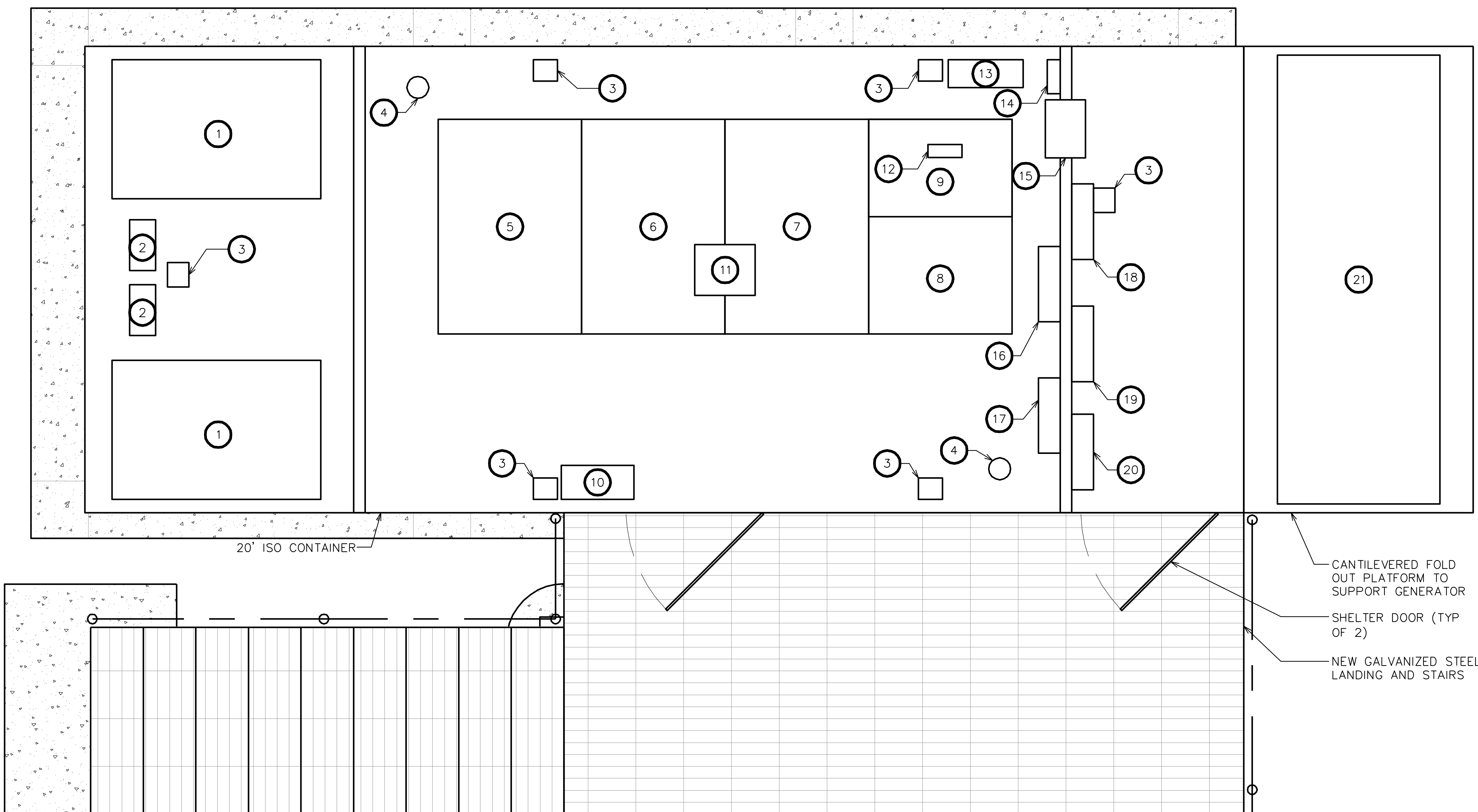
SHEET TITLE:
TOWER ELEVATION

SHEET NUMBER: **C-4**
REVISION: 2
TEP #: 70373.87669

DRAWING NOTES:

1. AIR CONDITIONING UNIT
2. AIR CONDITIONING DISCONNECT
3. GFCI OUTLET
4. CAMERA
5. RACK #1
6. RACK #2
7. RACK #3
8. RACK #4
9. UPS
10. TB1 ALARM PANEL
11. DOOR, SMOKE DETECTOR, & MOTION DETECTOR ALARMS
12. TB2 ALARM PANEL
13. GENSET, ECU, ATS, & SPARE ALARMS
14. TB3 ALARM PANEL
15. EMI FILTER
16. CAMERA PS
17. INTERIOR PDU
18. EXTERIOR PDU
19. TRANSFER SWITCH
20. MAIN SAFETY SWITCH
21. GENERATOR





SHELTER LAYOUT

SCALE: N.T.S.

PLANS PREPARED FOR:

Sabre Industries™
Towers and Poles
7101 SOUTHBRIDGE DRIVE
SIOUX CITY, IA 51111
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PROJECT INFORMATION:

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0	09-09-16	PRELIMINARY CONSTRUCTION

DRAWN BY: LES | CHECKED BY: JBG

SHEET TITLE:

SHELTER LAYOUT

SHEET NUMBER: **C-5**

REVISION: 2

TEP #: 70373.87669

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Geotechnical Study

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HILLIS-CARNES
ENGINEERING ASSOCIATES, INC.

503 Maryland Avenue, Unit 106
Delmar, MD 21875
Local 410-749-0940
Fax 410-896-3478
Toll Free 888-867-3134
www.hcea.com

Geotechnical Engineering Study
730' Wallops Island Tower
Wallops Island, Virginia
Project No. S15050

Prepared For:

David Wagman
United States Tower Services
5263 Argo Drive
Frederick, Maryland 21703

Prepared By:

Hillis-Carnes Engineering Associates, Inc.
503 Maryland Avenue, Unit 106
Delmar, Maryland 21875

June 24, 2015

HILLIS-CARNES

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ENGINEERING ASSOCIATES, INC.

June 24, 2015

David Wagman
United States Tower Services
5263 Argo Drive
Frederick, Maryland 21703

Reference: 730' Wallops Island Tower
Wallops Island, Virginia
HCEA Project No. S15050

Dear Mr. Wagman:

Hillis-Carnes Engineering Associates, Inc. (HCEA) is pleased to submit this report concerning the subsurface exploration and subsequent geotechnical evaluation for the proposed outer anchor points at the existing tower in Wallops Island, Virginia.

HCEA appreciates having had the opportunity to provide geotechnical consultation and we will remain available for further consultation during the various design stages. Should there be any questions concerning the contents of the report, the requirement of additional consultation, design, inspection or testing services, please contact the Salisbury HCEA office.

Best regards,
HILLIS-CARNES ENGINEERING ASSOCIATES, INC

Ryan C. Ward, EIT
Staff Engineer

Fernando García, D.GE.
Chief Engineer

COMMONWEALTH OF VIRGINIA
JEREMY M BOEHM
LIC. NO. 50528
PROFESSIONAL ENGINEER

Jeremy M. Boehm, P.E.
Project Engineer

TABLE OF TABLE OF CONTENTS

GEOTECHNICAL ENGINEERING STUDY
730' WALLOPS ISLAND TOWER
WALLOPS ISLAND, VIRGINIA
HCEA JOB NO. S15050

1.0 PURPOSE AND SCOPE

The purpose of this study was to determine the general subsurface conditions at the test locations and to evaluate those conditions with respect to the concept and design of the tower foundation and two sets (inner and outer) of three anchor points for added guy wires.

The evaluations and recommendations presented in this report were developed from an analysis of project characteristics and an interpretation of the general subsurface conditions at the site based on the sounding information. The stratification lines indicated on the sounding logs represent the approximate boundaries between soil types. In-situ the transitions may be gradual. Such variations can best be evaluated during construction and any minor design changes can be made at that time.

An evaluation of the site with respect to potential construction problems and recommendations dealing with the earthwork and inspection during construction are also included. Such an inspection is considered necessary to verify the subsurface conditions and to verify that the soils-related construction phases are performed properly.

The ***Appendix*** contains a summary of the field work on which this report is based.

2.0 PROJECT CHARACTERISTICS

The project site is located at the Wallops Island Flight Facility (WFF) in Wallops Island, Virginia. Refer to the Project Location Map (Figure 1) in the ***Appendix*** for the approximate project area.

The proposed construction involves a 730 foot tower with three (3) outer guy wires, three (3) inner guy wires and accompanying base. Guy wires will be spaced 120 degrees apart. Helical piles and shallow foundations will be utilized. The guy wire and base tensional and vertical loads have been estimated by others and are as follows:

> Tower Base: Download 495.1K /Shear 12.7K
> Inner Guyed Anchors: Download 134.5K/Shear 140.2K
> Outer Guyed Anchors: Download 36.5K/Shear 30.1K

Maximum foundation displacement on the order of 1-inch total and 1/2-inch differential has been assumed to be tolerable by the structures. Should any of the project characteristics, structural loading conditions or required settlement criteria differ from those outlined above, our office should be contacted for a re-evaluation of the site.

3.0 FIELD EXPLORATION

In order to gain information as to the properties of the existing native and placed soils, on June 10, 2015, six (6) **Cone Penetration Test (CPT)** soundings were performed within the reference area of the proposed guy wire anchor points and tower base. The soundings were named CPT-1 through CPT-7 (except CPT-5 location switched for DMT-5). The soundings were performed to approximately 50 feet below grade at guy anchor locations and 75 feet at the tower base. The approximate sounding locations are shown on the Testing Location Plan (Figure 2) in the ***Appendix*** of this report.

The Cone Penetration Test (CPT) is an in-situ testing method used to determine the geotechnical engineering properties of soils and delineating soil stratigraphy. It was initially developed in the 1950s at the Laboratory for Soil Mechanics in Denmark in order to investigate soft soils. Based on this history it has also been called the "Dutch cone test". Today, the CPT is one of the most used and accepted in-situ test methods for soil investigation worldwide.

The CPT test method consists of pushing an instrumented cone tip first into the ground at a controlled rate (usually 2 centimeters/second). The resolution of the CPT in delineating stratigraphic layers is related to the size of the cone tip, with typical cone tips having a cross-sectional area of either 10 or 15 cm^2, corresponding to diameters of 3.6 and 4.4 cm. HCEA uses a 10 cm^2 cross-sectional area cone.

The early applications of CPT mainly determined the soil geotechnical property of bearing capacity. The original cone penetrometers involved simple mechanical measurements of the total penetration resistance to pushing a tool with a conical tip into the soil. Different methods were employed to separate the total measured resistance into components generated by the conical tip (the "tip friction") and friction generated by the rod string. A friction sleeve was added to quantify this component of the friction and aid in determining soil cohesive strength in the 1960s (Begemann, 1965). Electronic measurements began in 1948 and improved further in the early 1970s (de Reister, 1971).

Most modern electronic CPT cones now also employ a pressure transducer with a filter to gather pore water pressure data. The filter is usually located on the cone tip (the so-called U1 position), immediately behind the cone tip (the most common U2 position – HCEA cone) or behind the friction sleeve (U3 position). Pore water pressure data aids determining stratigraphy and is primarily used to correct tip friction values for those effects. CPT testing which also gathers this 10 cm^2, piezometer data is called CPTU testing. CPT and CPTU testing equipment generally advances the cone using hydraulic rams mounted on either a heavily ballasted vehicle or using screwed-in anchors as a counter-force.

CPT for geotechnical applications was standardized in 1986 by ASTM Standard ***D 3441*** (***ASTM, 2004***). Later ASTM Standards have addressed the use of CPT for various environmental site characterization and groundwater monitoring activities. Particularly for geotechnical soil investigations, CPT is gaining popularity compared to standard penetration testing as a method of geotechnical soil investigation by its increased accuracy, speed of deployment and reduced cost over other soil testing methods. Diagrams illustrating the Cone Penetration Test are enclosed as Figures 3 and 4 in the ***Appendix*** of this report.

Due to the fine grained nature of the soil during testing, **one (1) Dilatometer Test** was performed at the proposed CPT-5 location. The test was named DMT-5. The

Dilatometer Test (DMT) is a state of the art in-situ testing tool which can be hydraulically advanced into soil without causing disturbance. The test is best suited for materials finer than gravelly sands. The dilatometer's suitability in loose sands is noted as one of the best applications of the device by experts in the DMT field.

To perform the test, a membrane on the side of the blade-shaped tool is expanded into the sidewall of the soil a distance of one millimeter. The pressure that is required to expand the membrane into the soil and the pressure prior to the expansion are noted (A and B pressures). The operator then deflates the membrane and records a third pressure (C pressure). The blade is then advanced to the next test depth and the test is repeated. A series of single dilatometer tests is referred to as a DMT sounding.

This abbreviated stress-strain test can be used to define many geotechnical parameters of soil including soil type, shear strength, constrained deformation modulus (i.e., settlement), pre-consolidation stress, in-situ pore water pressure and rate of consolidation. By coupling the reduced modulus data from the test with an elastic settlement program such as Schmertmann's Special Method a very accurate settlement prediction can be made for specific foundation load/size cases. Diagrams illustrating the dilatometer test are enclosed as ***Figures 5*** and ***6*** in the ***Appendix*** of this report.

For data analysis, DMT data reduction a software named WinDMT – Data Reduction Program V1.1.0 was used to prepare calculations for this report. The data as it has been reduced is based only on Professor. Marchetti's correlations. A spreadsheet using correlations and formulations is included in the ***Appendix*** as a reference of the variation in the parameters contingent upon the specific formulation used. HCEA used the elastic parameters by DMT for settlement evaluations and a combination of the theories and approaches for the estimation of strength parameters.

4.0 SUBSURFACE CONDITIONS

Details of the subsurface conditions encountered at the site are shown on the ***CPT & DMT Data Logs***. A brief description of the subsurface conditions and pertinent engineering characteristics of the soils are discussed in the following sections. Strata divisions shown on the ***CPT Logs*** have been estimated based on soil behavior charts. In the field strata changes could occur gradually and/or at slightly different levels than indicated. Groundwater conditions were estimated by pore pressure changes to be approximately 4.0 feet below existing grades during the period of the subsurface exploration. Fluctuations in groundwater levels could occur seasonally and may also be influenced by changes in grading, runoff, infiltration rates and other environmental factors.

Generalized subsurface conditions based on the results of the soundings and borings are discussed in the following sections:

4.1 Site Geology

The geology of the project site, as stated in the United States Geological Survey (USGS) Spatial Database, would characterize the location as being a part of the Beach Sand and Dune Sand Deposits - Fine- to coarse-grained quartz sand, poorly to well-sorted. Due to the encountered characteristics, the zone is also characteristic of the closely located Marsh and Intertidal Mud Deposits - Organic-rich clay and silt.

4.2 Surficial Materials

Surficial materials encountered included organic bearing soil (topsoil). The present depth of surficial materials and any fill materials may be expected to vary across the site.

4.3 Natural Materials

The native and placed soils encountered at the borings are consistent with the description of the materials presented in the geology section of this report. Subsurface soils generally consisted of materials classified as clean SAND (SP), clayey SAND (SC), silty SAND (SM), CLAY (CL) and SILT (ML) and combinations thereof.

Estimated "N" values (from CPT correlations) generally indicated very loose to dense relative densities for the granular materials encountered and very soft to hard for fine grained material. Blow count correlations show a range from 1 to 64. Refer to the ***CPT Data Logs and Interpretation*** for detailed information regarding the densities and consistencies of the soils along with each individual depth.

4.4 Groundwater

Groundwater was estimated from the “U2” pressure transducer readings to be approximately 3.0 to 8.0 feet below existing grades.

A more accurate determination of the hydrostatic water table would require the installation of perforated pipes or piezometers which could be monitored over an extended period of time. The actual level of the hydrostatic water table and the amount and level of perched water should be anticipated to fluctuate throughout the year depending on variations in precipitation, surface run-off, infiltration, site topography and drainage.

5.0 EVALUATIONS AND RECOMMENDATIONS

Our findings suggest that the site can be developed for the proposed structures utilizing conventional spread footings or ground-supported slab construction. Foundations must bear on natural soils or newly placed engineered fill.

It is particularly important to verify that topsoil and other deleterious surface materials are properly stripped in the grading process, that subgrades are verified for firmness prior to adding the first lift of new fill and that all grading operations are continuously monitored for material quality, lift thickness and compaction.

Special consideration should be given to the proper monitoring of newly required fill operations, footing excavations and concrete placement in all structural areas of the project.

The following recommendations have been developed on the basis of the previously described project characteristics and subsurface conditions. If there are any changes to the project characteristics or if different subsurface conditions are encountered during construction, HCEA should be consulted so that the recommendations of this report can be reviewed and revised where necessary.

5.1 General Site Preparation

Where applicable, any existing structures (including all above and below ground construction) within the areas to be developed should be removed prior to the initiation of new construction. We suggest that all available information regarding the existing utilities at the site be reviewed prior to construction.

Removal should also include the surficial materials, unsuitable existing fill and deleterious materials from the areas to be developed. Stripping operations should be performed in a manner consistent with good erosion and sediment control practices.

Areas of the site to receive fill, pavements, or slabs-on-grade should be proofrolled. The proofrolling operations should be performed using a 20-ton, fully-loaded tandem axle dump truck. The purpose of the proofrolling will be to locate any near-surface pockets of soft or loose soils requiring undercutting. A Geotechnical Engineer or experienced Soils Inspector should witness the proofrolling operations and should determine which areas need further undercutting and/or stabilization based on proofrolling and test-pitting of existing materials as required.

5.2 Fill Selection, Placement and Compaction

All material to be used as fill or backfill should be inspected, tested and approved by the Geotechnical Engineer. The on-site soils which are free from organic and other deleterious components can be re-used as site fill. Materials suitable for various construction purposes can be identified by an experienced Soils Inspector during grading operations.

If off-site borrow is required the imported materials should meet or exceed the requirements for structural fill set forth in the project specifications. We recommend all fill materials be tested in our laboratory prior to placement to determine its compliance with any necessary material requirements.

Moisture conditioning (that is, wetting or drying) of the soils should be anticipated to achieve proper compaction. The moisture contents of the soils should be controlled properly to avoid extensive construction delays. If imported fill material is required those materials should have Unified Soil Classifications of SM or better (better meaning fewer quantities of fine grained materials such as silts and clays).

Care should be exercised during the grading operations at the site. The excessive traffic of heavy construction equipment could create pumping and a general deterioration of site soil conditions if in the presence of water. If it is at all possible the grading should therefore be carried out during a dry season. Working during dry periods should minimize potential problems associated with excessive wet conditions- although they may not be eliminated. If such problems arise the Geotechnical Engineer should be consulted for an evaluation of the conditions.

All newly required fill should be placed in relatively horizontal 8-inch (maximum) loose lifts and should be compacted to a minimum of 95 percent of the Modified Proctor (ASTM

D-1557) maximum dry density. Fill materials in landscape and other non-structural areas should be compacted to at least 90 percent of the Modified Proctor maximum dry density with a maximum particle size of ¾ of an inch if significant subsidence of the fill under its own weight is to be avoided. Field moisture contents should be maintained within +/-2 percentage points of the optimum moisture content in order to provide adequate compaction.

Structural fill should extend a minimum of ten feet beyond building lines where floor slabs are to be constructed on the fill. Fill slopes and final cut slopes no steeper than 2(H):1(V) should be used. Testing should be performed by an experienced Engineering Technician on a full-time basis to verify that the proper degree of compaction is being obtained.

5.3 Shallow Foundations Bearing Capacity

Our findings indicate that the proposed structures can be supported on spread footings bearing on firm natural soils, on new engineered fill placed over natural soils or on a combination thereof. Footings should not be placed on or over any man-placed fill materials that are not properly certified by a Geotechnical Engineer or experienced Soils Inspector based on rigorous inspection and observations with a final approval by an HCEA Geotechnical Engineer during construction.

Based on the assumed maximum structural loads, the maximum allowable settlement, and the general soil conditions which were encountered, it is our judgment that a net allowable design soil bearing capacity of ***500 pounds per square foot (psf)*** will be available for proportioning the tower guy wire footings if this option is selected. The stability of the subgrade should be approved by HCEA upon excavation prior to the placement of any steel reinforcement and concrete.

We recommend using the following soil parameters for design.

Soil Characteristics

All CPT Locations *CPT-7 Only

Depth (ft)	USCS	Average N-value	Wet Density (pcf)	Cohesion (psf)	Φ (deg.)
0 - 10	SM-ML	20	116	-	22
10 - 30	CL-ML	2	105	400	-
30 - 50	CL-ML	5	108	550	-
50-75*	ML-CL	8	112	650	-

Groundwater Depth: ~3.0-8.0 feet

Based off the above design parameters and inclusion of detailed CPT/DMT data, all guy anchor blocks can achieve the desired specifications. Each anchor block measuring 14’ x 14’ x 5’ (5 foot embedment) will give the necessary reaction within a maximum 1 inch settlement limit.

All footing excavations should be inspected by a Geotechnical Engineer or experienced Soils Inspector prior to the placement of concrete. The purpose of the inspection would be to verify that the exposed materials will be capable of supporting the design bearing pressure. Such an inspection should include bearing tests performed with attention to adequate spacing and hand auguring to identify potential problem areas.

If soft or loose pockets are encountered in the footing excavations, the unsuitable materials should be removed and the footings should be located at a lower elevation. The unsuitable materials could be undercut and replaced with either new fill placed and compacted in accordance with the recommendations of Sections 5.1 and 5.2 of this report or with lean (500 psi) concrete.

In all areas where foundations will be supported on structural fill, the structural fill should extend a sufficient distance laterally beyond the perimeters of footings. For design purposes the plans should reflect structural fill extending a minimum distance of 9.0 inches laterally beyond a footing perimeter for each vertical foot of structural fill below the bearing level.

5.4 Deep Foundation

HCEA recommends that the tower base be founded on deep foundations (piles). The piles could be Concrete Pre-cast 12, 14 or 16 inches side driven piles. Deep foundations can also be used to anchor the guy wires. According with our experience in similar projects and the loads for this kind of structure, we have calculated the capacity of Concrete 12 inches square, as follow:

Concrete Pre-cast Piles 12 inches

Pile Length (feet)	Capacity (Tons)	Tensile Capacity (Tons)
55	30	27
65	38	32
70	40	35
75	50	39

The piles tip should be at a minimum elevation -75 feet below existing grade.

We recommend the piles be tested (at least three) according with the New Engineering Formula, to confirm the pile embedment and final capacity. The test pile should be monitored by a Geotechnical Engineer.

5.5 Helical Piles

Helical piles are an alternative to supplement the guy anchor foundations and increase the tension load capacity
. Helical piles can be installed using equipment mounted on a tracked excavator, eliminating the need for a crane.

Helical piles consist of one or more bearing plates (typically two or three) attached to a central shaft. The piles are installed by rotation, similar to a screw. A torque meter is used to determine when the piles have reached design capacity. Helical piles are proprietary systems available from multiple manufacturers, but sharing common characteristics. HCEA should review the pile capacities and installation procedures submitted by the helical pile contractor. The following table provides the allowable vertical (compression and tension) capacity based on widely available configurations and a factor of safety of 2.5.

CPT-2

Tip Depth	Plate 1 Diameter	Plate 2 Diameter	Plate 3 Diameter	Allowable Vertical Load	Installation Torque
35.0 ft.	8 in.	10 in.	12 in.	9 kips	2250 ft-lb
35.0 ft.	10 in.	12 in.	14 in.	13 kips	3250 ft-lb
45.0 ft.	10 in.	12 in.	14 in.	13.5 kips	3380 ft-lb

Helical piles for tension loads should be installed at batter angles matching the angle of the applied load. Helical piles should extend a minimum of 20 feet below grade in order to reach the intended bearing layer. The values given in the tables are based on an effective cohesion of 2500 and an effective unit weight of 50 pound per cubic foot for the medium stiff cohesive soil. Installation torques are based on a helix torque factor (K_t) of 10 ft^{-1}. The required installation torque should be adjusted for the K_t of the selected pile shaft.

5.6 Lateral Capacity

Based on the CPT exploration and the determination of the Elastic Modulus, E, it is our professional opinion that the foundation embedment depth below existing grade should be minimum 6 feet in the existing ground to develop enough lateral bearing capacity. For design purposes it is recommended that a maximum lateral capacity of 80 PSF/FT be used. It is also our recommendation that HCEA be consulted during foundation construction to ensure proper excavation, soils are undisturbed and appropriate concrete placement.

5.7 Frost Protection

Exterior footings and footings in unheated areas should be located at depths of at least 2.5 feet below final exterior grades so as to provide adequate protection from frost heave. If the structure is to be constructed during the winter months, or if the building interior will likely be subjected to freezing temperatures after footing construction, then all footings should be provided with adequate frost cover protection. Otherwise, interior footings can be located on suitable materials at nominal depths (as required by design) below finished floor grade.

5.8 Groundwater and Drainage

The shallowest groundwater encountered was at approximately 4.0 feet below grade. Groundwater-related problems should not be anticipated in excavation areas during construction. Necessary precautions should be taken if deep excavations are needed.

Any water infiltration resulting from a shallow interception of the groundwater table, precipitation, surface run-off, or perched water should be able to be controlled by means of sump pits and pumps, or by gravity ditching procedures. Such procedures are only to be used if it is necessary to lower the water by 1$\pm$ foot to 2$\pm$ feet. If it is necessary to lower the water by more than 2 feet, then a more extensive water evacuation system may be required.

Adequate drainage should be provided at the site to minimize any increases in the moisture contents of the foundation soils. Surface water should not be allowed to reach excavations, prepared subgrade or surrounding areas.

6.0 SEISMIC CONSIDERATIONS

According to the 2012 IBC, Section 1615.1.1 Site class definitions, and the table 1615.1.1 the site class is **E** - soft soil profile.

7.0 RECOMMENDED ADDITIONAL SERVICES

Additional soil and foundation engineering, testing and consulting services recommended for this project are summarized below:

Site Preparation: A Geotechnical Engineer or experienced Soils Inspector should inspect the site prior to the start of final grading. The inspector should determine if any undercutting or in-place densification is necessary to prepare a subgrade for fill placement or for slab support.

Fill Placement and Compaction: A Geotechnical Engineer or experienced Soils Inspector should witness any required filling operations and should take sufficient in-place density tests to verify that the specified degree of fill compaction is achieved. He should observe and approve borrow materials used and should determine if their existing moisture contents are suitable.

Footing Excavation Inspections: A Geotechnical Engineer or an experienced Soils Inspector should inspect footing excavations prior to pouring the foundation. It is necessary to verify that the design bearing pressure criteria has been achieved and that no loose pockets exist beneath the bearing surfaces of the footing excavations. Based on the inspection, the Inspector would either approve the bearing surfaces or recommend that loose or soft soils be undercut to expose satisfactory bearing materials. Particular care and rigid inspection procedures should be exercised for footings bearing on existing man-placed fill materials.

Helical Pile Installation Inspections: A Geotechnical Engineer or an experienced Soils Inspector should monitor the installation of the helical piles to verify dimensions, angle and torque. A Professional Engineer will review the installation information and then certify the pile capacity.

8.0 REMARKS

This report has been prepared to aid in the evaluation of the site for the proposed construction. It is considered that adequate recommendations have been provided to serve as a basis for design of plans and specifications. Additional recommendations can be provided as needed.

These analyses and recommendations are based on the information made available at the time of writing the report as relevant to on-site conditions including surface and subsurface existing at the time the exploratory borings were drilled. Further assumption has been made that the limited exploratory borings in relation both to the area of the site and to depth are representative of conditions across the site. The recommendations contained herein have been based on a series of widely spaced soil borings. Actual subsurface conditions encountered could vary from those outlined in this report.

If subsurface conditions are encountered which differ from those reported herein, this office should be notified immediately so that the analyses and recommendations can be reviewed and/or revised as necessary. It is also recommended that:

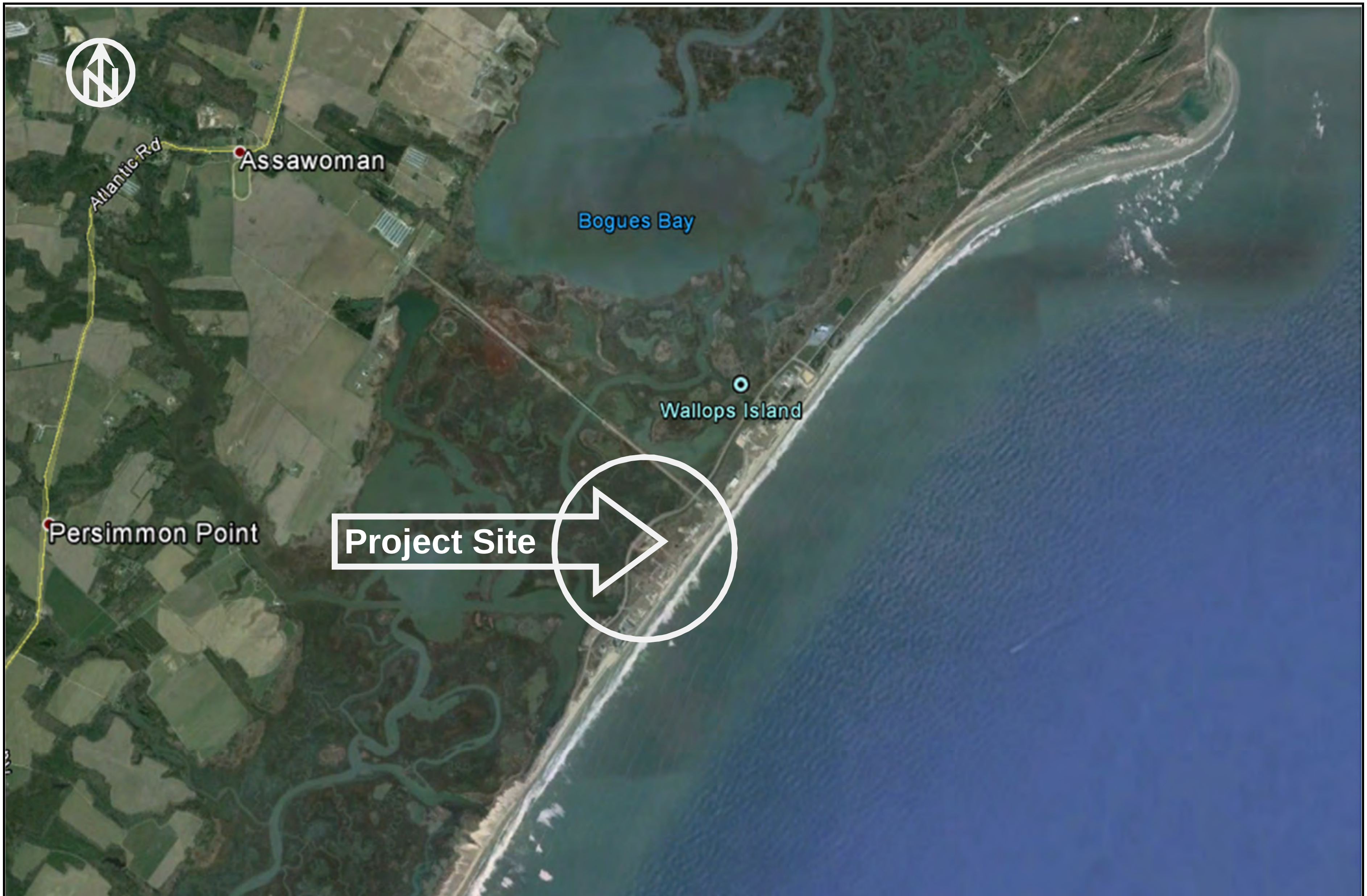
1. We are given the opportunity to review any existing man-placed fill certifications, plans and specifications prepared subsequent to the final geotechnical study in order to comment on the interaction of the soil conditions as described herein and the design requirements.

2. A Geotechnical Engineer or experienced Soils Inspector is present at the site during the construction phase to verify installation according to the approved plans and specifications. Such a presence on of an inspector is particularly important during excavation, placement, and compaction of fill materials.

Please note that successful completion of the project is dependent on the compliance with all of the recommendations provided in this report. While represented separately, the recommendations represent work that is intertwined. The successful completion of the project is specifically conditioned on your complying with all recommendations.

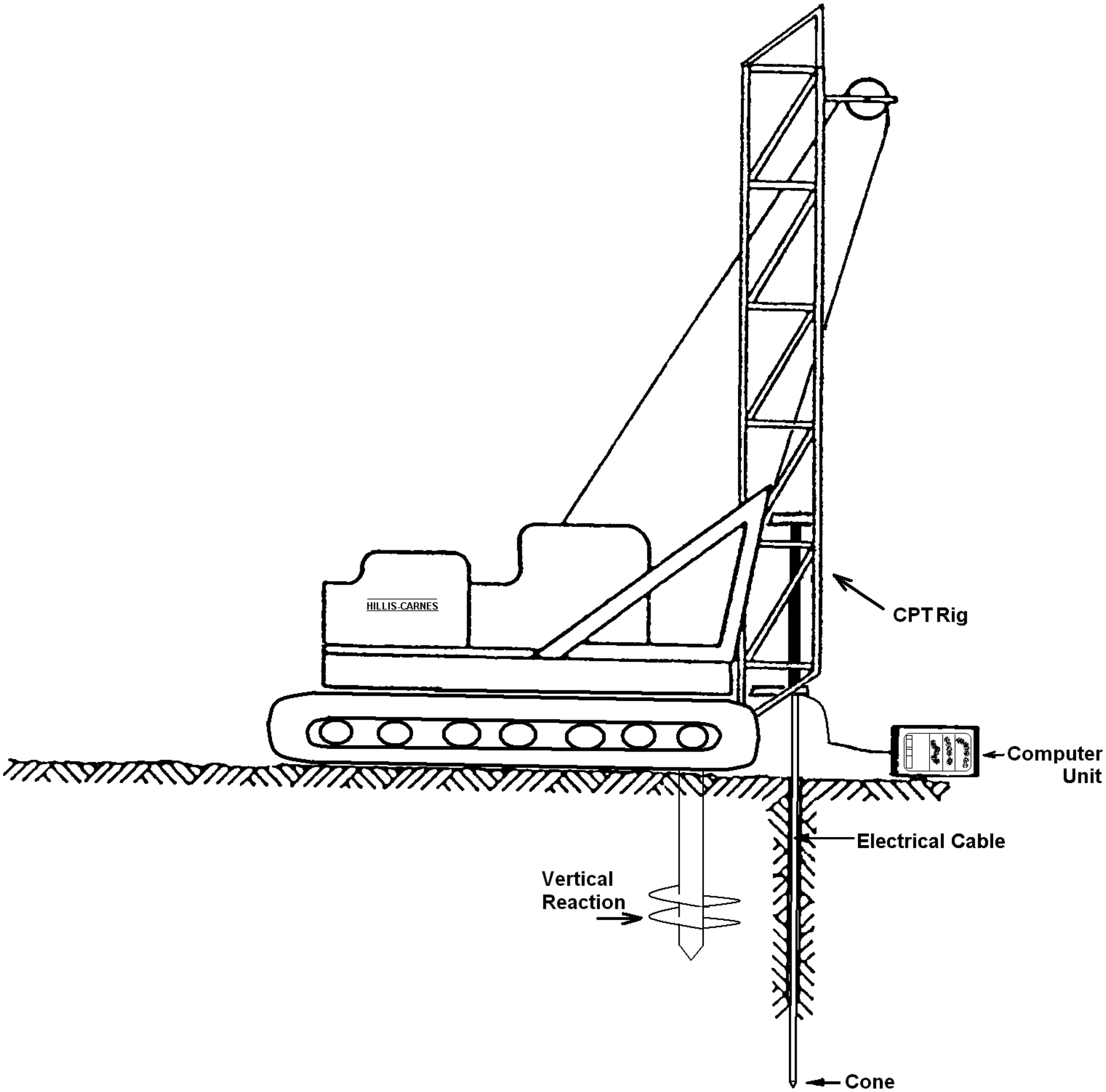
Our professional services have been performed, our findings obtained and our recommendations prepared in accordance with generally accepted engineering principles and practices. This warranty is in lieu of all other warranties either implied or expressed. Hillis-Carnes Engineering Associates, Inc. assumes no responsibility for interpretations made by others based on work or recommendations made by HCEA.

ATTACHMENTS

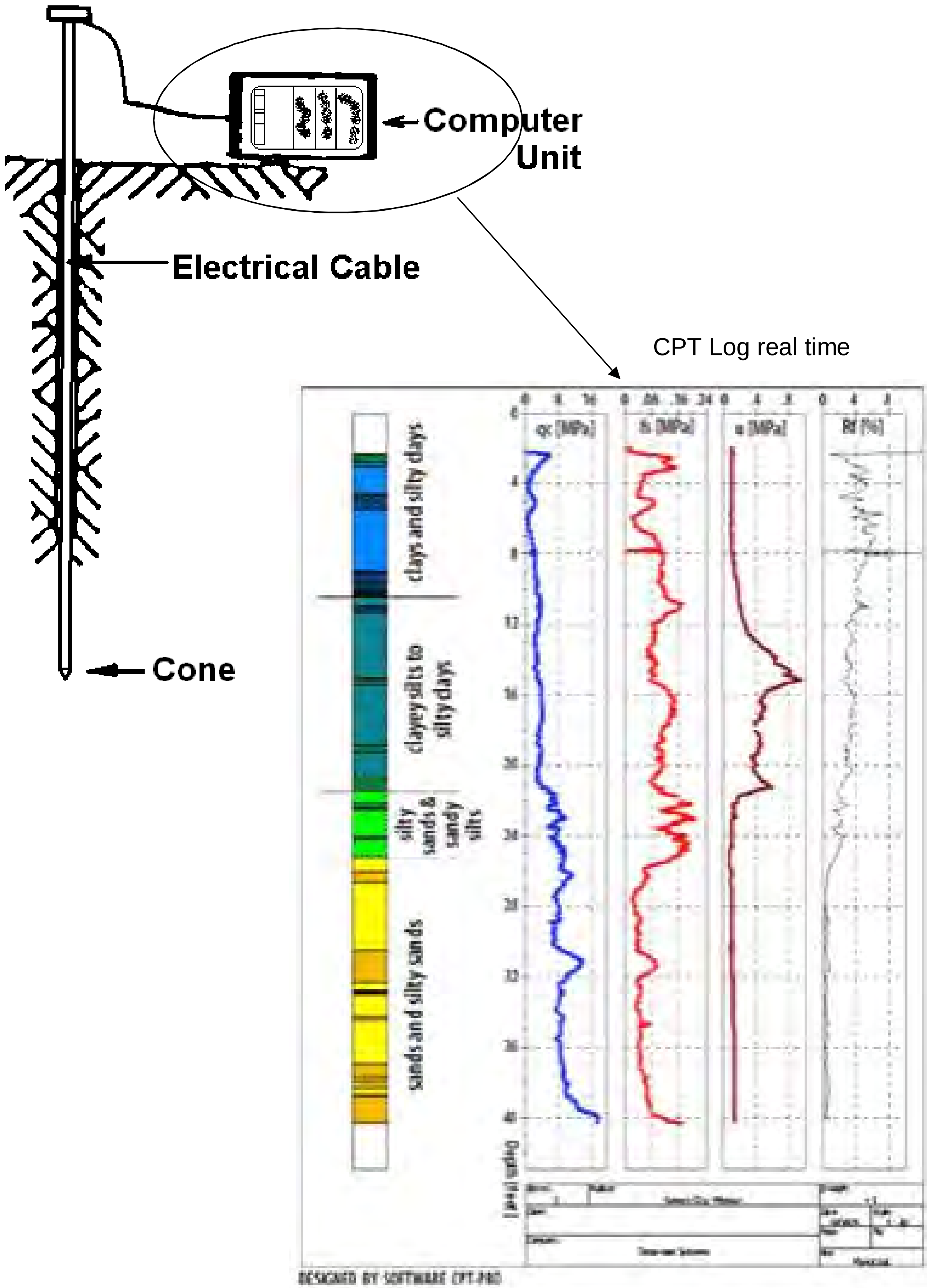


HILLIS-CARNES		PROJECT LOCATION MAP	JOB No.:	S15050	DESIGN BY:	Google
ENGINEERING ASSOCIATES, INC.		FIGURE 1	DATE:	06/24/2015	DRAWN BY:	Google
503 Maryland Avenue Unit 106	Delmar, MD 21875	730' Wallops Island Tower	SCALE:	NTS		
PHONE: (410) 749-0940	FAX: (410) 896-3478	Wallops Island, Virginia	PAGE:	1	CHECKED BY:	RCW

HILLIS-CARNES		TESTING LOCATION PLAN	JOB No.:	S15050	DESIGN BY:	Google
ENGINEERING ASSOCIATES, INC.		FIGURE 2	DATE:	06/24/2015	DRAWN BY:	Google
503 Maryland Avenue Unit 106	Delmar, MD 21875	730' Wallops Island Tower	SCALE:	NTS		
PHONE: (410) 749-0940	FAX: (410) 896-3478	Wallops Island, Virginia	PAGE:	1	CHECKED BY:	RCW



H I L L I S - C A R N E S		**CPT RIG AND CPT**	**JOB No:**	S15050	**DESIGN BY:**	FGM
ENGINEERING ASSOCIATES, INC.		**FIGURE 3**	**DATE:**	6/24/2015	**DRAWN BY:**	FGM
503 Maryland Avenue, Unit 106	Delmar, MD 21875	**730' Wallops Island Tower**	**SCALE:**	NTS		
PHONE: (410) 749-0940	FAX: (410) 896-3478	Wallops Island, Virginia	**PAGE:**	1	**CHECKED BY:**	**FGM**



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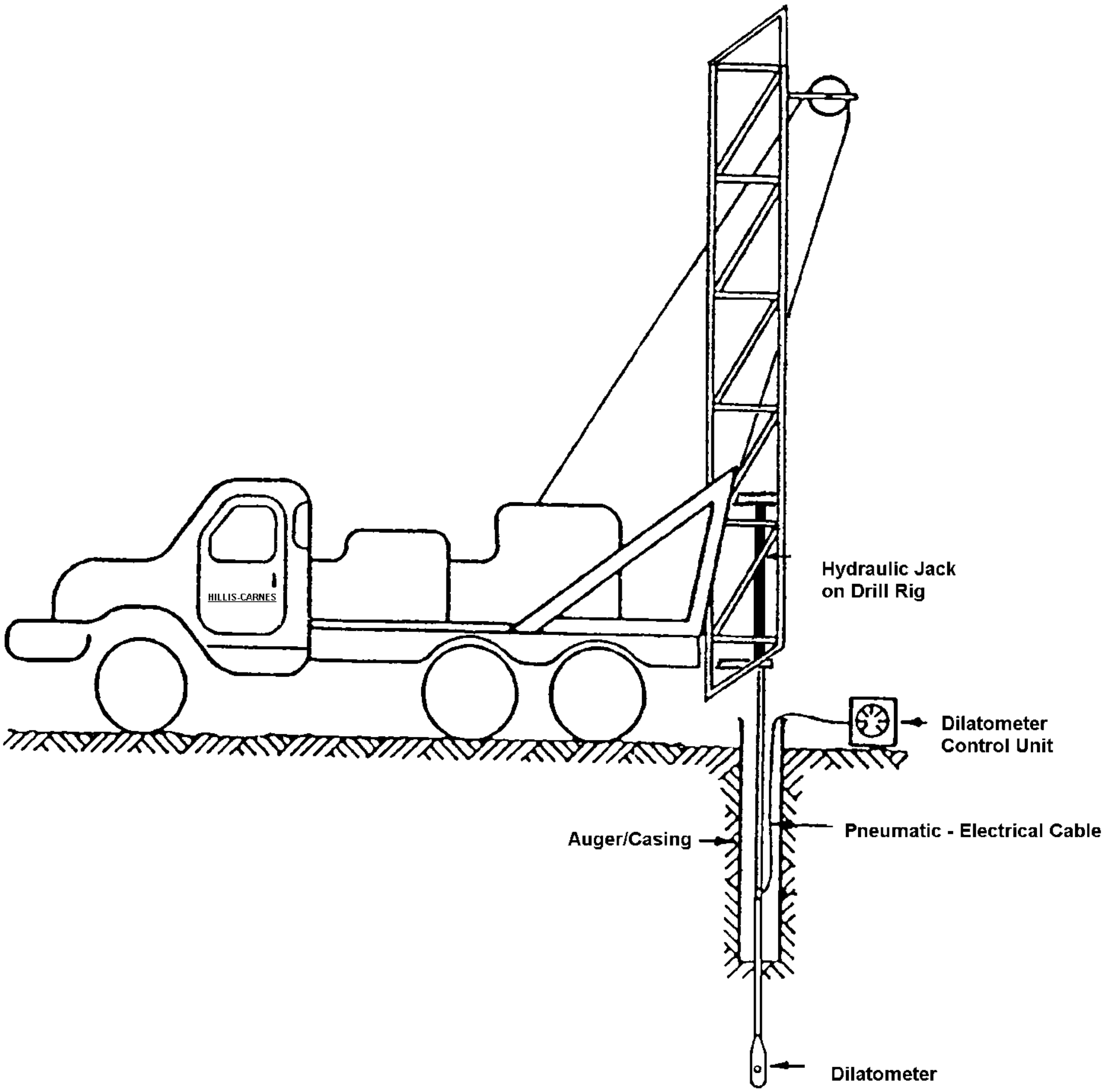
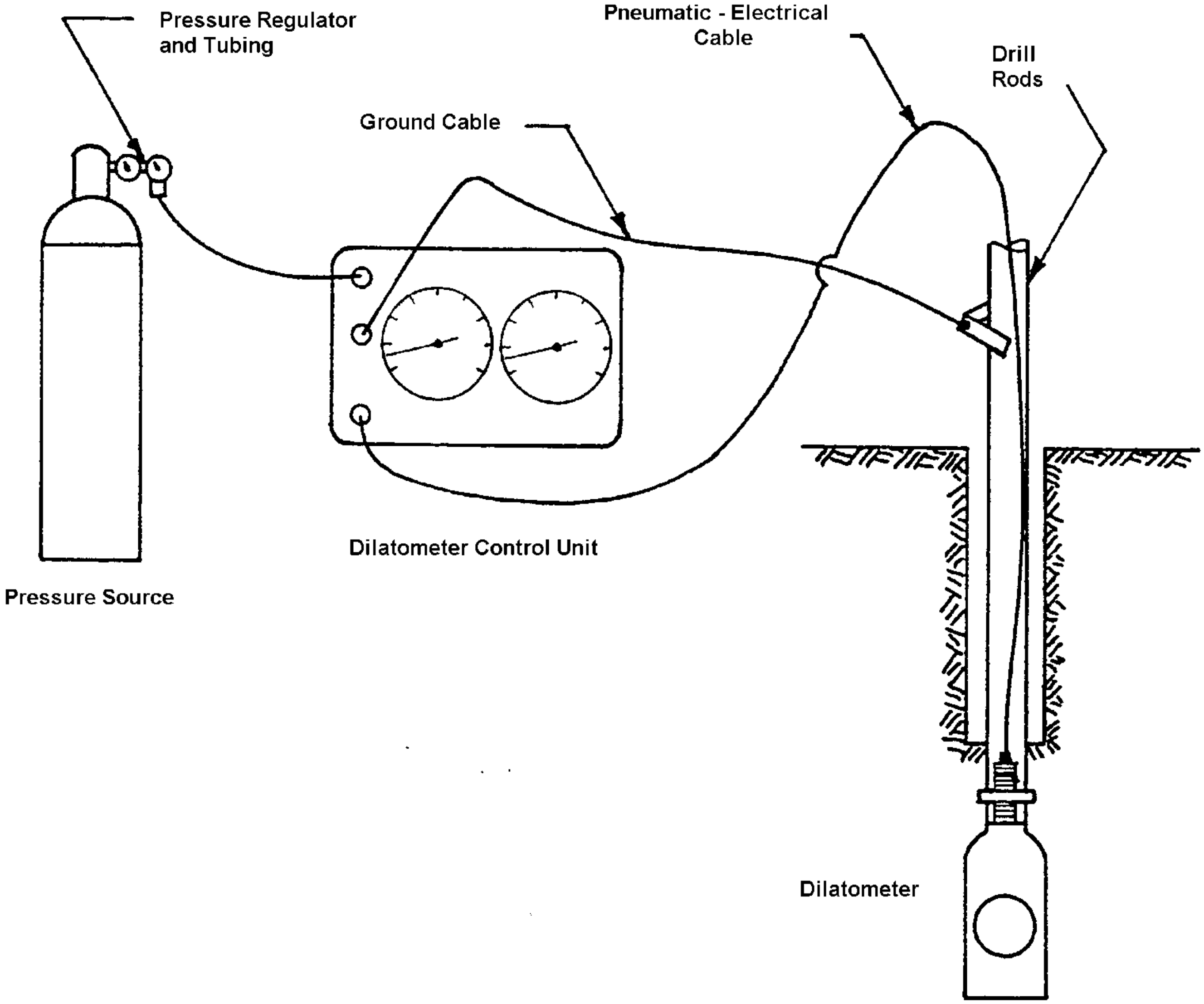
ENGINEERING ASSOCIATES, INC.		**FIGURE 4**	**DATE:** 6/24/2015	**DRAWN BY:**	FGM
503 Maryland Avenue, Unit 106	Delmar, MD 21875	**730' Wallops Island Tower**	**SCALE:** NTS		
PHONE: (410) 749-0940	FAX: (410) 896-3478	Wallops Island, Virginia	**PAGE:** 1	**CHECKED BY:**	**FGM**

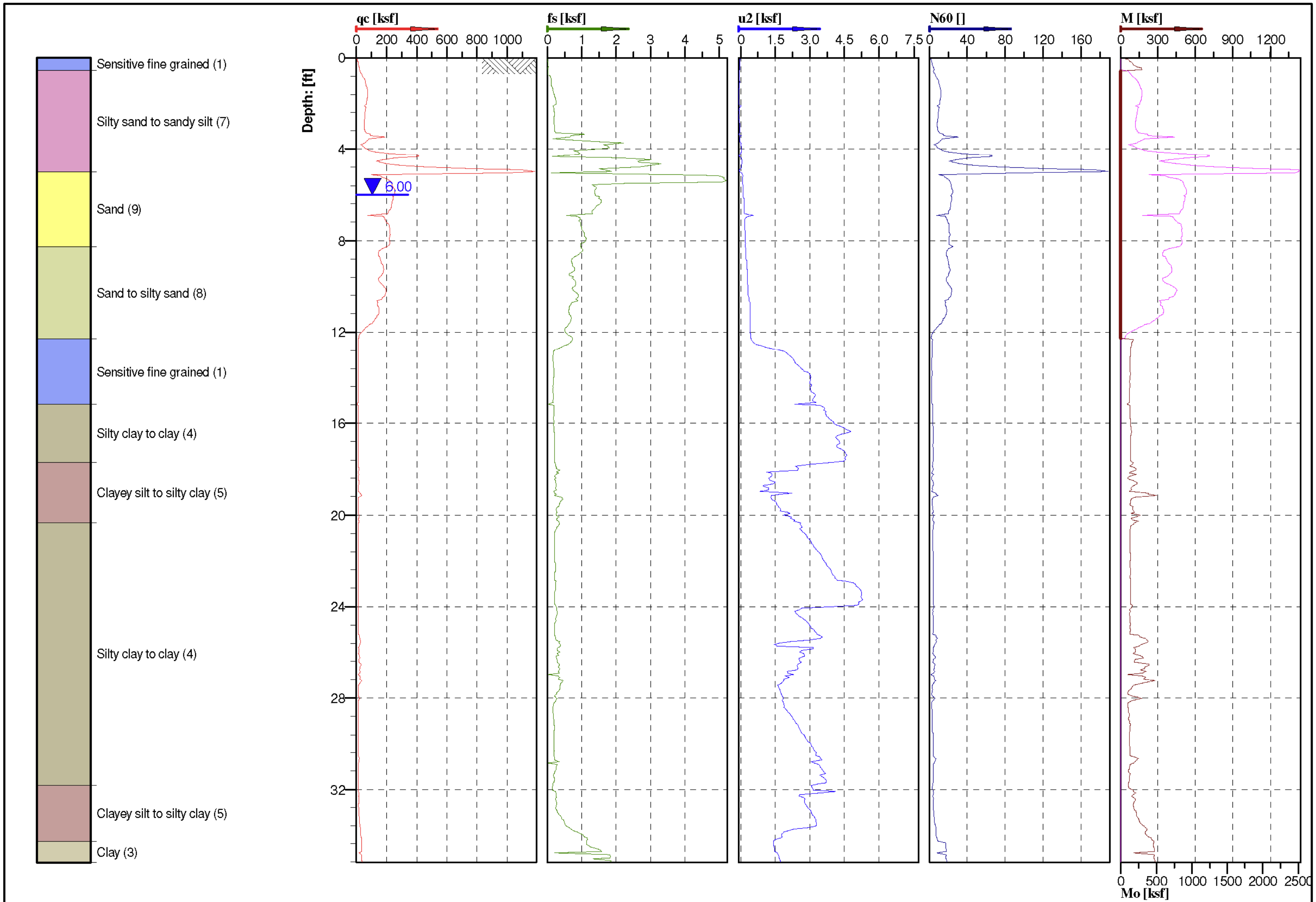


H I L L I S - C A R N E S		DRILL RIG TRUCK AND DMT	JOB No: S15050	DESIGN BY: FGM	
ENGINEERING ASSOCIATES, INC.		FIGURE 5	DATE: 06/24/2015	DRAWN BY: FGM	
503 Maryland Avenue, Unit 106	Delmar, MD 21875	730' Wallops Island Tower	SCALE: NTS		
PHONE: (410) 749-0940	FAX: (410) 896-3478	Wallops Island, Virginia	PAGE: 1	CHECKED BY: FGM	



H I L L I S - C A R N E S	DMT TEST SKETCH	JOB No:	S15050	DESIGN BY:	FGM
ENGINEERING ASSOCIATES, INC.	FIGURE 6	DATE:	06/24/2015	DRAWN BY:	FGM
503 Maryland Avenue, Unit 106 Delmar, MD 21875	730' Wallops Island Tower	SCALE:	NTS		
PHONE: (410) 749-0940 FAX: (410) 896-3478	Wallops Island, Virginia	PAGE:	1	CHECKED BY:	FGM

Appendix A: CPT & DMT Data Logs and Interpretations



HILLIS-CARNES ENGINEERING ASSOCIATES

Cone No: 4212
Tip area [cm2]: 10
Sleeve area [cm2]: 150

Location: Wallops Island Flight Facility, VA	Position: X: 0.00 ft, Y: 0.00 ft	Ground level: 6.00	Test No.: CPT-1
Project ID: S15050	Client: United States Tower Services	Date: 6/10/2015	Scale: 1 : 72
Project: 730' WALLOPS ISLAND TOWER		Page: 1/2	Fig.:
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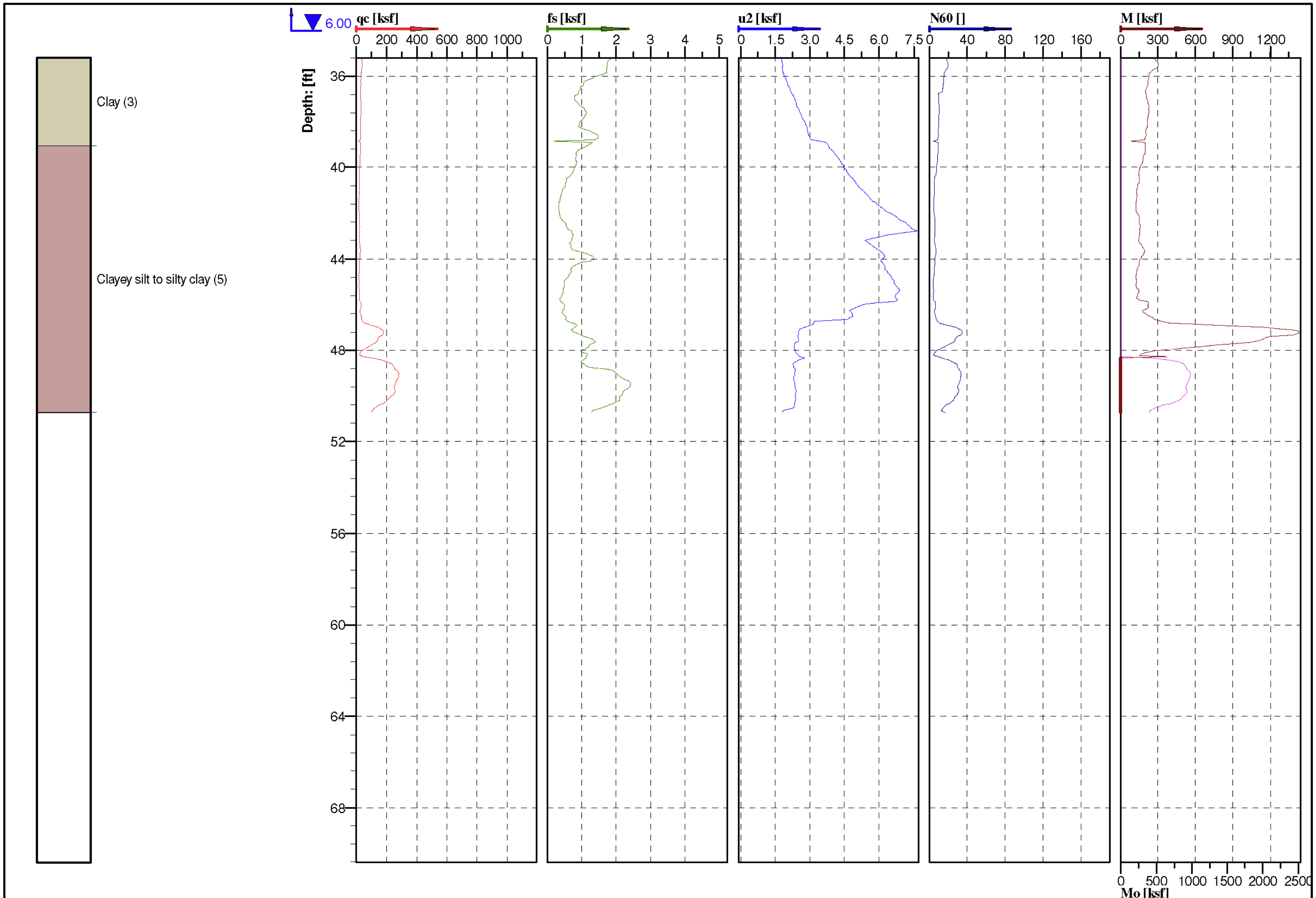

HILLIS-CARNES
ENGINEERING ASSOCIATES

Cone No: 4212
Tip area [cm2]: 10
Sleeve area [cm2]: 150

Location: Wallops Island Flight Facility, VA	Position: X: 0.00 ft, Y: 0.00 ft	Ground level: 6.00	Test No.: CPT-1
Project ID: S15050	Client: United States Tower Services	Date: 6/10/2015	Scale: 1 : 72
Project: 730' WALLOPS ISLAND TOWER		Page: 2/2	Fig.:
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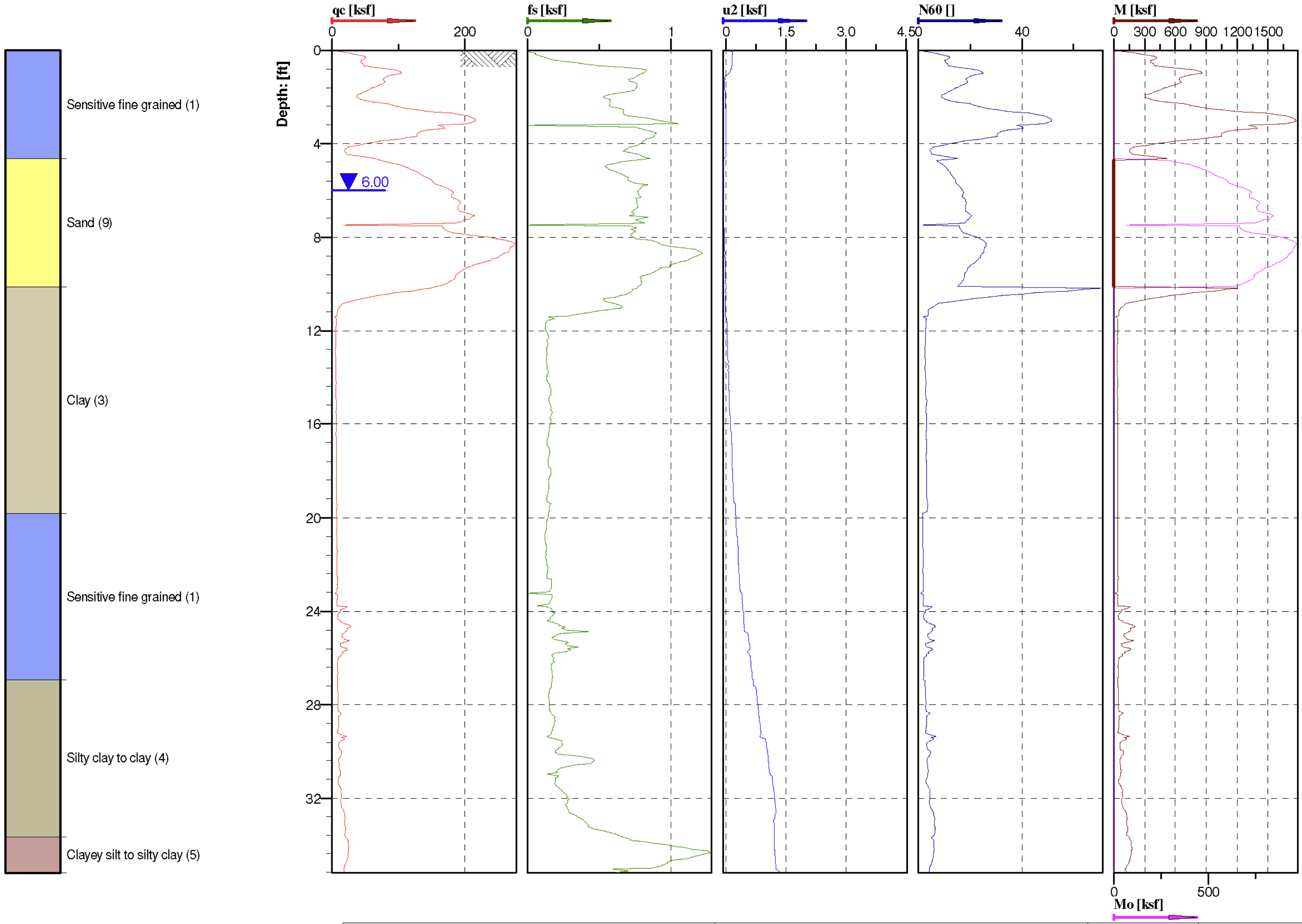

HILLIS-CARNES
ENGINEERING ASSOCIATES

U2

Cone No: 4212
Tip area [cm2]: 10
Sleeve area [cm2]: 150

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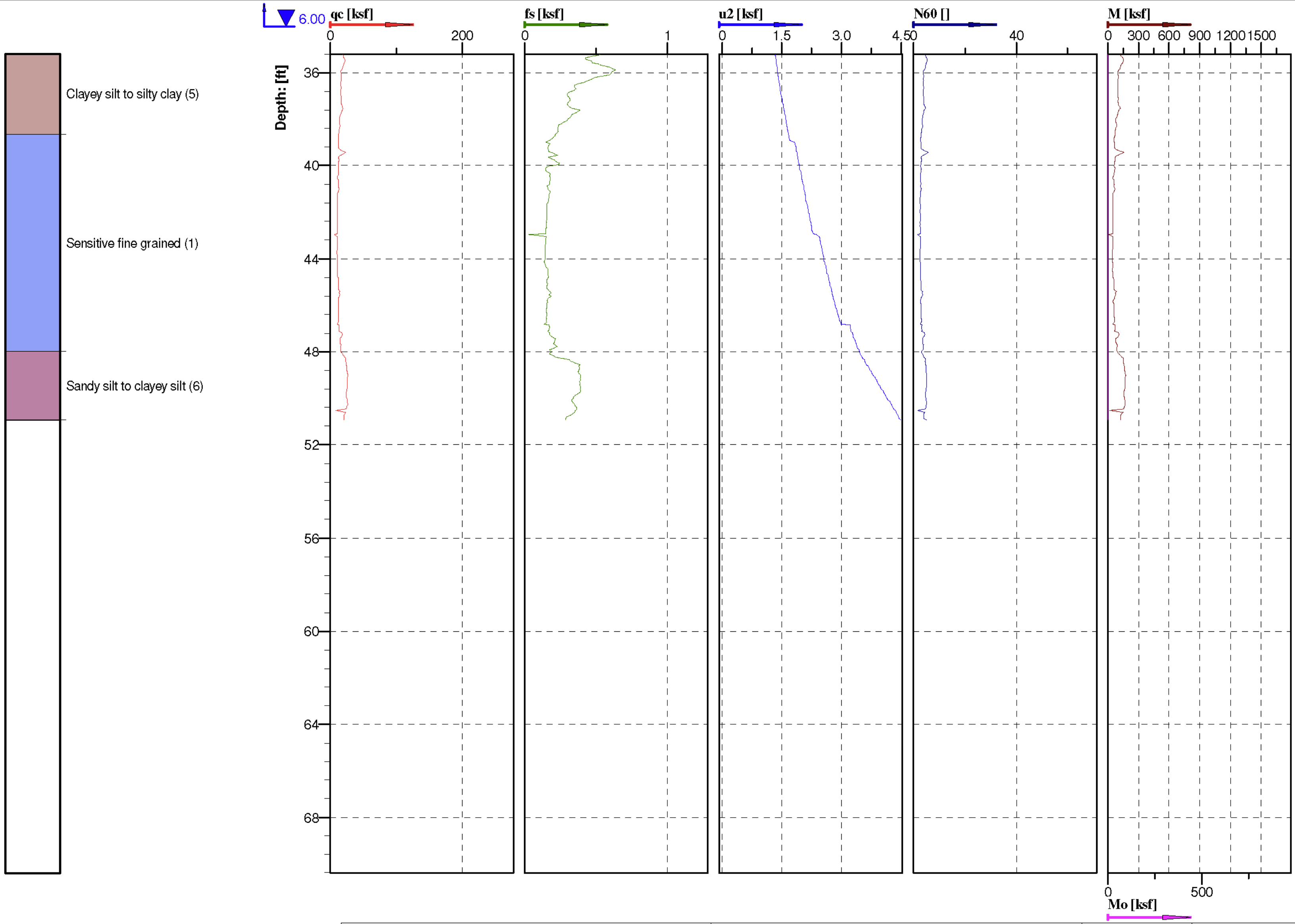
 HILLIS-CARNES ENGINEERING ASSOCIATES, INC.



HILLIS-CARNES ENGINEERING ASSOCIATES

Cone No: 4212
Tip area [cm2]: 10
Sleeve area [cm2]: 150

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Project ID: S15050	Client: United States Tower Services	Date: 6/10/2015	Scale: 1 : 72
Project: 730' WALLOPS ISLAND TOWER		Page: 2/2	Fig.:
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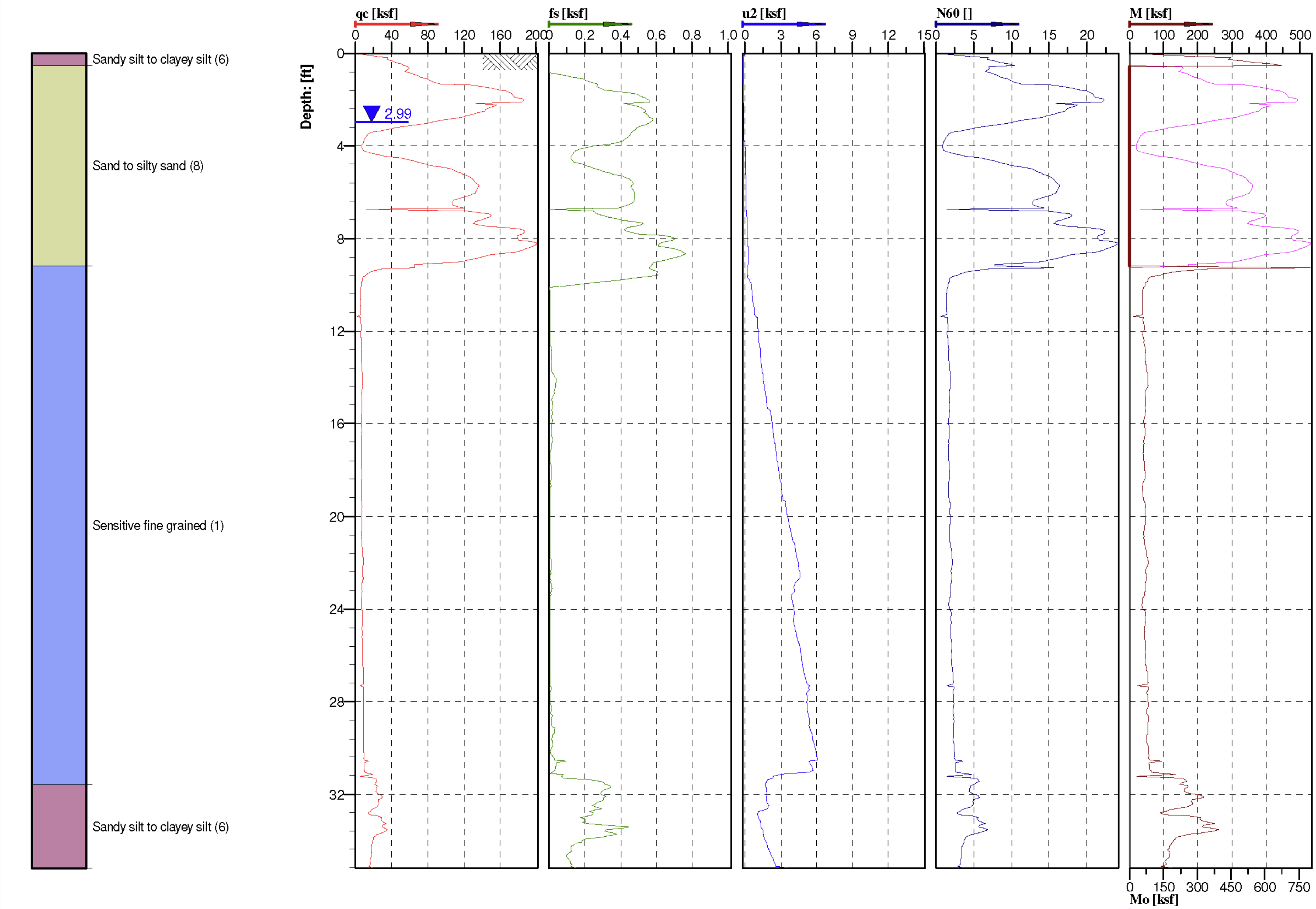

HILLIS-CARNES ENGINEERING ASSOCIATES

Cone No: 4212
Tip area [cm2]: 10
Sleeve area [cm2]: 150

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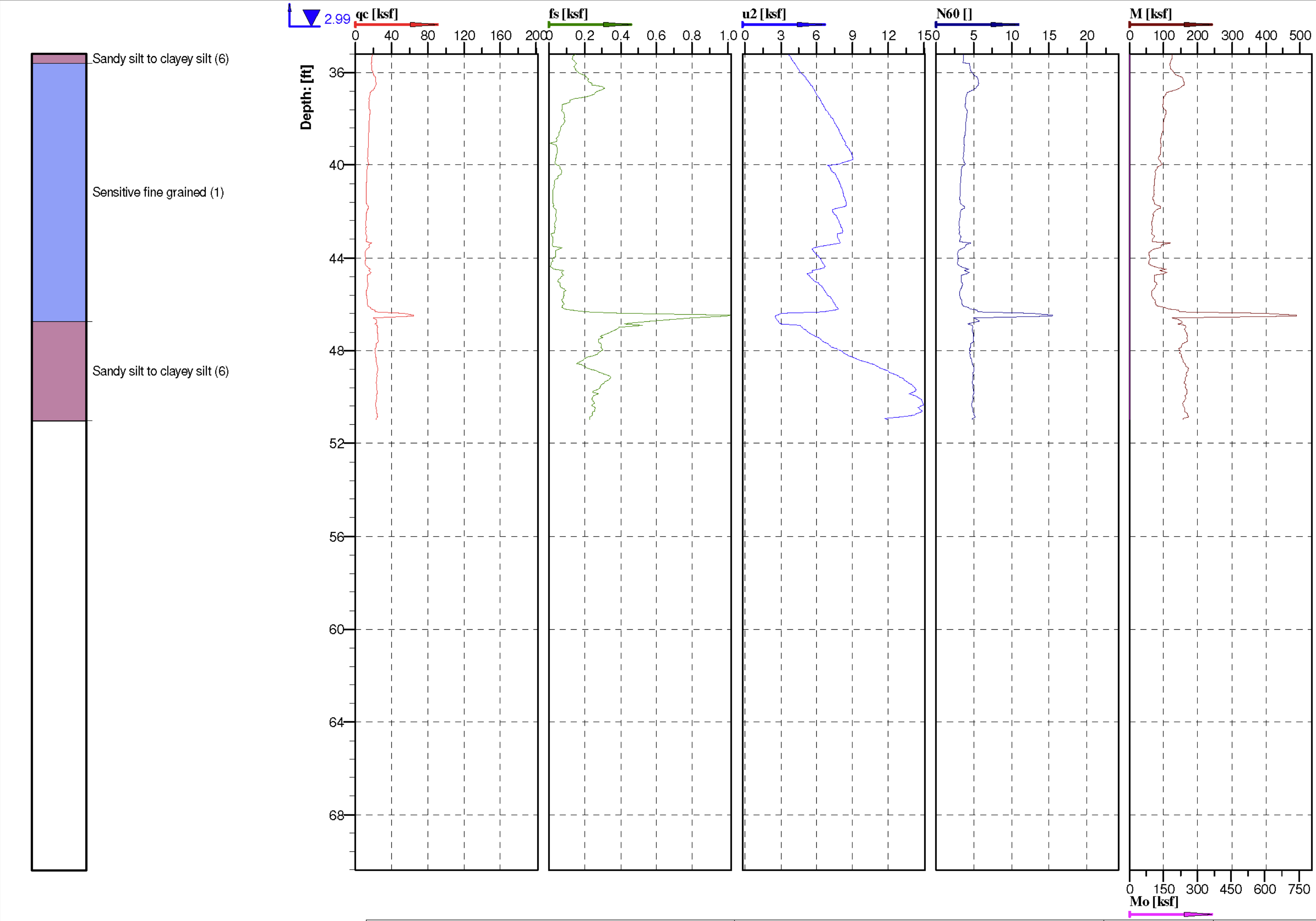

HILLIS-CARNES
ENGINEERING ASSOCIATES

U2
Cone No: 4212
Tip area [cm2]: 10
Sleeve area [cm2]: 150

Location: Wallops Island Flight Facility, VA	Position: X: 0.00 ft, Y: 0.00 ft	Ground level: 2.99	Test No.: CPT-3
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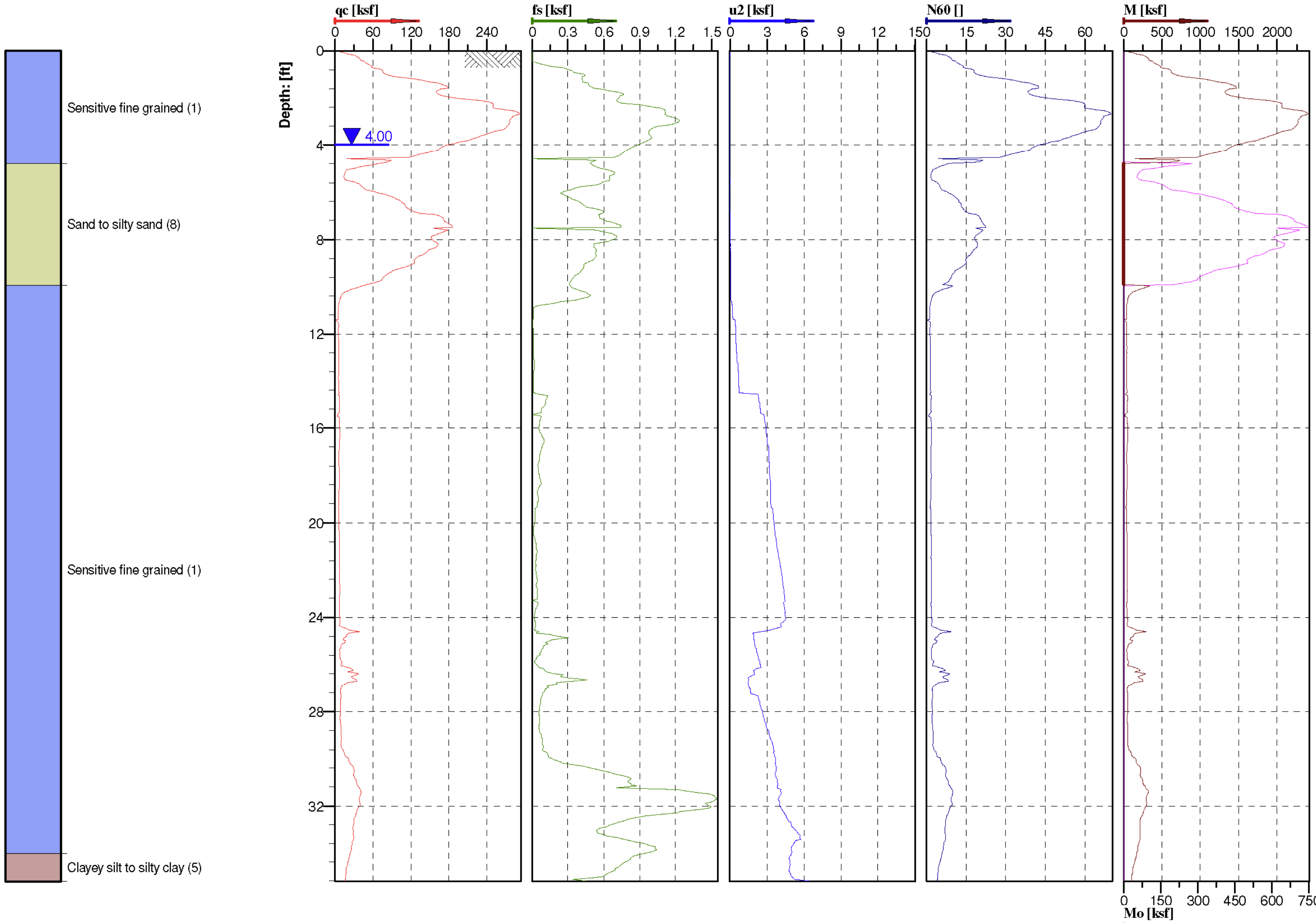

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Project ID: S15050	Client: United States Tower Services	Date: 6/10/2015	Scale: 1 : 72
Project: 730' WALLOPS ISLAND TOWER		Page: 1/2	Fig.:
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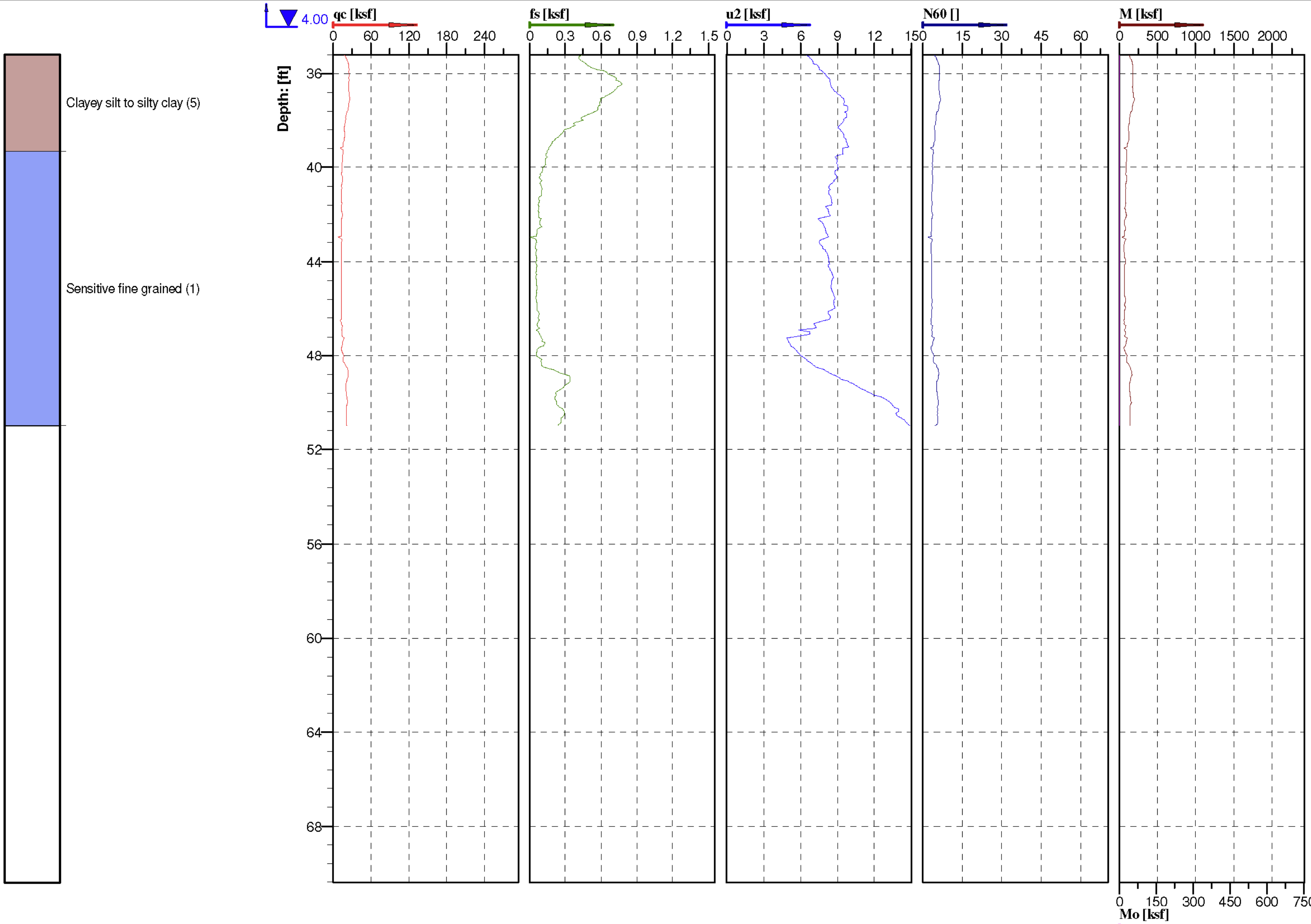
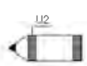
HILLIS-CARNES ENGINEERING ASSOCIATES

Cone No: 4212
Tip area [cm2]: 10
Sleeve area [cm2]: 150



HILLIS-CARNES
ENGINEERING ASSOCIATES



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Sleeve area [cm2]: 150

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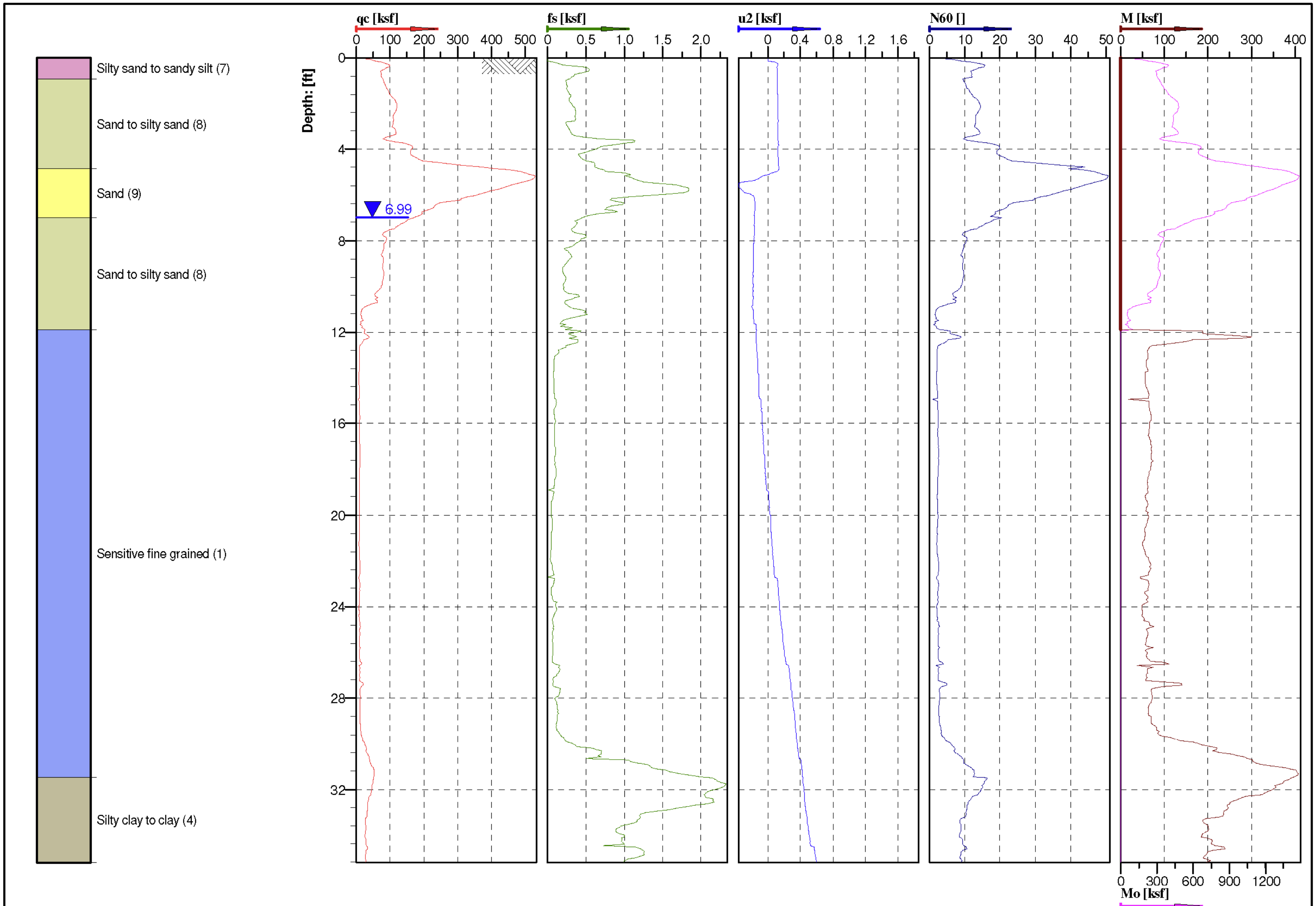

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Sleeve area [cm2]: 150

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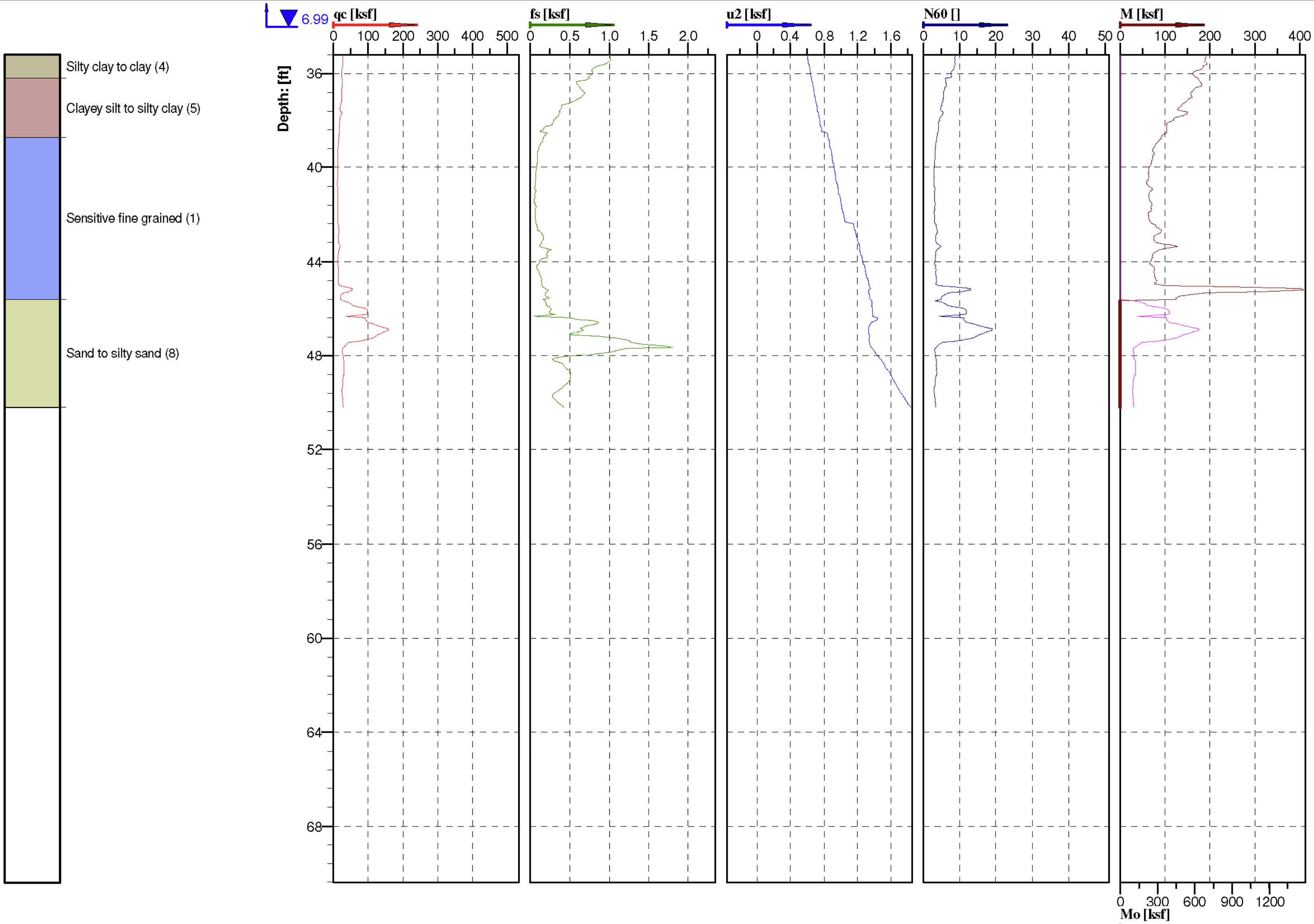

HILLIS-CARNES
ENGINEERING ASSOCIATES

U2

Cone No: 4212
Tip area [cm2]: 10
Sleeve area [cm2]: 150

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Project: 730' WALLOPS ISLAND TOWER		Page: 2/2	Fig.:
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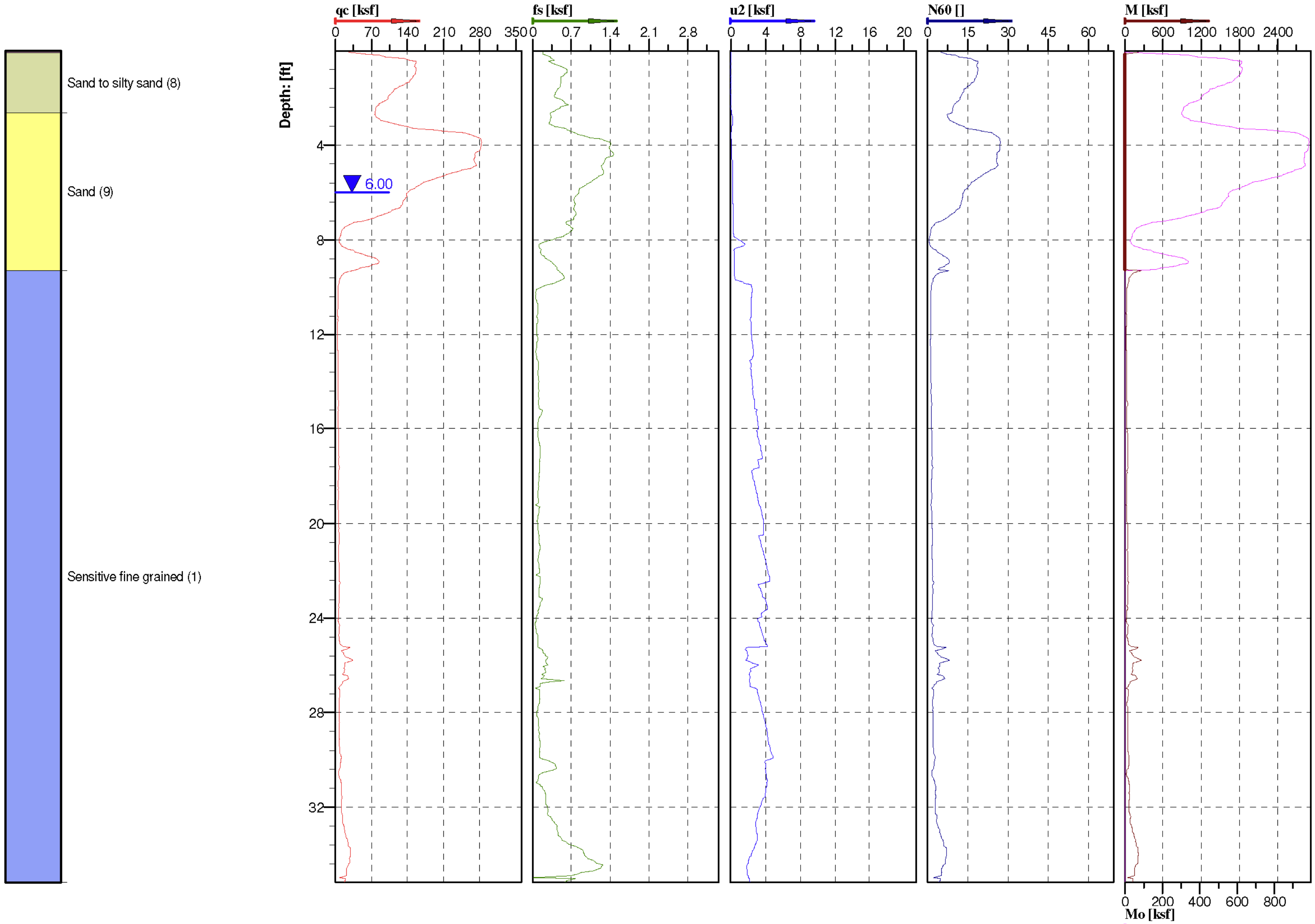

HILLIS-CARNES ENGINEERING ASSOCIATES

Cone No: 4212
Tip area [cm2]: 10
Sleeve area [cm2]: 150

Location: Wallops Island Flight Facility, VA	Position: X: 0.00 ft, Y: 0.00 ft	Ground level: 6.00	Test No.: CPT-7
Project ID: S15050	Client: United States Tower Services	Date: 6/10/2015	Scale: 1 : 72
Project: 730' WALLOPS ISLAND TOWER		Page: 2/3	Fig.:
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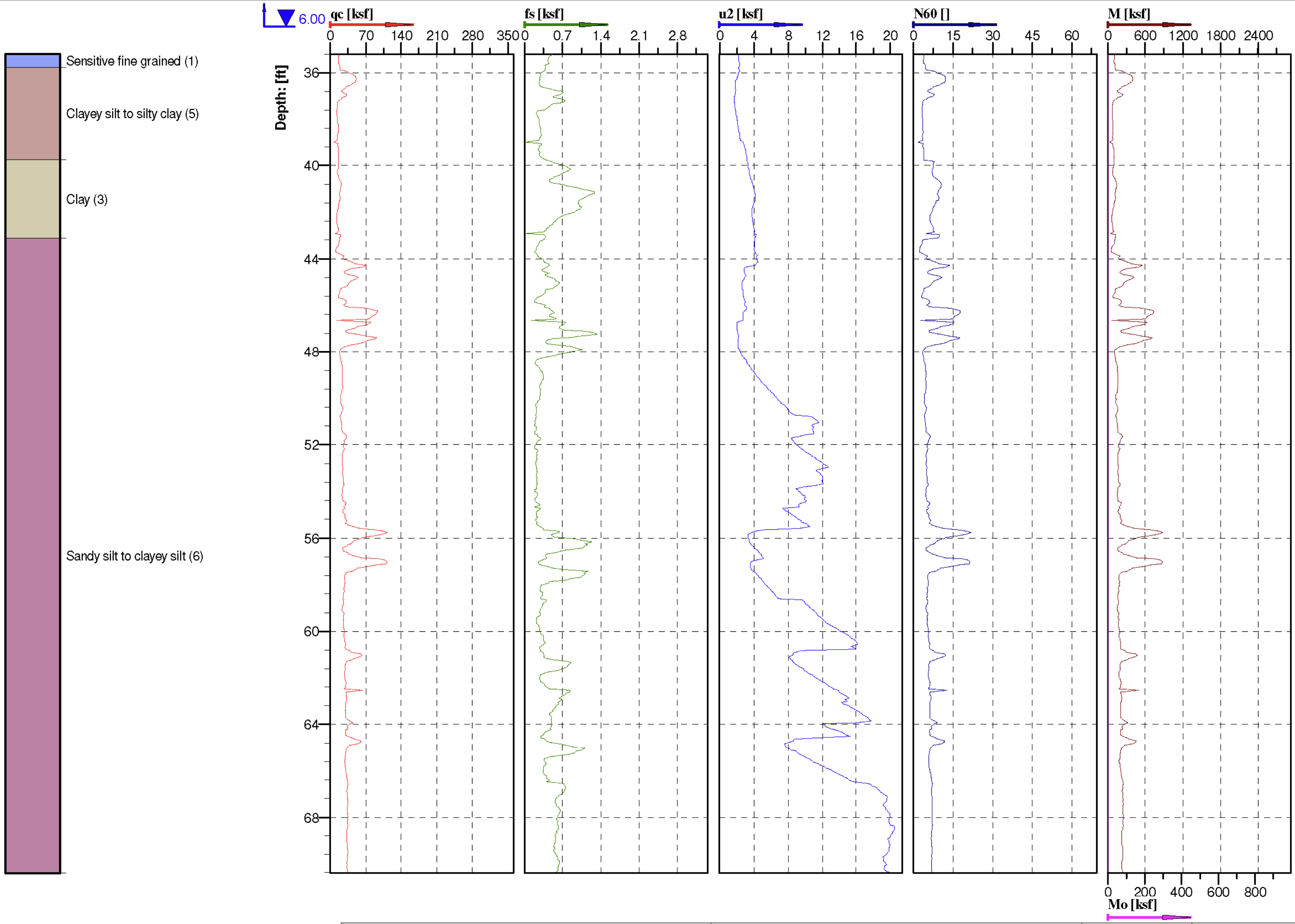
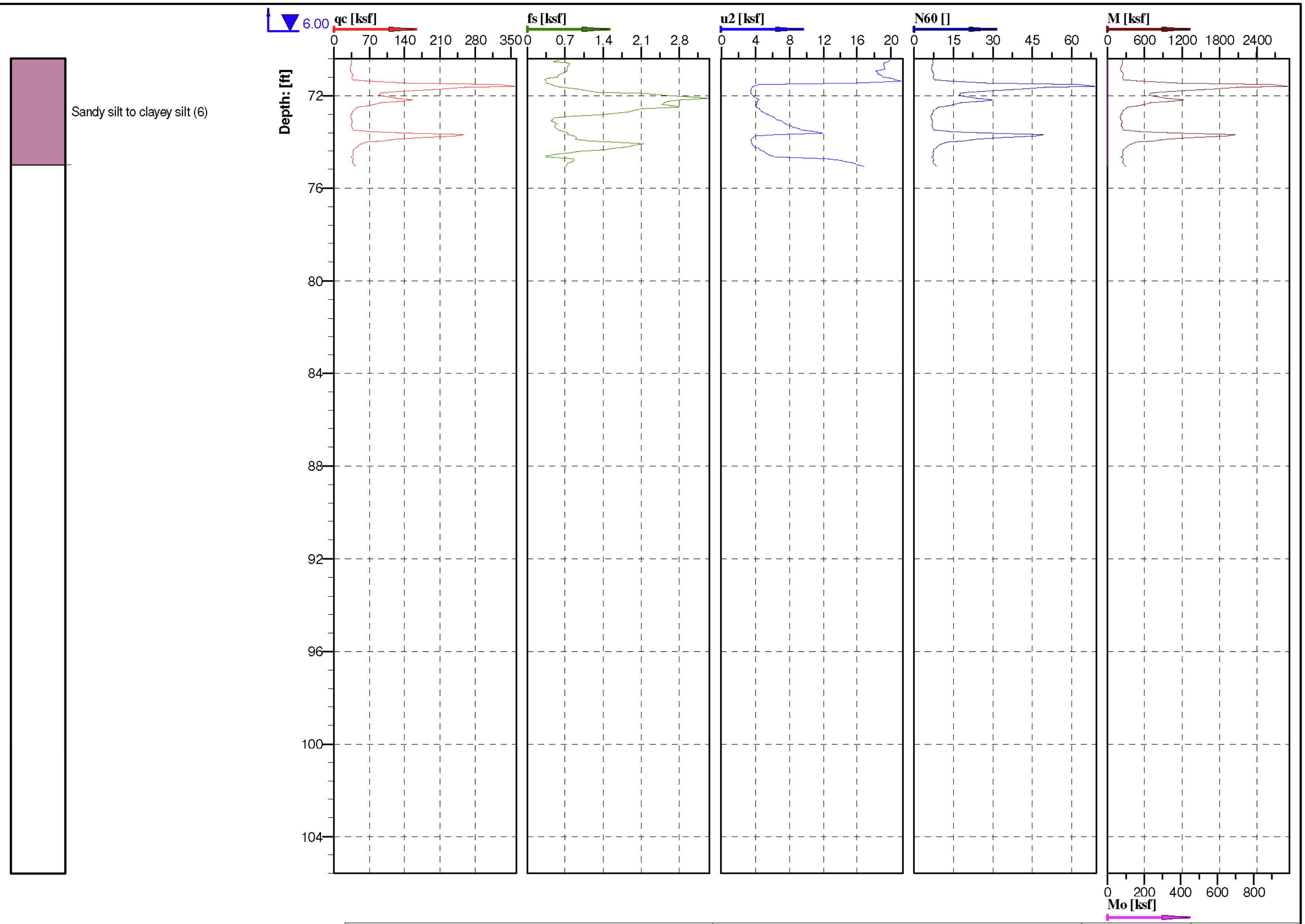


HILLIS-CARNES
ENGINEERING ASSOCIATES

Cone No: 4212
Tip area [cm2]: 10
Sleeve area [cm2]: 150

Location: Wallops Island Flight Facility, VA	Position: X: 0.00 ft, Y: 0.00 ft	Ground level: 6.00	Test No.: CPT-7
Project ID: S15050	Client: United States Tower Services	Date: 6/10/2015	Scale: 1 : 72
Project: 730' WALLOPS ISLAND TOWER		Page: 3/3	Fig.:
		File: WALLOPS CPT-7.cpt	

 HILLIS-CARNES ENGINEERING ASSOCIATES, INC.



HILLIS-CARNES
ENGINEERING ASSOCIATES

Cone No: 4212
Tip area [cm2]: 10
Sleeve area [cm2]: 150

Location: Wallops Island Flight Facility, VA	Position: X: 0.00 ft, Y: 0.00 ft	Ground level: 6.00	Test No.: CPT-7
Project ID: S15050	Client: United States Tower Services	Date: 6/10/2015	Scale: 1 : 72
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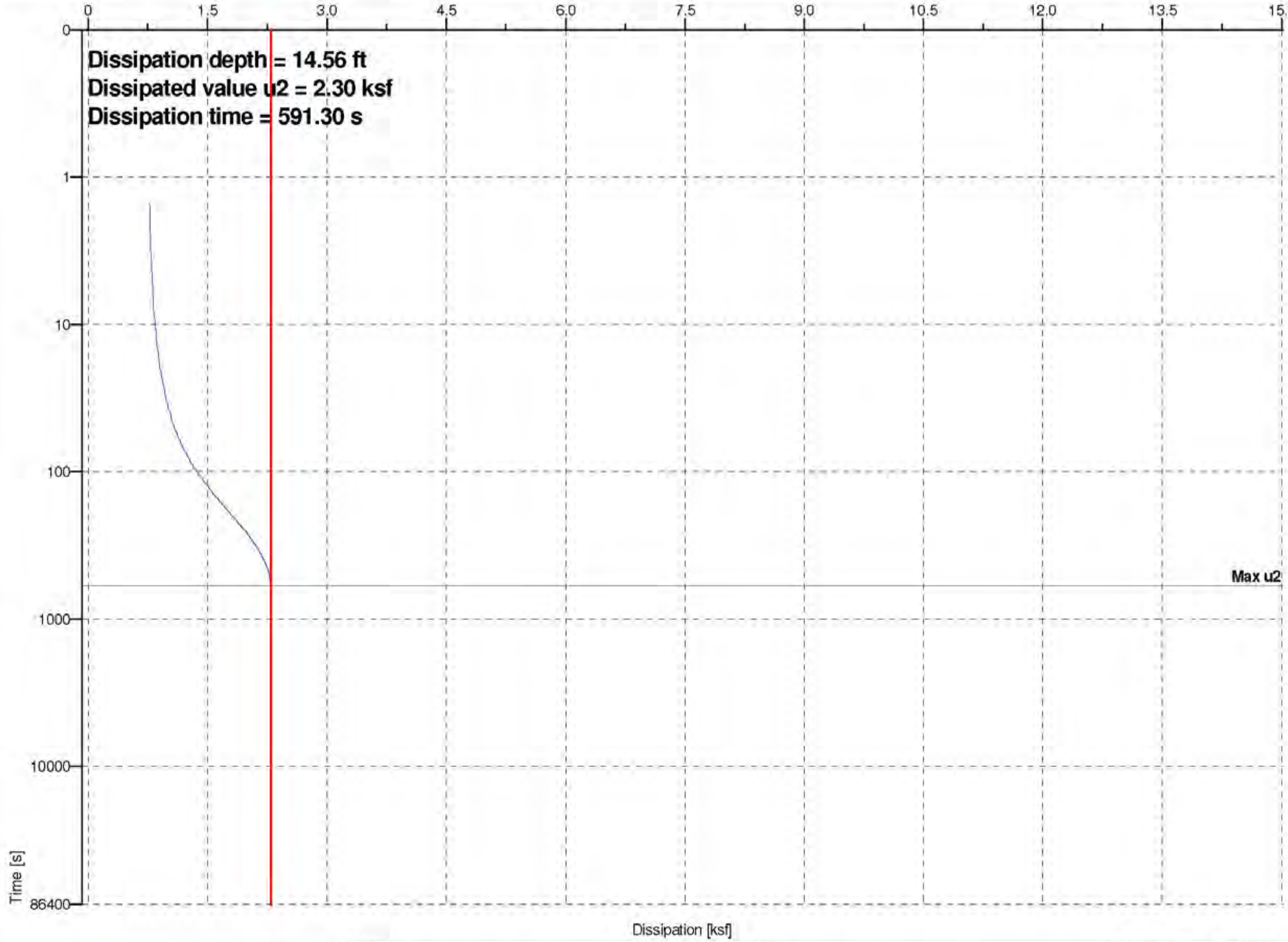

HILLIS-CARNES
ENGINEERING ASSOCIATES

Cone No: 4212
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Sleeve area [cm2]: 150

Location: Wallops Island Flight Facility, VA	Position: X: 0.00 ft, Y: 0.00 ft	Ground level: 4.00	Test No.: CPT-4
Project ID: S15050	Client: United States Tower Services	Date: 6/10/2015	Scale: 1 : 72
Project: 730' WALLOPS ISLAND TOWER		Page: 1/2	Fig.:
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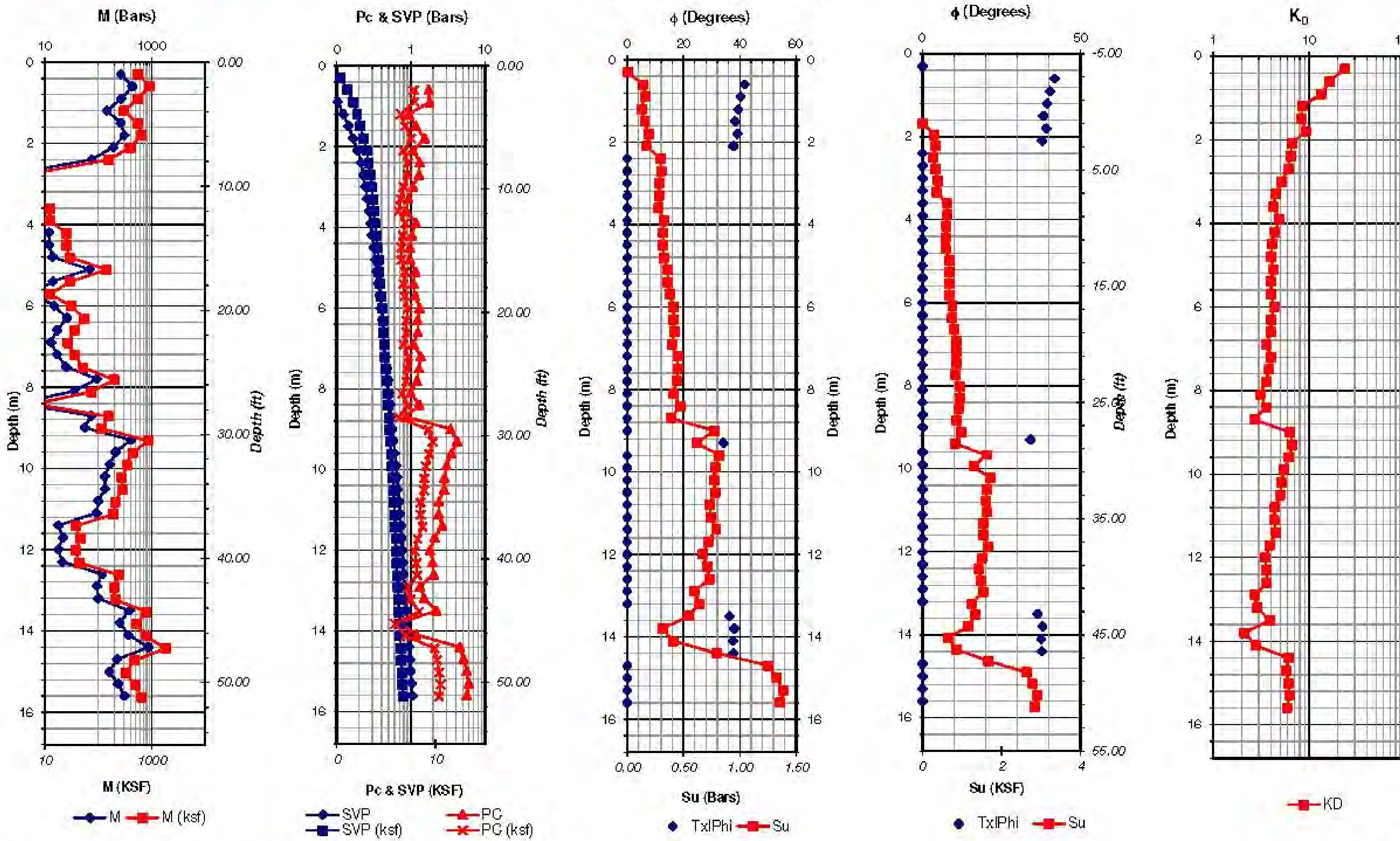
HILLIS-CARNES
ENGINEERING ASSOCIATES, INC

Sounding DMT-5 Log



Wallops Tower DMT Settlement.xls

DMT-1 Plot

HILLIS-CARNES
ENGINEERING ASSOCIATES, INC

Project: 730' Wallops Island Tower

SETTLEMENT ESTIMATE BASED ON DILATOMETER DATA AT CENTER OF UNIFORMLY LOADED RECTANGULAR/SQUARE FOOTING USING BOUSSINESQ SOLUTION FOR STRESS INCREASE

Calculated By F. Garcia	Date: 08/15/15		Checked By F. Garcia	Date: 08/15/15	
Footing Number:	Near B-4		Dilatometer Sounding:	DMT-1	
Bottom of Footing Elevation	0.00 feet		Dilatometer Ground Elev:	4.00 feet	
Adjacent Final Ground Elev:	4.00 feet		Footing Embedment:	4.0 feet =	1.22 meters
Design Footing Load:	600 kips		Applied Bearing Pressure:	0.50 ksf =	0.24 Bars
Footing Width, B =	31.6 feet =	9.64 meters	Unit Weight of Fill/Cut	130 pcf	
Footing Length, L =	31.6 feet =	9.64 meters	Additional Fill/Cut Pressure	0 ksf =	0.00 Bars

DILATOMETER SOUNDING DATA / SETTLEMENT COMPUTATIONS (Schmertmann's Ordinary Method)

Depth Z (Meters)	Material Index Id	Effective Stress SV (BAR)	Preconsolidation Pressure Pc (BAR)	OCR	Constrained Deformation Modulus M (BAR)	Soil Type	DMT Test Depth Below Footing (Meters)	Layer Midpoint Depth (Meters)	Layer Thickness (Meters)	Stress Factor	Delta Stress (BARS)	σ_f' (BARS)	$\sigma_f':p_c$ Ratio	Corner of Quarter SETTLEMENT (Meters)	Corner of Quarter SETTLEMENT (Inches)
0.30	1.70	0.057	0.0	0.0	266.0	SANDY SILT	0.00	0.00	0.00	0.000	0.000	0.06	0.00	0.00000	0.000
0.60	3.30	0.079	1.7	21.9	437.0	SAND	0.00	0.00	0.00	0.000	0.000	0.08	0.05	0.00000	0.000
0.90	2.02	0.103	1.8	17.3	268.0	SILTY SAND	0.00	0.00	0.00	0.000	0.000	0.10	0.06	0.00000	0.000
1.20	1.70	0.123	0.9	7.6	145.0	SANDY SILT	0.00	0.00	0.00	0.000	0.000	0.12	0.13	0.00000	0.000
1.50	2.72	0.144	1.2	8.1	264.0	SILTY SAND	0.28	0.29	0.43	0.250	0.060	0.20	0.17	0.00010	0.004
1.80	2.37	0.167	1.5	9.2	310.0	SILTY SAND	0.58	0.58	0.30	0.250	0.060	0.23	0.15	0.00006	0.002
2.10	2.02	0.191	1.1	5.6	189.0	SILTY SAND	0.88	0.88	0.30	0.249	0.060	0.25	0.23	0.00009	0.004
2.40	0.77	0.212	1.3	6.2	75.0	CLAYEY SILT	1.18	1.18	0.30	0.247	0.059	0.27	0.21	0.00024	0.009
2.70	0.04	0.228	1.3	5.7	4.0	MUD	1.48	1.48	0.30	0.245	0.059	0.29	0.22	0.00440	0.173
3.00	0.04	0.242	1.1	4.4	3.0	MUD	1.78	1.78	0.30	0.242	0.058	0.30	0.28	0.00579	0.228
3.30	0.04	0.257	0.9	3.6	3.0	MUD	2.08	2.08	0.30	0.238	0.057	0.31	0.34	0.00570	0.224
3.60	0.09	0.272	0.9	3.2	6.0	MUD	2.38	2.38	0.30	0.233	0.056	0.33	0.38	0.00279	0.110
3.90	0.07	0.287	1.2	4.1	6.0	MUD	2.68	2.68	0.30	0.227	0.054	0.34	0.29	0.00272	0.107
4.20	0.16	0.301	1.0	3.4	12.0	MUD	2.98	2.98	0.30	0.221	0.053	0.35	0.34	0.00132	0.052
4.50	0.16	0.316	1.0	3.1	12.0	MUD	3.28	3.28	0.30	0.214	0.051	0.37	0.38	0.00128	0.050
4.80	0.20	0.331	1.0	2.9	14.0	MUD	3.58	3.58	0.30	0.207	0.050	0.38	0.39	0.00106	0.042
5.10	0.81	0.347	1.2	3.3	69.0	CLAYEY SILT	3.88	3.88	0.30	0.199	0.048	0.39	0.34	0.00021	0.008
5.40	0.18	0.363	1.1	3.0	14.0	MUD	4.18	4.18	0.30	0.192	0.046	0.41	0.38	0.00098	0.039
5.70	0.07	0.378	1.1	3.0	6.0	MUD	4.48	4.48	0.30	0.184	0.044	0.42	0.37	0.00220	0.087
6.00	0.15	0.393	1.3	3.3	15.0	MUD	4.78	4.78	0.30	0.176	0.042	0.44	0.33	0.00084	0.033
6.30	0.28	0.409	1.2	3.0	26.0	CLAY	5.08	5.08	0.30	0.169	0.040	0.45	0.37	0.00047	0.018
6.60	0.19	0.425	1.2	2.9	17.0	MUD	5.38	5.38	0.30	0.161	0.039	0.46	0.37	0.00068	0.027
6.90	0.17	0.440	1.1	2.4	19.0	MUD	5.68	5.68	0.30	0.154	0.037	0.48	0.44	0.00085	0.034
7.20	0.17	0.454	1.4	3.0	17.0	MUD	5.98	5.98	0.30	0.147	0.035	0.49	0.36	0.00062	0.024
7.50	0.26	0.471	1.3	2.7	25.0	CLAY	6.28	6.28	0.30	0.140	0.034	0.50	0.39	0.00040	0.016
7.80	1.05	0.490	1.2	2.5	94.0	SILT	6.58	6.58	0.30	0.134	0.032	0.52	0.43	0.00010	0.004
8.10	0.50	0.509	1.0	2.0	35.0	SILTY CLAY	6.88	6.88	0.30	0.128	0.031	0.54	0.54	0.00026	0.010
8.40	0.03	0.525	1.3	2.5	3.0	MUD	7.18	7.18	0.30	0.122	0.029	0.56	0.43	0.00292	0.115
8.70	1.18	0.541	0.9	1.6	73.0	SILT	7.48	7.48	0.30	0.116	0.028	0.57	0.65	0.00011	0.005
9.00	0.22	0.560	3.4	6.1	56.0	CLAY	7.78	7.78	0.30	0.111	0.027	0.59	0.17	0.00014	0.006
9.30	1.43	0.583	4.2	7.2	412.0	SANDY SILT	8.08	8.08	0.30	0.106	0.025	0.61	0.15	0.00002	0.001
9.60	0.79	0.606	3.6	5.9	210.0	CLAYEY SILT	8.38	8.38	0.30	0.101	0.024	0.63	0.18	0.00003	0.001
9.90	0.73	0.630	3.0	4.8	165.0	CLAYEY SILT	8.68	8.68	0.30	0.097	0.023	0.65	0.21	0.00004	0.002
10.20	0.63	0.652	2.8	4.4	133.0	CLAYEY SILT	8.98	8.98	0.30	0.093	0.022	0.67	0.24	0.00005	0.002
10.50	0.64	0.672	2.8	4.2	134.0	CLAYEY SILT	9.28	9.28	0.30	0.089	0.021	0.69	0.25	0.00005	0.002
10.80	0.57	0.693	2.4	3.4	100.0	SILTY CLAY	9.58	9.58	0.30	0.085	0.020	0.71	0.30	0.00006	0.002
11.10	0.53	0.714	2.4	3.3	93.0	SILTY CLAY	9.88	9.88	0.30	0.081	0.019	0.73	0.31	0.00006	0.002
11.40	0.09	0.731	2.6	3.6	18.0	MUD	10.18	10.18	0.30	0.078	0.019	0.75	0.29	0.00031	0.012
11.70	0.15	0.747	2.1	2.8	22.0	CLAY	10.48	10.48	0.30	0.074	0.018	0.76	0.37	0.00024	0.010
12.00	0.14	0.765	1.8	2.4	18.0	CLAY	10.78	10.78	0.30	0.071	0.017	0.78	0.43	0.00029	0.011
12.30	0.15	0.783	2.0	2.5	21.0	CLAY	11.08	11.08	0.30	0.069	0.016	0.80	0.41	0.00023	0.009
12.60	0.80	0.802	2.0	2.5	118.0	CLAYEY SILT	11.38	11.38	0.30	0.066	0.016	0.82	0.40	0.00004	0.002
12.90	1.01	0.822	1.3	1.6	94.0	SILT	11.68	11.68	0.30	0.063	0.015	0.84	0.63	0.00005	0.002
13.20	0.92	0.843	1.5	1.8	99.0	SILT	11.98	11.98	0.30	0.061	0.015	0.86	0.57	0.00004	0.002
13.50	2.02	0.867	2.2	2.5	379.0	SILTY SAND	12.28	12.58	0.90	0.056	0.013	0.88	0.40	0.00003	0.001
13.80	3.26	0.893	0.7	0.8	249.0	SILTY SAND	12.58	12.58	0.30	0.056	0.013	0.91	1.26	0.00002	0.001
14.10	3.03	0.920	1.2	1.3	371.0	SILTY SAND	12.88	12.88	0.30	0.054	0.013	0.93	0.78	0.00001	0.000
14.40	2.14	0.948	4.6	4.8	869.0	SILTY SAND	13.18	13.18	0.30	0.052	0.012	0.96	0.21	0.00000	0.000
14.70	0.59	0.974	5.1	5.3	226.0	SILTY CLAY	13.48	13.48	0.30	0.050	0.012	0.99	0.19	0.00002	0.001
15.00	0.38	0.998	5.7	5.7	160.0	SILTY CLAY	13.78	13.78	0.30	0.048	0.012	1.01	0.18	0.00002	0.001
15.30	0.53	1.021	6.1	5.9	235.0	SILTY CLAY	14.08	14.08	0.30	0.047	0.011	1.03	0.17	0.00001	0.001
15.60	0.74	1.045	5.6	5.4	311.0	CLAYEY SILT	14.38	14.38	0.30	0.045	0.011	1.06	0.19	0.00001	0.000
											TOTAL SETTLEMENT			0.1519	5.98

SETTLEMENT COMPUTATIONS (Schmertmann's Special Method)

Depth Z (Meters)	OC/NC Description	σ_o' (BARS)	Delta Stress (BARS)	σ_f' (BARS)	m	Slope q OR b	$M\sigma_o'$ (BARS)	Mp_c (BARS)	$M\sigma_f'$ (BARS)	Corner of Quarter SETTLEMENT (Meters)	Corner of Quarter SETTLEMENT (Inches)
0.30	HOC	0.058	0.000	0.057	1114.151	2333.333				0.00000	0.000
0.60	HOC	0.080	0.000	0.079	1554.776	591.037				0.00000	0.000
0.90	HOC	0.104	0.000	0.103	835.057	312.951				0.00000	0.000
1.20	HOC	0.124	0.000	0.123	413.443	213.217				0.00000	0.000
1.50	HOC	0.145	0.060	0.204	695.701	321.588				0.00010	0.004
1.80	HOC	0.168	0.060	0.227	758.584	305.642				0.00006	0.002
2.10	HOC	0.192	0.060	0.251	432.459	209.037				0.00009	0.004
2.40	HOC	0.213	0.059	0.271	353.774	353.774				0.00024	0.009
2.70	HOC	0.229	0.059	0.287	17.544	17.544				0.00440	0.173
3.00	HOC	0.243	0.058	0.300	12.397	12.397				0.00579	0.228
3.30	HOC	0.258	0.057	0.314	11.673	11.673				0.00570	0.224
3.60	HOC	0.273	0.056	0.328	22.059	22.059				0.00279	0.110
3.90	HOC	0.288	0.054	0.341	20.906	20.906				0.00272	0.107
4.20	HOC	0.302	0.053	0.354	39.867	39.867				0.00132	0.052
4.50	HOC	0.317	0.051	0.367	37.975	37.975				0.00128	0.050
4.80	HOC	0.332	0.050	0.381	42.296	42.296				0.00106	0.042
5.10	HOC	0.348	0.048	0.395	198.847	198.847				0.00021	0.008
5.40	HOC	0.364	0.046	0.409	38.567	38.567				0.00098	0.039
5.70	HOC	0.379	0.044	0.422	15.873	15.873				0.00220	0.087
6.00	HOC	0.394	0.042	0.435	38.168	38.168				0.00084	0.033
6.30	HOC	0.410	0.040	0.449	63.570	63.570				0.00047	0.018
6.60	HOC	0.426	0.039	0.464	40.000	40.000				0.00068	0.027
6.90	HOC	0.441	0.037	0.477	29.546	29.546				0.00085	0.034
7.20	HOC	0.455	0.035	0.489	37.445	37.445				0.00062	0.024
7.50	HOC	0.472	0.034	0.505	53.079	53.079				0.00040	0.016
7.80	HOC	0.491	0.032	0.522	134.286	61.039				0.00010	0.004
8.10	HOC	0.510	0.031	0.540	68.762	68.762				0.00026	0.010
8.40	HOC	0.526	0.029	0.554	5.714	5.714				0.00292	0.115
8.70	HOC	0.542	0.028	0.569	99.249	53.203				0.00011	0.005
9.00	HOC	0.561	0.027	0.587	100.000	100.000				0.00014	0.006
9.30	HOC	0.584	0.025	0.608	539.589	131.981				0.00002	0.001
9.60	HOC	0.607	0.024	0.630	346.535	346.535				0.00003	0.001
9.90	HOC	0.631	0.023	0.653	261.905	261.905				0.00004	0.002
10.20	HOC	0.653	0.022	0.674	203.988	203.988				0.00005	0.002
10.50	HOC	0.673	0.021	0.693	199.405	199.405				0.00005	0.002
10.80	HOC	0.694	0.020	0.713	144.300	144.300				0.00006	0.002
11.10	HOC	0.715	0.019	0.733	130.252	130.252				0.00006	0.002
11.40	HOC	0.732	0.019	0.750	24.624	24.624				0.00031	0.012
11.70	HOC	0.748	0.018	0.765	29.451	29.451				0.00024	0.010
12.00	HOC	0.766	0.017	0.782	23.529	23.529				0.00029	0.011
12.30	HOC	0.784	0.016	0.799	26.820	26.820				0.00023	0.009
12.60	HOC	0.803	0.016	0.818	147.132	147.132				0.00004	0.002
12.90	HOC	0.823	0.015	0.837	103.679	45.121				0.00005	0.002
13.20	HOC	0.844	0.015	0.858	107.825	43.874				0.00004	0.002
13.50	HOC	0.868	0.013	0.880	407.033	137.211				0.00003	0.001
13.80	NC	0.894	0.013	0.906	263.496	139.418	249.000		250.870	0.00001	0.001
14.10	HOC	0.921	0.013	0.933	386.794	176.547				0.00001	0.000
14.40	HOC	0.949	0.012	0.960	892.515	208.979				0.00000	0.000
14.70	HOC	0.975	0.012	0.986	232.033	232.033				0.00002	0.001
15.00	HOC	0.999	0.012	1.010	160.321	160.321				0.00002	0.001
15.30	HOC	1.022	0.011	1.032	230.167	230.167				0.00001	0.001
15.60	HOC	1.046	0.011	1.056	297.608	297.608				0.00001	0.000
					TOTAL SETTLEMENT					0.1519	5.98

Note: Settlements were computed based on Dr. Schmertmann's Paper "Dilatometer to Compute Foundation Settlement", Use of In-Situ Tests in Geotechnical Engineering, ASCE, 1986.
Stress Distributions were computed using Boussinesq Solution for a point under corner rectangular area. (Ref. Settlement Analysis US Army Corps of Engineers, EM 1110-1-1904, 30 Sep 1990)
For the analysis, the center of the footing is represented as the corner of 4 equally sized smaller rectangles. Superposition was used, and the total settlement equals 4 times the sum of the settlement column ("Q" and "AB").

HILLIS-CARNES ENGINEERING ASSOCIATES, Inc.

503 Maryland Avenue, Unit 106 • Delmar, Maryland 21875
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Description of Soils – per ASTM D2487

Major Component	Component Type	Component Description	Symbol	Group Name
Coarse-Grained Soils, More than 50% is retained on the No. 200 sieve	**Gravels** – More than 50% of the coarse fraction is retained on the No. 4 sieve. Coarse = 1" to 3" Medium = ½" to 1" Fine = ¼" to ½"	Clean Gravels <5% Passing No. 200 sieve	**GW**	Well Graded Gravel
			GP	Poorly Graded Gravel
		Gravels with fines, >12% Passing the No. 200 sieve	**GM**	Silty Gravel
			GC	Clayey Gravel
	Sands – More than 50% of the coarse fraction passes the No. 4 sieve. Coarse = No.10 to No.4 Medium = No. 10 to No. 40 Fine = No. 40 to No. 200	Clean Sands <5% Passing No. 200 sieve	**SW**	Well Graded Sand
			SP	Poorly Graded Sand
		Sands with fines, >12% Passing the No. 200 sieve	**SM**	Silty Sand
			SC	Clayey Sand
Fine Grained Soils, More than 50% passes the No. 200 sieve	Silts and Clays Liquid Limit is less than 50 Low to medium plasticity	Inorganic	**ML**	Silt
			CL	Lean Clay
		Organic	**OL**	Organic silt
				Organic Clay
	Silts and Clays Liquid Limit of 50 or greater Medium to high plasticity	Inorganic	**MH**	Elastic Silt
			CH	Fat Clay
		Organic	**OH**	Organic Silt
				Organic Clay
Highly Organic Soils	Primarily Organic matter, dark color, organic odor		**PT**	Peat

Proportions of Soil Components

Component Form	Description	Approximate percent by weight
Noun	Sand, Gravel, Silt, Clay, etc.	50% or more
Adjective	Sandy, silty, clayey, etc.	35% to 49%
Some	Some sand, some silt, etc.	12% to 34%
Trace	Trace sand, trace mica, etc.	1% to 11%
With	With sand, with mica, etc.	Presence only

Particle Size Identification

Particle Size	Particle dimension
Boulder	12" diameter or more
Cobble	3" to 12" diameter
Gravel	¼" to 3" diameter
Sand	0.005" to ¼" diameter
Silt/Clay (fines)	Cannot see particle

Cohesive Soils

Field Description	No. of SPT Blows/ft	Consistency
Easily Molded in Hands	0 – 3	Very Soft
Easily penetrated several inches by thumb	4 – 5	Soft
Penetrated by thumb with moderate effort	6 – 10	Medium
Penetrated by thumb with great effort	11 – 30	Stiff
Indented by thumb only with great effort	Greater than 30	Hard

Granular Soils

No. of SPT Blows/ft	Relative Density
0 – 4	Very Loose
5 – 10	Loose
11 – 30	Medium Dense
31 – 50	Dense
Greater than 50	Very Dense

Other Definitions**:**

- **Fill:** Encountered soils that were placed by man. Fill soils may be controlled (engineered structural fill) or uncontrolled fills that may contain rubble and/or debris.
- **Saprolite**: Soil material derived from the in-place chemical and physical weathering of the parent rock material. May contain relic structure. Also called residual soils. Occurs in Piedmont soils, found west of the fall line.
- **Disintegrated Roc**k: Residual soil material with rock-like properties, very dense, N = 60 to 51/0".
- **Karst:** Descriptive term which denotes the potential for solutioning of the limestone rock and the development of sinkholes.
- **Alluvium:** Recently deposited soils placed by water action, typically stream or river floodplain soils.
- **Groundwater Level**: Depth within borehole where water is encountered either during drilling, or after a set period of time to allow groundwater conditions to reach equilibrium.
- **Caved Depth:** Depth at which borehole collapsed after removal of augers/casing. Indicative of loose soils and/or groundwater conditions**.**

Wetlands Delineation and U.S. Army Corps of Engineers Preliminary Jurisdictional Determination

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DEPARTMENT OF THE ARMY
US ARMY CORPS OF ENGINEERS
NORFOLK DISTRICT
FORT NORFOLK
803 FRONT STREET
NORFOLK VA 23510-1096

Reply to
Attention of
CENAO-WR-R

July 24, 2015

PRELIMINARY JURISDICTIONAL DETERMINATION

Eastern Virginia Regulatory Section
NAO-2015-0923 (Womans Bay, Bogues bay, Atlantic Ocean)

NASA Wallops Flight Facility
Attn: Joshua Bundick
34200 Fulton Street
Wallops Island, Virginia 23337

Dear Mr. Bundick:

This letter is in regard to your request for a preliminary jurisdictional determination for waters of the U.S. (including wetlands) on property known as NASA Wallops Island Tower Sites, located on two 35 acre study areas at NASA's Wallops Island Flight Facility, in Wallops Island, Virginia.

The maps entitled "Figure 4 Study Area 1 Waters of the U.S. Delineation Map, and Figure 5 Study Area 2 Waters of the U.S. Delineation Map", by VHB and Corps date stamped as received June 1, 2015 (*copies enclosed)* provides the locations of waters and/or wetlands on the study areas listed above. The basis for this delineation includes application of the Corps' 1987 Wetland Delineation Manual and Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Atlantic and Gulf Coastal Plain Region or Eastern Mountains and Piedmont Region and the positive indicators of wetland hydrology, hydric soils, and hydrophytic vegetation and the presence of an ordinary high water mark.

Discharges of dredged or fill material, including those associated with mechanized landclearing, into waters and/or wetlands on this site may require a Department of the Army permit and authorization by state and local authorities including a Virginia Water Protection Permit from the Virginia Department of Environmental Quality (DEQ), a permit from the Virginia Marine Resources Commission (VMRC) and/or a permit from your local wetlands board. This letter is a confirmation of the Corps preliminary jurisdiction for the waters and/or wetlands on the subject property and does not authorize any work in these areas. Please obtain all required permits before starting work in the delineated waters/wetland areas.

This is a preliminary jurisdictional determination and is therefore not a legally binding determination regarding whether Corps jurisdiction applies to the waters or wetlands in question. Accordingly, you may either consent to jurisdiction as set out in this preliminary jurisdictional determination and the attachments hereto if you agree with the determination, or you may request and obtain an approved jurisdictional determination.

This preliminary jurisdictional determination and associated wetland delineation map may be submitted with a permit application.

Enclosed is a copy of the "Preliminary Jurisdictional Determination Form". Please review the document, sign, and return one copy to Mr. Brian Denson, either via email (brian.c.denson@usace.army.mil) or via standard mail to US Army Corps of Engineers, Regulatory Office, and ATTN: Brian Denson, 803 Front Street Norfolk, Virginia 23510 within 30 days of receipt and keep one for your records. This delineation of waters and/or wetlands is valid for a period of five years from the date of this letter unless new information warrants revision prior to the expiration date.

If you have any questions, please contact me, either via telephone at (757) 201-7792 or via email at brian.c.denson@usace.army.mil.

Sincerely,

Brian Denson
Project Manager,
Environmental Scientist

Enclosure(s): Figures 4 and 5, Preliminary JD Form

Cc: NASA, VHB

0 200 400
SCALE IN FEET

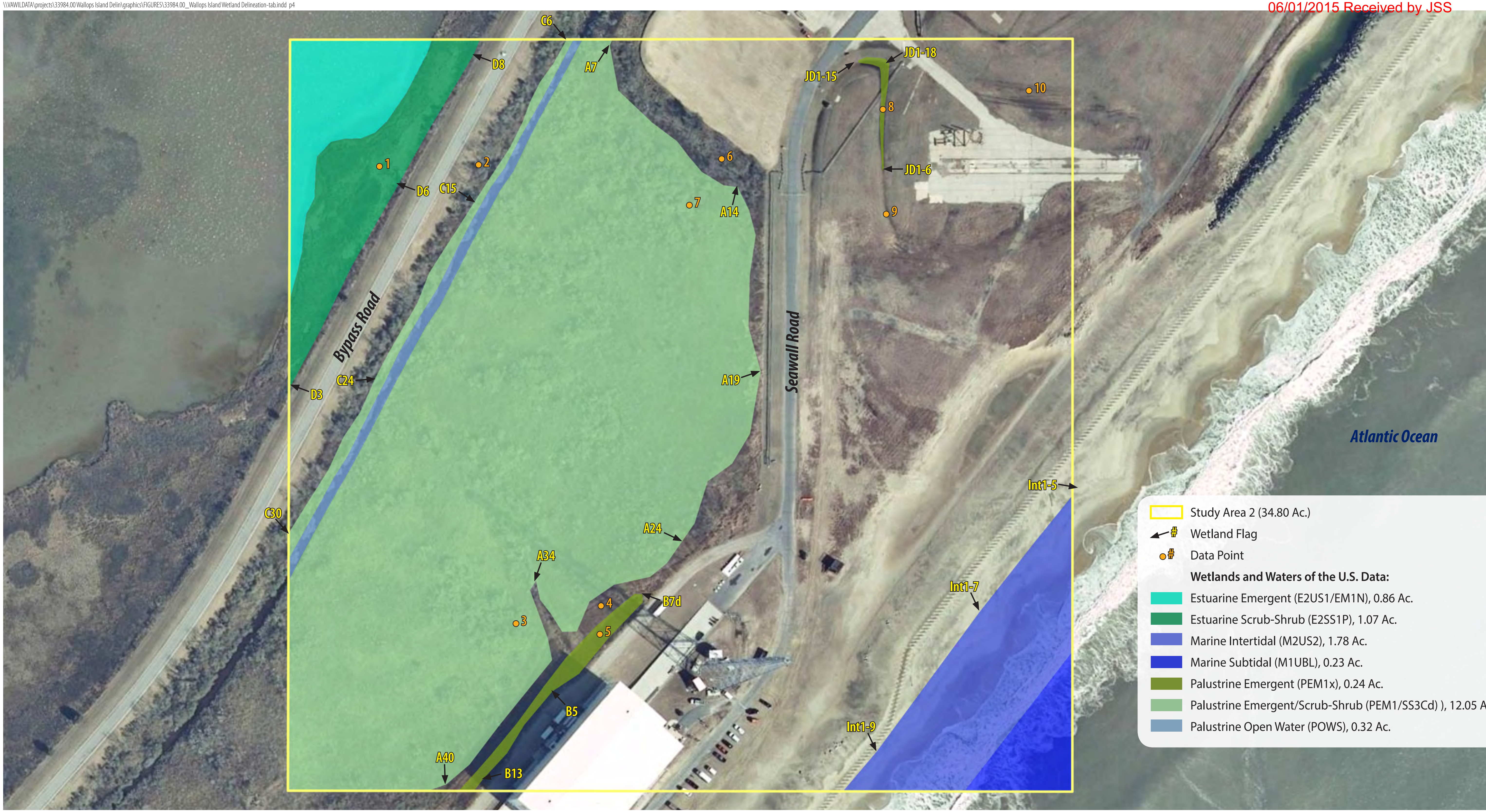
NASA WALLOPS ISLAND TOWER SITES

WATERS OF THE U.S. DELINEATION
ACCOMACK COUNTY, VIRGINIA

FIGURE 4
Study Area 1 Waters of the U.S. Delineation Map

USACE Norfolk District Regulatory
06/01/2015 Received by JSS

\\VAWILDATA\projects\33984.00 Wallops Island Delin\graphics\FIGURES\33984.00_Wallops Island Wetland Delineation-tab.indd p4



0 200 400
SCALE IN FEET

NASA WALLOPS ISLAND TOWER SITES

WATERS OF THE U.S. DELINEATION
ACCOMACK COUNTY, VIRGINIA

FIGURE 5
Study Area 2 Waters of the U.S. Delineation Map

June 1, 2015

Ref: 33984.00

Norfolk District - Regulatory Branch
U.S. Army Corps of Engineers
Regulator of the Day (ROD)
803 Front Street
Norfolk, Virginia 23510

DELIVERED VIA EMAIL

Re: Request for Preliminary Jurisdictional Determination
NASA Wallops Island Tower Sites, Accomack County, Virginia

Dear Norfolk District ROD,

On behalf of the National Aeronautics and Space Administration (NASA) Wallops Flight Facility, in cooperation with LJT & Associates, Inc., Vanasse Hangen Brustlin, Inc. (VHB) is requesting a Preliminary Jurisdictional Determination (PJD) within two study areas on Wallops Island in Accomack County, Virginia (Attachment 1: Figure 1). Each study area is approximately 35 acres in size and is being considered by NASA for suitability pertaining to tower construction. To assist in the completion of the PJD, VHB conducted a detailed delineation of Waters of the U.S. (WOUS), including wetlands, within each study area. Information required by the U.S. Army Corps of Engineers (USACE) to complete the PJD is provided below.

Methodology: VHB applied the technical criteria outlined in the *Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Atlantic and Gulf Coastal Plains Region (Version 2.0)* and associated guidance to identify jurisdictional boundaries within the project area (USACE 2010). Preliminary site research utilized soil types identified by Natural Resources Conservation Service (NRCS, Attachment 1: Figure 2) as well as features depicted on the U.S. Fish and Wildlife Service (USFWS) National Wetland Inventory (Attachment 1: Figure 3). Fieldwork was then conducted on April 22nd and 23rd of 2015, when precipitation and drought conditions were considered in the normal range. Data collection for USACE data sheets (Attachment 2) was conducted throughout each study area, and plants encountered during sampling were identified to species level using several regional references, with nomenclature following the 2014 National Wetland Plant List. Representative photographs were taken of the data observation points and are included as Attachment 3.

Site Description: Each approximate 35-acre study area is located on Wallops Island within the NASA Flight Facility property. Based on the NRCS Web Soil Survey (WSS), the study areas are predominantly underlain by several soil series, including Assateague fine sand, Beaches, Camocca fine sand, Chincoteague silt loam, Fisherman-Camocca complex, and Udorthents and Udipsamment soils (Attachment 1: Figure 2). The USFWS National Wetlands Inventory

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(NWI) mapping depicts a variety of palustrine and estuarine wetland types within and surrounding the study area, as well as marine systems associated with the Atlantic Ocean (Attachment 1: Figure 3).

The detailed wetland delineation conducted by VHB determined that WOUS, including wetlands, are present within each of the two study area. Based on classification standards included in Cowardin et al. (1979), VHB identified several types of estuarine, marine, and palustrine jurisdictional water resources (See Attachment 1, Figure 4 and 5; and Table 1 and 2 below).

Table 1: Summary of Jurisdictional Wetlands and Other Waters of the U.S. located within Study Area 1 of the NASA Wallops Island Tower Sites Project.

Resource Type	Area	Notes
Estuarine Emergent (E2EM1N)	0.19 Ac.	Edge of estuary north of Bypass Road
Marine Intertidal (M2US2)	0.08 Ac.	Intertidal beach of Atlantic Ocean
Palustrine Emergent (PEM1R)	0.66 Ac.	Edge of estuary north of Bypass Road
Palustrine Emergent/Scrub-Shrub (PEM1/SS3Cd)	14.77 Ac.	Mostly dominated by *Phragmites australis*
Palustrine Open Water (POWS)	0.35 Ac.	Receiving waters for most PEM/SS areas

Table 2: Summary of Jurisdictional Wetlands and Other Waters of the U.S. located within Study Area 2 of the NASA Wallops Island Tower Sites Project.

Resource Type	Area	Notes
Estuarine Emergent (E2US1/EM1N)	0.86 Ac.	Edge of estuary northeast of Bypass Road
Estuarine Scrub-Shrub (E2SS1P)	1.07 Ac.	Edge of estuary northeast of Bypass Road
Marine Intertidal (M2US2)	1.78 Ac.	Intertidal beach of Atlantic Ocean
Marine Subtidal (M1UBL)	0.23 Ac.	Subtidal edge of Atlantic Ocean
Palustrine Emergent (PEM1x)	0.24 Ac.	Jurisdictional ditches and excavated wetlands
Palustrine Emergent/Scrub-Shrub (PEM1/SS3Cd)	12.05 Ac.	Mostly dominated by *Phragmites australis*
Palustrine Open Water (POWS)	0.32 AC	Receiving waters for most PEM/SS areas

Data describing these resources are presented in the USACE data forms provided in Attachment 2 and representative photographs are provided in Attachment 3. The following paragraphs provide a brief description of each jurisdictional feature type, as well as non-wetland resources within each study area.

Estuarine WOUS - These wetlands identified by VHB are connected to the larger estuarine system located north and northeast of Bypass Road (Attachment 1; Figure 4 and 5). Within each study area, emergent and/or scrub-shrub habitats are located along the edge of the estuarine system. Typical vegetation includes eastern baccharis (*Baccharis halimifolia*), cordgrass (*Spartina* spp.), saltgrass (*Distichlis spicata*), and saltmeadow rush (*Juncus gerardii*). These wetland communities meet the three parameters required for a jurisdictional wetland determination, based on meeting multiple indicators for hydrophytic vegetation, hydric soils, and wetland hydrology.

Marine WOUS – Marine features within the study area are found along the Atlantic Ocean seaboard. Due to beach renourishment and natural processes, the intertidal beach zone appears typical of natural marine systems found along barrier islands. The transition to the subtidal zone is gradual and active beach erosion appears normal. These jurisdictional features meet the parameters required for marine classifications of WOUS.

Palustrine WOUS – The majority of wetlands identified within the study areas belong to the freshwater palustrine system. Palustrine emergent (EM) and scrub-shrub (SS) mosaics are the dominant wetland type; however most of the PEM/SS wetlands identified in Study Area 1 are dominated by dense, contiguous stands of common reed (*Phragmites australis*) bordered by wax myrtle communities along the wetland boundary. Study Area 2 has a greater density of wax myrtle and bayberry (*Morella pensylvanica*), but common reed also remains very dense. These wetland communities meet the three parameters required for a jurisdictional wetland determination, based on meeting multiple indicators for hydrophytic vegetation, hydric soils, and wetland hydrology. Palustrine open waters (POW) are also present paralleling Bypass Road, and provide the receiving waters for the PEM/SS wetland complex.

Further, several PEMx wetlands found in Study Area 1 also meet the three wetland parameters, but appear disconnected from the larger PEM/PSS complex. Past land use and excavation activities have likely influenced the conditions in these wetland areas, and typical wetland functions may therefore be reduced. Study Area 2 also has multiple wetland areas that are disconnected from the main PEM/SS complex. These wetlands are occasionally dominated by common reed, but some vegetation communities appear to be maintained and lack dense populations of reed. These PEM wetlands meet the three wetland parameters, and may have hydraulic inputs from both groundwater and precipitation.

Non-wetland Features - Non-wetland habitats identified by VHB within the project area generally include the following community types: 1) roads and nearby grass communities (maintained), 2) dunes, 3) elevated fill created by historic land use, and 4) natural upland buffers along the edge of PEM/SS wetland complexes. These non-wetland habitat are occasional found to meet 1 or 2 wetland parameters required for federal jurisdiction, but all three parameters are typically absent.

Confirmation Request - Included in this PJD request package are figures showing the GPS-location of the 2015 WOUS delineation (Attachment 1), USACE regional supplement data forms (Attachment 2), representative field photographs (Attachment 3), and a USACE Pre-application Request Form (Attachment 4). VHB would be happy to arrange an onsite meeting with you to review the WOUS delineation and to answer any questions you may have. In the interim, if you have any questions or require any additional information, please do not hesitate to contact me at (757) 220-0500, or via email at csenfield@vhb.com.

Sincerely,

Christopher R. Senfield, PWS, PWD

Wetland Scientist
csenfield@vhb.com

CC: Mr. Joshua Bundick, NASA Flight Facility (SENT VIA EMAIL)
Ms. Marianne Simko, LJT & Associates, Inc. (SENT VIA EMAIL)

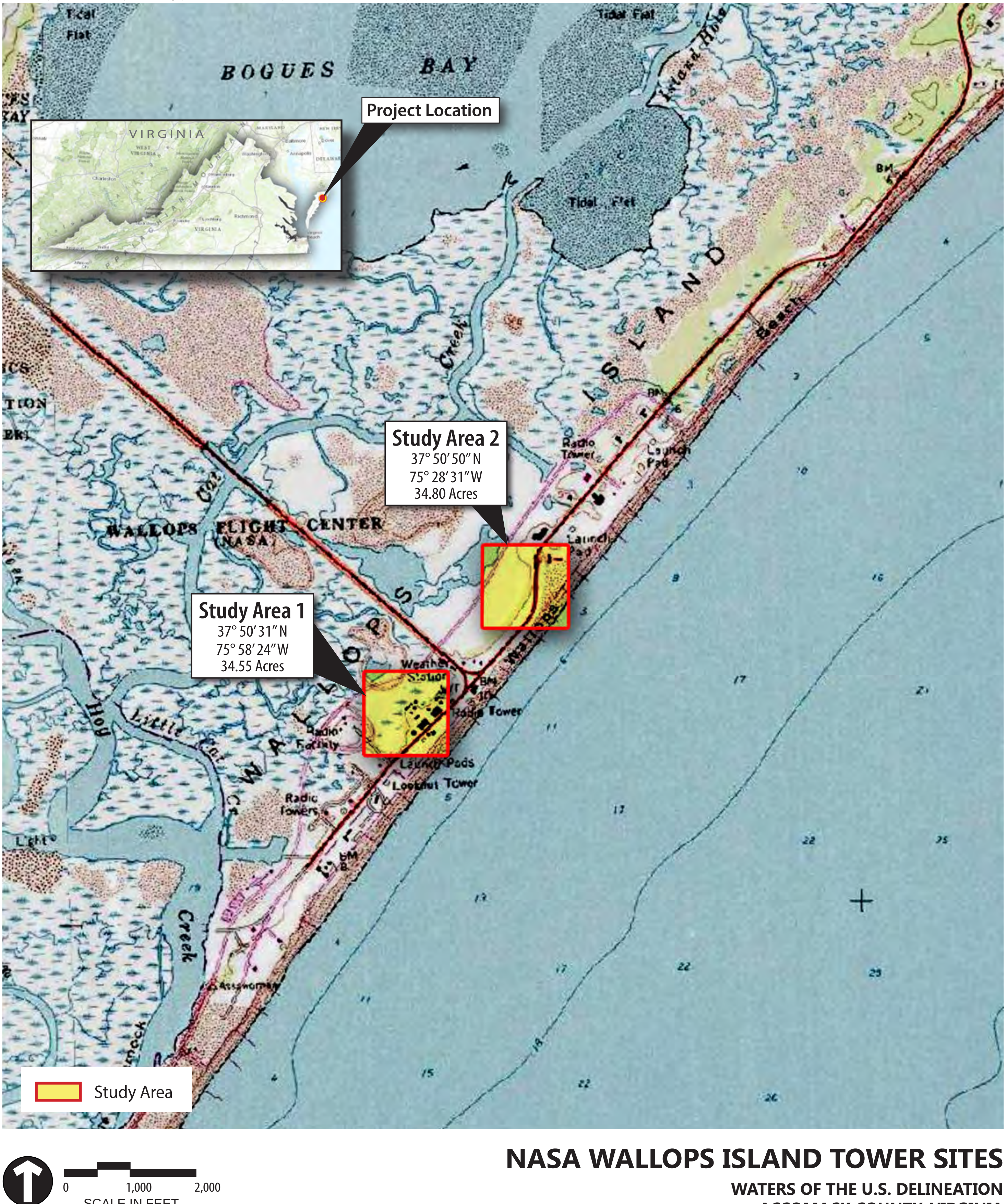
Reference Cited:

Cowardin, L. M., V. Carter, F. C. Golet, and E. T. LaRoe. 1979. *Classification of Wetlands and Deepwater Habitats of the United States*. U. S. Department of the Interior, Fish and Wildlife Service, Washington, D.C.

U.S. Army Corps of Engineers (USACE). 2010. *Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Atlantic and Gulf Coast Region* (Version 2.0). Wetland Regulatory Assistance Program. May.

Attachment 1

2015 Waters of the U.S. Delineation Figures



NASA WALLOPS ISLAND TOWER SITES

WATERS OF THE U.S. DELINEATION
ACCOMACK COUNTY, VIRGINIA

FIGURE 1
Project Location Map

NASA WALLOPS ISLAND TOWER SITES

WATERS OF THE U.S. DELINEATION
ACCOMACK COUNTY, VIRGINIA

FIGURE 2
NRCS Soil Map

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NASA WALLOPS ISLAND TOWER SITES

WATERS OF THE U.S. DELINEATION
ACCOMACK COUNTY, VIRGINIA

FIGURE 3
National Wetland Inventory Map

0 200 400
SCALE IN FEET

NASA WALLOPS ISLAND TOWER SITES

WATERS OF THE U.S. DELINEATION
ACCOMACK COUNTY, VIRGINIA

FIGURE 4
Study Area 1 Waters of the U.S. Delineation Map

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NASA WALLOPS ISLAND TOWER SITES

WATERS OF THE U.S. DELINEATION
ACCOMACK COUNTY, VIRGINIA

FIGURE 5
Study Area 2 Waters of the U.S. Delineation Map

Attachment 2

2015 USACE Data Sheets

VHB

WETLAND DETERMINATION DATA FORM - Atlantic and Gulf Coastal Plain Region

1

Project Site: **NASA Wallops Tower Site - Study Area 1** City/County: **Accomack County** Samp. Date: **4/23/2015**
Applicant/Owner: **LJT & Associates, Inc./NASA Wallops Island** State: **VA** Sampling Point: **1**
Investigator(s): **C. Senfield, PWS, PWD** Section, Township, Range: **NA**
Landform (hillslope, terrace, etc.): **Estuary** Local relief (concave, convex, none): **None** Slope (%): **0-1**
Subregion (LRR or MLRA): **LRR T, MLRA 153D** Lat: **37 50 31 N** Long: **75 58 24 W** Datum: **WGS 1984**
Soil Map Unit: **Chincoteague silt loam, 0 to 1 percent slopes, frequently flooded** NWI Map Unit: **E2EM1N**
Are climatic/hydrologic conditions on the site typical for this time of year? **Yes** (If no, explain in Remarks.)
Are Vegetation, Soil, or Hydrology significantly disturbed? **No** Normal Circumstances? **Yes**
Are Vegetation, Soil, or Hydrology naturally problematic? **No** (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS - Attach site map showing sample point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	**YES**	Is This Sample Area Within a Wetland? **YES**
Hydric Soil Present?	**YES**	
Wetland Hydrology Present?	**YES**	

Remarks:
All parameters are met. Area is classified as a estuarine emergent (E2EM) wetland. Observation point taken near flag F-6.

HYDROLOGY

Wetland Hydrology Indicators:
Primary Indicators (minimum of one is required; check all that apply)

	Surface Water (A1)		Aquatic Fauna (B13)		Surface Soil Cracks (B6)
X	High Water Table (A2)		Marl Deposits (B15)		Sparsely Vegetated Concave Surface (B8)
X	Saturation (A3)	X	Hydrogen Sulfide Odor (C1)		Drainage Patterns (B10)
	Water Marks (B1)		Oxidized Rhizospheres on Living Roots (C3)		Moss Trim Lines (B16)
	Sediment Deposits (B2)		Presence of Reduced Iron (C4)		Dry-Season Water Table (C2)
	Drift Deposits (B3)		Recent Iron Reduction in Tilled Soils (C6)		Crayfish Burrows (C8)
	Algal Mat or Crust (B4)		Thin Muck Surface (C7)		Saturation Visible on Aerial Imagery (C9)
	Iron Deposits (B5)		Other (Explain in Remarks)		Geomorphic Position (D2)
	Inundation Visible on Aerial (B7)				Shallow Aquitard (D3)
	Water-Stained Leaves (B9)				FAC-Neutral Test (D5)
					Sphagnum Moss (D8)

Secondary Indicators (minimum of two required)

Field Observations:

Surface Water Present?		Depth (inches):		Wetland Hydrology Present? **YES**
Water Table Present?	**YES**	Depth (inches):	**SURFACE**	
Saturation Present?	**YES**	Depth (inches):	**SURFACE**	

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:
Primary indicators of wetland hydrology present; parameter is met.

SOIL

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth	Matrix		Redox Features					
(in)	Color (moist)	%	Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-5	**10YR 3/2**	**100**					**mucky peat**	
5-15	**10YR 3/1**	**100**					**muck**	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, MS=Masked Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

X	Histosol (A1)		Dark Surface (S7)
	Histic Epipedon (A2)		Polyvalue Below Surface (S8)
	Black Histic (A3)		Thin Dark Surface (S9)
	Hydrogen Sulfide (A4)		Loamy Gleyed Matrix (F2)
	Stratified Layers (A5)		Depleted Matrix (F3)
	Organic Bodies (A6)		Redox Dark Surface (F6)
	5cm Mucky Mineral (A7)		Depleted Dark Surface (F7)
	1cm Muck (A9)		Redox Depressions (F8)
	Depleted Below Dark Surface (A11)		Iron-Manganese Masses (F12)
	Thick Dark Surface (A12)		Umbric Surface (F13)
	Sandy Gleyed Matrix (S4)		Piedmont Floodplain Soils (F19)
	Sandy Redox (S5)		Anomalous Bright Loamy Soils (F20)
	Stripped Matrix (S6)		

Indicators for Problematic Hydric Soils[3]:

	2 cm Muck (A10)
	Piedmont Floodplain Soils (F19)
	Anomalous Bright Loamy Soils (F20)
	Red Parent Material (F21)
	Very Shallow Dark Surface (TF12)
	Other (Explain in Remarks)

[3] Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):
Type:
Depth (inches):

Hydric Soil Present? **YES**

Remarks:
Indicator A1 (Histosol) present and soil meets NTCHS definition of hydric soil; parameter is met.

VEGETATION - Use scientific names of plants. VHB Sampling Point: **1**

Tree Stratum (Plot size: **30' radius**)	Absolute % Cover	Dom. Sp?	Indicator Status
1.			
2.			
3.			
4.			
5.			
6.			
7.			
		= Total Cover	

Sapling Stratum (Plot size: **30' radius**)	Absolute % Cover	Dom. Sp?	Indicator Status
1.			
2.			
3.			
4.			
5.			
6.			
7.			
		= Total Cover	

Shrub Stratum (Plot size: **15' radius**)	Absolute % Cover	Dom. Sp?	Indicator Status
1.			
2.			
3.			
4.			
5.			
6.			
7.			
		= Total Cover	

Herb Stratum (Plot size: **10' radius**)	Absolute % Cover	Dom. Sp?	Indicator Status
1. **Spartina patens**	**63**	**X**	**FACW**
2. **Distichlis spicata**	**38**	**X**	**OBL**
3. **Juncus gerardii**	**15**		**OBL**
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
12.			
	116	= Total Cover	

Woody Vines (Plot size: **30' radius**)	Absolute % Cover	Dom. Sp?	Indicator Status
1.			
2.			
3.			
4.			
5.			
		= Total Cover	

Dominance Test Worksheet:

# Dominants OBL, FACW, FAC:	**2**	(A)
# Dominants across all strata:	**2**	(B)
% Dominants OBL, FACW, FAC:	**100%**	(A/B)

Prevalence Index Worksheet:

Total % Cover of:			Multiply By:	
OBL	**53**	x 1 =	**53**	
FACW	**63**	x 2 =	**126**	
FAC		x 3 =		
FACU		x 4 =		
UPL		x 5 =		
Sum:	**116** (A)		**179**	(B)
Prevalence Index		= B/A =	**1.54**	

Hydrophytic Vegetation Indicators:

- **X** Dominance Test is > 50%
- **X** Prevalence Index is <= 3.0
- ___ Problematic Hydrophytic Vegetation[1] (explain)
- ___ Rapid Test for Hydrophytic Vegetation
- ___ Morphological Adaptations

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definitions of Vegetation Strata:

Tree - Woody plants, excluding woody vines, approximately 20ft (6m) or more in height and 3in (7.6cm) or larger in diameter at breast height (DBH).

Sapling - Woody plants, excluding woody vines, approximately 20ft (6m) or more in height and less than 3in (7.6cm) DBH.

Shrub - Woody plants, excluding woody vines, approximately 3 to 20ft (1 to 6m) in height.

Herb - All herbaceous (non-woody) plants, including herbaceous vines, regardless of size. Includes woody plants, except woody vines, less than approximately 3ft (1m) in height.

Woody vine - All woody vines, regardless of height.

Hydrophytic Vegetation Present? **YES**

Remarks: (If observed, list morphological adaptations below).

Indicator 1 (Rapid Test) present due to dominance of FACW or OBL species.

Other indicators calculated for reference only.

WETLAND DETERMINATION DATA FORM - Atlantic and Gulf Coastal Plain Region

Project Site: NASA Wallops Tower Site - Study Area 1 City/County: Accomack County Samp. Date: 4/23/2015
Applicant/Owner: LJT & Associates, Inc./NASA Wallops Island State: VA Sampling Point: 2
Investigator(s): C. Senfield, PWS, PWD Section, Township, Range: NA
Landform (hillslope, terrace, etc.): Terrace Local relief (concave, convex, none): Convex Slope (%): 0-1
Subregion (LRR or MLRA): LRR T, MLRA 153D Lat: 37 50 31 N Long: 75 58 24 W Datum: WGS 1984
Soil Map Unit: Udorthent and Udipsamment soils, 0 to 30 percent slopes NWI Map Unit: None
Are climatic/hydrologic conditions on the site typical for this time of year? Yes (If no, explain in Remarks.)
Are Vegetation, Soil, or Hydrology significantly disturbed? No Normal Circumstances? Yes
Are Vegetation, Soil, or Hydrology naturally problematic? No (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS - Attach site map showing sample point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	YES	Is This Sample Area Within a Wetland? NO
Hydric Soil Present?	NO	
Wetland Hydrology Present?	NO	

Remarks: **One or more parameters lacking. Area is not a jurisdictional wetland.**
Observation point taken in upland shrub community near flag G-13.

HYDROLOGY

Wetland Hydrology Indicators:
Primary Indicators (minimum of one is required; check all that apply)

___ Surface Water (A1)
___ High Water Table (A2)
___ Saturation (A3)
___ Water Marks (B1)
___ Sediment Deposits (B2)
___ Drift Deposits (B3)
___ Algal Mat or Crust (B4)
___ Iron Deposits (B5)
___ Inundation Visible on Aerial (B7)
___ Water-Stained Leaves (B9)
___ Aquatic Fauna (B13)
___ Marl Deposits (B15)
___ Hydrogen Sulfide Odor (C1)
___ Oxidized Rhizospheres on Living Roots (C3)
___ Presence of Reduced Iron (C4)
___ Recent Iron Reduction in Tilled Soils (C6)
___ Thin Muck Surface (C7)
___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

___ Surface Soil Cracks (B6)
___ Sparsely Vegetated Concave Surface (B8)
___ Drainage Patterns (B10)
___ Moss Trim Lines (B16)
___ Dry-Season Water Table (C2)
___ Crayfish Burrows (C8)
___ Saturation Visible on Aerial Imagery (C9)
___ Geomorphic Position (D2)
___ Shallow Aquitard (D3)
___ FAC-Neutral Test (D5)
___ Sphagnum Moss (D8)

Field Observations:
Surface Water Present? ___ Depth (inches): ___
Water Table Present? ___ Depth (inches): ___
Saturation Present? Depth (inches):

Wetland Hydrology Present? NO

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks: **No primary or secondary indicators of wetland hydrology present; parameter is not met.**

SOIL

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth	Matrix		Redox Features					
(in)	Color (moist)	%	Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-5	10YR 3/3	100					sandy loam	
5-16	10YR 4/4	100					sandy loam	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, MS=Masked Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

___ Histosol (A1)
___ Histic Epipedon (A2)
___ Black Histic (A3)
___ Hydrogen Sulfide (A4)
___ Stratified Layers (A5)
___ Organic Bodies (A6)
___ 5cm Mucky Mineral (A7)
___ 1cm Muck (A9)
___ Depleted Below Dark Surface (A11)
___ Thick Dark Surface (A12)
___ Sandy Gleyed Matrix (S4)
___ Sandy Redox (S5)
Stripped Matrix (S6)
___ Dark Surface (S7)
___ Polyvalue Below Surface (S8)
___ Thin Dark Surface (S9)
___ Loamy Gleyed Matrix (F2)
___ Depleted Matrix (F3)
___ Redox Dark Surface (F6)
___ Depleted Dark Surface (F7)
___ Redox Depressions (F8)
___ Iron-Manganese Masses (F12)
___ Umbric Surface (F13)
___ Piedmont Floodplain Soils (F19)
___ Anomalous Bright Loamy Soils (F20)

Indicators for Problematic Hydric Soils[3]:

___ 2 cm Muck (A10)
___ Piedmont Floodplain Soils (F19)
___ Anomalous Bright Loamy Soils (F20)
___ Red Parent Material (F21)
___ Very Shallow Dark Surface (TF12)
___ Other (Explain in Remarks)

[3] Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):
Type: ___
Depth (inches): ___

Hydric Soil Present? NO

Remarks: **No hydric soil indicators present and soil does not meet NTCHS definition of hydric soil; parameter is not met.**

VEGETATION - Use scientific names of plants. VHB Sampling Point: **2**

Tree Stratum (Plot size: **30' radius**)	Absolute % Cover	Dom. Sp?	Indicator Status
1.			
2.			
3.			
4.			
5.			
6.			
7.			
		= Total Cover	
Sapling Stratum (Plot size: **30' radius**)			
1.			
2.			
3.			
4.			
5.			
6.			
7.			
		= Total Cover	
Shrub Stratum (Plot size: **15' radius**)			
1. **Morella cerifera**	**63**	**X**	**FAC**
2. **Toxicodendron radicans**	**15**		**FAC**
3. **Rhus copallinum**	**15**		**UPL**
4. **Juniperus virginiana**	**15**		**FACU**
5.			
6.			
7.			
	108	= Total Cover	
Herb Stratum (Plot size: **10' radius**)			
1. **Lonicera japonica**	**15**	**X**	**FACU**
2. **Phragmites australis**	**15**	**X**	**FACW**
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
12.			
	30	= Total Cover	
Woody Vines (Plot size: **30' radius**)			
1. **Smilax rotundifolia**	**38**	**X**	**FAC**
2. **Lonicera japonica**	**15**	**X**	**FACU**
3.			
4.			
5.			
	53	= Total Cover	

Dominance Test Worksheet:

# Dominants OBL, FACW, FAC:	**3**	(A)
# Dominants across all strata:	**5**	(B)
% Dominants OBL, FACW, FAC:	**60%**	(A/B)

Prevalence Index Worksheet:

Total % Cover of:		Multiply By:	
OBL		x 1 =	
FACW	**15**	x 2 =	**30**
FAC	**116**	x 3 =	**348**
FACU	**45**	x 4 =	**180**
UPL	**15**	x 5 =	**75**
Sum:	**191** (A)		**633** (B)

Prevalence Index = B/A = **3.31**

Hydrophytic Vegetation Indicators:

- **X** Dominance Test is > 50%
- ___ Prevalence Index is <= 3.0
- ___ Problematic Hydrophytic Vegetation[1] (explain)
- ___ Rapid Test for Hydrophytic Vegetation
- ___ Morphological Adaptations

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definitions of Vegetation Strata:

Tree - Woody plants, excluding woody vines, approximately 20ft (6m) or more in height and 3in (7.6cm) or larger in diameter at breast height (DBH).

Sapling - Woody plants, excluding woody vines, approximately 20ft (6m) or more in height and less than 3in (7.6cm) DBH.

Shrub - Woody plants, excluding woody vines, approximately 3 to 20ft (1 to 6m) in height.

Herb - All herbaceous (non-woody) plants, including herbaceous vines, regardless of size. Includes woody plants, except woody vines, less than approximately 3ft (1m) in height.

Woody vine - All woody vines, regardless of height.

Hydrophytic Vegetation Present? **YES**

Remarks: (If observed, list morphological adaptations below).

Indicator 2 (Dominance Test) present with >50% of dominant species across all vegetation strata FAC or wetter.

Other indicators calculated for reference only.

WETLAND DETERMINATION DATA FORM - Atlantic and Gulf Coastal Plain Region

Project Site: **NASA Wallops Tower Site - Study Area 1** City/County: **Accomack County** Samp. Date: **4/23/2015**
Applicant/Owner: **LJT & Associates, Inc./NASA Wallops Island** State: **VA** Sampling Point: **3**
Investigator(s): **C. Senfield, PWS, PWD** Section, Township, Range: **NA**
Landform (hillslope, terrace, etc.): **Natural Dome** Local relief (concave, convex, none): **Convex** Slope (%): **0-1**
Subregion (LRR or MLRA): **LRR T, MLRA 153D** Lat: **37 50 31 N** Long: **75 58 24 W** Datum: **WGS 1984**
Soil Map Unit: **Chincoteague silt loam, 0 to 1 percent slopes, frequently flooded** NWI Map Unit: **None**
Are climatic/hydrologic conditions on the site typical for this time of year? **Yes** (If no, explain in Remarks.)
Are Vegetation, Soil, or Hydrology significantly disturbed? **No** Normal Circumstances? **Yes**
Are Vegetation, Soil, or Hydrology naturally problematic? **No** (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS - Attach site map showing sample point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	NO	Is This Sample Area Within a Wetland? **NO**
Hydric Soil Present?	NO	
Wetland Hydrology Present?	NO	

Remarks: **One or more parameters lacking. Area is not a jurisdictional wetland.**
Observation point taken in upland forest community on uplan island "H".

HYDROLOGY

Wetland Hydrology Indicators:
Primary Indicators (minimum of one is required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Inundation Visible on Aerial (B7)
- ___ Water-Stained Leaves (B9)
- ___ Aquatic Fauna (B13)
- ___ Marl Deposits (B15)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres on Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Drainage Patterns (B10)
- ___ Moss Trim Lines (B16)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ FAC-Neutral Test (D5)
- ___ Sphagnum Moss (D8)

Field Observations:
Surface Water Present? ___ Depth (inches): ___
Water Table Present? ___ Depth (inches): ___
Saturation Present? Depth (inches):

Wetland Hydrology Present? **NO**

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks: **No primary or secondary indicators of wetland hydrology present; parameter is not met.**

SOIL

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (in)	Matrix Color (moist)	Matrix %	Redox Color (moist)	Redox %	Type[1]	Loc[2]	Texture	Remarks
0-3	10YR 3/2	100					loamy sand	
3-16	10YR 4/3	100					sand	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, MS=Masked Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5)
- ___ Organic Bodies (A6)
- ___ 5cm Mucky Mineral (A7)
- ___ 1cm Muck (A9)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Dark Surface (S7)
- ___ Polyvalue Below Surface (S8)
- ___ Thin Dark Surface (S9)
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)
- ___ Iron-Manganese Masses (F12)
- ___ Umbric Surface (F13)
- ___ Piedmont Floodplain Soils (F19)
- ___ Anomalous Bright Loamy Soils (F20)

Indicators for Problematic Hydric Soils[3]:

- ___ 2 cm Muck (A10)
- ___ Piedmont Floodplain Soils (F19)
- ___ Anomalous Bright Loamy Soils (F20)
- ___ Red Parent Material (F21)
- ___ Very Shallow Dark Surface (TF12)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):
Type:
Depth (inches):

Hydric Soil Present? **NO**

Remarks: **No hydric soil indicators present and soil does not meet NTCHS definition of hydric soil; parameter is not met.**

VEGETATION - Use scientific names of plants. Sampling Point: 3

Tree Stratum (Plot size: 30' radius)	Absolute % Cover	Dom. Sp?	Indicator Status
1. Prunus serotina	63	X	FACU
2.			
3.			
4.			
5.			
6.			
7.			
	63	= Total Cover	
Sapling Stratum (Plot size: 30' radius)			
1. Prunus serotina	15	X	FACU
2.			
3.			
4.			
5.			
6.			
7.			
	15	= Total Cover	
Shrub Stratum (Plot size: 15' radius)			
1. Juniperus virginiana	15	X	FACU
2. Prunus serotina	15	X	FACU
3.			
4.			
5.			
6.			
7.			
	30	= Total Cover	
Herb Stratum (Plot size: 10' radius)			
1. Smilax rotundifolia	38	X	FAC
2. Andropogon virginicus	38	X	FAC
3. Panicum virgatum	15		FAC
4. Achillea millefolium	3		FACU
5. Plantago lanceolata	3		FACU
6.			
7.			
8.			
9.			
10.			
11.			
12.			
	97	= Total Cover	
Woody Vines (Plot size: 30' radius)			
1.			
2.			
3.			
4.			
5.			
		= Total Cover	

Dominance Test Worksheet:

# Dominants OBL, FACW, FAC:	2	(A)
# Dominants across all strata:	6	(B)
% Dominants OBL, FACW, FAC:	33%	(A/B)

Prevalence Index Worksheet:

Total % Cover of:			Multiply By:
OBL		x 1 =	
FACW		x 2 =	
FAC	91	x 3 =	273
FACU	114	x 4 =	456
UPL		x 5 =	
Sum:	205 (A)		729 (B)

Prevalence Index = B/A = 3.56

Hydrophytic Vegetation Indicators:

___ Dominance Test is > 50%
___ Prevalence Index is <= 3.0
___ Problematic Hydrophytic Vegetation[1] (explain)
___ Rapid Test for Hydrophytic Vegetation
___ Morphological Adaptations

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definitions of Vegetation Strata:

Tree - Woody plants, excluding woody vines, approximately 20ft (6m) or more in height and 3in (7.6cm) or larger in diameter at breast height (DBH).

Sapling - Woody plants, excluding woody vines, approximately 20ft (6m) or more in height and less than 3in (7.6cm) DBH.

Shrub - Woody plants, excluding woody vines, approximately 3 to 20ft (1 to 6m) in height.

Herb - All herbaceous (non-woody) plants, including herbaceous vines, regardless of size. Includes woody plants, except woody vines, less than approximately 3ft (1m) in height.

Woody vine - All woody vines, regardless of height.

Hydrophytic Vegetation Present? NO

Remarks: (If observed, list morphological adaptations below).

No hydrophytic vegetation indicators present; parameter is not met.

WETLAND DETERMINATION DATA FORM - Atlantic and Gulf Coastal Plain Region

4

Project Site:	NASA Wallops Tower Site - Study Area 1	City/County:	Accomack County	Samp. Date:	4/23/2015
Applicant/Owner:	LJT & Associates, Inc./NASA Wallops Island	State:	VA	Sampling Point:	4
Investigator(s):	C. Senfield, PWS, PWD	Section, Township, Range:	NA		
Landform (hillslope, terrace, etc.):	Maintained Field	Local relief (concave, convex, none):	None	Slope (%):	0-1
Subregion (LRR or MLRA):	LRR T, MLRA 153D	Lat: 37 50 31 N	Long: 75 58 24 W	Datum:	WGS 1984
Soil Map Unit:	Camocca fine sand, 0 to 2 percent slopes, frequently flooded			NWI Map Unit:	None

Are climatic/hydrologic conditions on the site typical for this time of year? **Yes** (If no, explain in Remarks.)

Are Vegetation, Soil, or Hydrology significantly disturbed? **No** Normal Circumstances? **Yes**

Are Vegetation, Soil, or Hydrology naturally problematic? **No** (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS - Attach site map showing sample point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	YES	Is This Sample Area Within a Wetland? **NO**
Hydric Soil Present?	NO	
Wetland Hydrology Present?	NO	

Remarks: **One or more parameters lacking. Area is not a jurisdictional wetland.**
Observation point taken in upland field near flag A-47.

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

Surface Water (A1)	Aquatic Fauna (B13)
High Water Table (A2)	Marl Deposits (B15)
Saturation (A3)	Hydrogen Sulfide Odor (C1)
Water Marks (B1)	Oxidized Rhizospheres on Living Roots (C3)
Sediment Deposits (B2)	Presence of Reduced Iron (C4)
Drift Deposits (B3)	Recent Iron Reduction in Tilled Soils (C6)
Algal Mat or Crust (B4)	Thin Muck Surface (C7)
Iron Deposits (B5)	Other (Explain in Remarks)
Inundation Visible on Aerial (B7)	
Water-Stained Leaves (B9)	

Secondary Indicators (minimum of two required)

- Surface Soil Cracks (B6)
- Sparsely Vegetated Concave Surface (B8)
- Drainage Patterns (B10)
- Moss Trim Lines (B16)
- Dry-Season Water Table (C2)
- Crayfish Burrows (C8)
- Saturation Visible on Aerial Imagery (C9)
- Geomorphic Position (D2)
- Shallow Aquitard (D3)
- FAC-Neutral Test (D5)
- Sphagnum Moss (D8)

Field Observations:

Surface Water Present? Depth (inches):

Water Table Present? Depth (inches):

Saturation Present? Depth (inches):

Wetland Hydrology Present? **NO**

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks: **No primary or secondary indicators of wetland hydrology present; parameter is not met.**

SOIL

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth	Matrix		Redox Features					
(in)	Color (moist)	%	Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-3	10YR 3/1	100					sandy loam	
3-7	10YR 4/3	90	7.5YR 5/6	10	C	M	loamy sand	
7-16	10YR 4/2	80	7.5YR 5/6	20	C	M	loamy sand	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, MS=Masked Sand Grains.
[2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

Histosol (A1)	Dark Surface (S7)
Histic Epipedon (A2)	Polyvalue Below Surface (S8)
Black Histic (A3)	Thin Dark Surface (S9)
Hydrogen Sulfide (A4)	Loamy Gleyed Matrix (F2)
Stratified Layers (A5)	Depleted Matrix (F3)
Organic Bodies (A6)	Redox Dark Surface (F6)
5cm Mucky Mineral (A7)	Depleted Dark Surface (F7)
1cm Muck (A9)	Redox Depressions (F8)
Depleted Below Dark Surface (A11)	Iron-Manganese Masses (F12)
Thick Dark Surface (A12)	Umbric Surface (F13)
Sandy Gleyed Matrix (S4)	Piedmont Floodplain Soils (F19)
Sandy Redox (S5)	Anomalous Bright Loamy Soils (F20)
Stripped Matrix (S6)	

Indicators for Problematic Hydric Soils[3]:

- 2 cm Muck (A10)
- Piedmont Floodplain Soils (F19)
- Anomalous Bright Loamy Soils (F20)
- Red Parent Material (F21)
- Very Shallow Dark Surface (TF12)
- Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):
Type:
Depth (inches):

Hydric Soil Present? **NO**

Remarks: **No hydric soil indicators present and soil does not meet NTCHS definition of hydric soil; parameter is not met.**

VEGETATION - Use scientific names of plants.

Sampling Point: 4

	Absolute % Cover	Dom. Sp?	Indicator Status
Tree Stratum (Plot size: 30' radius)			
1.			
2.			
3.			
4.			
5.			
6.			
7.			
= Total Cover			
Sapling Stratum (Plot size: 30' radius)			
1.			
2.			
3.			
4.			
5.			
6.			
7.			
= Total Cover			
Shrub Stratum (Plot size: 15' radius)			
1.			
2.			
3.			
4.			
5.			
6.			
7.			
= Total Cover			
Herb Stratum (Plot size: 10' radius)			
1. **Schedonorus arundinaceus**	**85**	**X**	**FAC**
2. **Poa pratensis**	**15**		**FACU**
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
12.			
= Total Cover	**100**		
Woody Vines (Plot size: 30' radius)			
1.			
2.			
3.			
4.			
5.			
= Total Cover			

Dominance Test Worksheet:

Dominants OBL, FACW, FAC: **1** (A)

Dominants across all strata: **1** (B)

% Dominants OBL, FACW, FAC: **100%** (A/B)

Prevalence Index Worksheet:

Total % Cover of:			Multiply By:
OBL		x 1 =	
FACW		x 2 =	
FAC	**85**	x 3 =	**255**
FACU	**15**	x 4 =	**60**
UPL		x 5 =	
Sum:	**100** (A)		**315** (B)

Prevalence Index = B/A = **3.15**

Hydrophytic Vegetation Indicators:

- **X** Dominance Test is > 50%
- ___ Prevalence Index is <= 3.0
- ___ Problematic Hydrophytic Vegetation[1] (explain)
- ___ Rapid Test for Hydrophytic Vegetation
- ___ Morphological Adaptations

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definitions of Vegetation Strata:

Tree - Woody plants, excluding woody vines, approximately 20ft (6m) or more in height and 3in (7.6cm) or larger in diameter at breast height (DBH).

Sapling - Woody plants, excluding woody vines, approximately 20ft (6m) or more in height and less than 3in (7.6cm) DBH.

Shrub - Woody plants, excluding woody vines, approximately 3 to 20ft (1 to 6m) in height.

Herb - All herbaceous (non-woody) plants, including herbaceous vines, regardless of size. Includes woody plants, except woody vines, less than approximately 3ft (1m) in height.

Woody vine - All woody vines, regardless of height.

Hydrophytic Vegetation Present? **YES**

Remarks: (If observed, list morphological adaptations below).

Indicator 2 (Dominance Test) present with >50% of dominant species across all vegetation strata FAC or wetter.

Other indicators calculated for reference only.

VHB

WETLAND DETERMINATION DATA FORM - Atlantic and Gulf Coastal Plain Region

Project Site: **NASA Wallops Tower Site - Study Area 1** City/County: **Accomack County** Samp. Date: **4/23/2015**

Applicant/Owner: **LJT & Associates, Inc./NASA Wallops Island** State: **VA** Sampling Point: **5**

Investigator(s): **C. Senfield, PWS, PWD** Section, Township, Range: **NA**

Landform (hillslope, terrace, etc.): **Depression** Local relief (concave, convex, none): **Concave** Slope (%): **0-1**

Subregion (LRR or MLRA): **LRR T, MLRA 153D** Lat: **37 50 31 N** Long: **75 58 24 W** Datum: **WGS 1984**

Soil Map Unit: **Camocca fine sand, 0 to 2 percent slopes, frequently flooded** NWI Map Unit: **None**

Are climatic/hydrologic conditions on the site typical for this time of year? **Yes** (If no, explain in Remarks.)

Are Vegetation, Soil, or Hydrology significantly disturbed? **No** Normal Circumstances? **Yes**

Are Vegetation, Soil, or Hydrology naturally problematic? **No** (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS - Attach site map showing sample point locations, transects, important features, etc.

Hydrophytic Vegetation Present? **YES**

Hydric Soil Present? **YES**

Wetland Hydrology Present? **YES**

Is This Sample Area Within a Wetland? **YES**

Remarks: **All parameters are met. Area is classified as a palustrine emergent (PEM) wetland.**
Observation point taken near flag A-47.

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

	Surface Water (A1)		Aquatic Fauna (B13)
X	High Water Table (A2)		Marl Deposits (B15)
X	Saturation (A3)		Hydrogen Sulfide Odor (C1)
	Water Marks (B1)	X	Oxidized Rhizospheres on Living Roots (C3)
	Sediment Deposits (B2)		Presence of Reduced Iron (C4)
	Drift Deposits (B3)		Recent Iron Reduction in Tilled Soils (C6)
	Algal Mat or Crust (B4)		Thin Muck Surface (C7)
	Iron Deposits (B5)		Other (Explain in Remarks)
	Inundation Visible on Aerial (B7)		
	Water-Stained Leaves (B9)		

Secondary Indicators (minimum of two required)

	Surface Soil Cracks (B6)
	Sparsely Vegetated Concave Surface (B8)
	Drainage Patterns (B10)
	Moss Trim Lines (B16)
	Dry-Season Water Table (C2)
	Crayfish Burrows (C8)
	Saturation Visible on Aerial Imagery (C9)
	Geomorphic Position (D2)
	Shallow Aquitard (D3)
	FAC-Neutral Test (D5)
	Sphagnum Moss (D8)

Field Observations:

Surface Water Present? Depth (inches):

Water Table Present? **YES** Depth (inches): **SURFACE**

Saturation Present? **YES** Depth (inches): **SURFACE**

Wetland Hydrology Present? **YES**

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:
Primary indicators of wetland hydrology present; parameter is met.

SOIL

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (in)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox %	Type[1]	Loc[2]	Texture	Remarks
0-16	2.5Y 4/2	90	7.5YR 5/8	10	C	M	sandy loam	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, MS=Masked Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

	Histosol (A1)		Dark Surface (S7)
	Histic Epipedon (A2)		Polyvalue Below Surface (S8)
	Black Histic (A3)		Thin Dark Surface (S9)
	Hydrogen Sulfide (A4)		Loamy Gleyed Matrix (F2)
	Stratified Layers (A5)	X	Depleted Matrix (F3)
	Organic Bodies (A6)		Redox Dark Surface (F6)
	5cm Mucky Mineral (A7)		Depleted Dark Surface (F7)
	1cm Muck (A9)		Redox Depressions (F8)
	Depleted Below Dark Surface (A11)		Iron-Manganese Masses (F12)
	Thick Dark Surface (A12)		Umbric Surface (F13)
	Sandy Gleyed Matrix (S4)		Piedmont Floodplain Soils (F19)
	Sandy Redox (S5)		Anomalous Bright Loamy Soils (F20)
	Stripped Matrix (S6)		

Indicators for Problematic Hydric Soils[3]:

	2 cm Muck (A10)
	Piedmont Floodplain Soils (F19)
	Anomalous Bright Loamy Soils (F20)
	Red Parent Material (F21)
	Very Shallow Dark Surface (TF12)
	Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):
Type:
Depth (inches):

Hydric Soil Present? **YES**

Remarks: **Indicator F3 (Depleted Matrix) present and soil meets NTCHS definition of hydric soil; parameter is met.**

VEGETATION - Use scientific names of plants. Sampling Point: 5

Tree Stratum (Plot size: 30' radius)	Absolute % Cover	Dom. Sp?	Indicator Status
1.			
2.			
3.			
4.			
5.			
6.			
7.			
		= Total Cover	
Sapling Stratum (Plot size: 30' radius)			
1.			
2.			
3.			
4.			
5.			
6.			
7.			
		= Total Cover	
Shrub Stratum (Plot size: 15' radius)			
1.			
2.			
3.			
4.			
5.			
6.			
7.			
		= Total Cover	
Herb Stratum (Plot size: 10' radius)			
1. Phragmites australis	95	X	FACW
2.			
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
12.			
	95	= Total Cover	
Woody Vines (Plot size: 30' radius)			
1.			
2.			
3.			
4.			
5.			
		= Total Cover	

Dominance Test Worksheet:

# Dominants OBL, FACW, FAC:	1	(A)
# Dominants across all strata:	1	(B)
% Dominants OBL, FACW, FAC:	100%	(A/B)

Prevalence Index Worksheet:

Total % Cover of:			Multiply By:
OBL		x 1 =	
FACW	95	x 2 =	190
FAC		x 3 =	
FACU		x 4 =	
UPL		x 5 =	
Sum:	95 (A)		190 (B)

Prevalence Index = B/A = 2.00

Hydrophytic Vegetation Indicators:

X Dominance Test is > 50%

X Prevalence Index is <= 3.0

___ Problematic Hydrophytic Vegetation[1] (explain)

___ Rapid Test for Hydrophytic Vegetation

___ Morphological Adaptations

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definitions of Vegetation Strata:

Tree - Woody plants, excluding woody vines, approximately 20ft (6m) or more in height and 3in (7.6cm) or larger in diameter at breast height (DBH).

Sapling - Woody plants, excluding woody vines, approximately 20ft (6m) or more in height and less than 3in (7.6cm) DBH.

Shrub - Woody plants, excluding woody vines, approximately 3 to 20ft (1 to 6m) in height.

Herb - All herbaceous (non-woody) plants, including herbaceous vines, regardless of size. Includes woody plants, except woody vines, less than approximately 3ft (1m) in height.

Woody vine - All woody vines, regardless of height.

Hydrophytic Vegetation Present? YES

Remarks: (If observed, list morphological adaptations below).

Indicator 1 (Rapid Test) present due to dominance of FACW or OBL species.

Other indicators calculated for reference only.

WETLAND DETERMINATION DATA FORM - Atlantic and Gulf Coastal Plain Region

Project Site:	NASA Wallops Tower Site - Study Area 1	City/County:	Accomack County	Samp. Date:	4/23/2015
Applicant/Owner:	LJT & Associates, Inc./NASA Wallops Island	State:	VA	Sampling Point:	6
Investigator(s):	C. Senfield, PWS, PWD	Section, Township, Range:	NA		
Landform (hillslope, terrace, etc.):	Maintained Field	Local relief (concave, convex, none):	Convex	Slope (%):	0-1
Subregion (LRR or MLRA):	LRR T, MLRA 153D	Lat: 37 50 31 N	Long: 75 58 24 W	Datum:	WGS 1984
Soil Map Unit:	Camocca fine sand, 0 to 2 percent slopes, frequently flooded			NWI Map Unit:	None

Are climatic/hydrologic conditions on the site typical for this time of year? **Yes** (If no, explain in Remarks.)

Are Vegetation, Soil, or Hydrology significantly disturbed? **No** Normal Circumstances? **Yes**

Are Vegetation, Soil, or Hydrology naturally problematic? **No** (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS - Attach site map showing sample point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	NO	Is This Sample Area Within a Wetland? **NO**
Hydric Soil Present?	NO	
Wetland Hydrology Present?	NO	

Remarks: **One or more parameters lacking. Area is not a jurisdictional wetland. Observation point taken in upland field near flag A-12.**

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

___ Surface Water (A1)	___ Aquatic Fauna (B13)	
___ High Water Table (A2)	___ Marl Deposits (B15)	
___ Saturation (A3)	___ Hydrogen Sulfide Odor (C1)	
___ Water Marks (B1)	___ Oxidized Rhizospheres on Living Roots (C3)	
___ Sediment Deposits (B2)	___ Presence of Reduced Iron (C4)	
___ Drift Deposits (B3)	___ Recent Iron Reduction in Tilled Soils (C6)	
___ Algal Mat or Crust (B4)	___ Thin Muck Surface (C7)	
___ Iron Deposits (B5)	___ Other (Explain in Remarks)	
___ Inundation Visible on Aerial (B7)		
___ Water-Stained Leaves (B9)		

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Drainage Patterns (B10)
- ___ Moss Trim Lines (B16)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ FAC-Neutral Test (D5)
- ___ Sphagnum Moss (D8)

Field Observations:

Surface Water Present?	___	Depth (inches):	___
Water Table Present?	___	Depth (inches):	___
Saturation Present?		Depth (inches):	

Wetland Hydrology Present? **NO**

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks: **No primary or secondary indicators of wetland hydrology present; parameter is not met.**

SOIL

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (in)	Matrix Color (moist)	%	Redox Features Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-4	10YR 4/4	100					loamy sand	
4-11	2.5Y 5/6	100					loamy sand	
11-16	2.5Y 4/2	50	2.5Y 4/3	50			loamy sand	MIXED MATRIX

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, MS=Masked Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

___ Histosol (A1)	___ Dark Surface (S7)
___ Histic Epipedon (A2)	___ Polyvalue Below Surface (S8)
___ Black Histic (A3)	___ Thin Dark Surface (S9)
___ Hydrogen Sulfide (A4)	___ Loamy Gleyed Matrix (F2)
___ Stratified Layers (A5)	___ Depleted Matrix (F3)
___ Organic Bodies (A6)	___ Redox Dark Surface (F6)
___ 5cm Mucky Mineral (A7)	___ Depleted Dark Surface (F7)
___ 1cm Muck (A9)	___ Redox Depressions (F8)
___ Depleted Below Dark Surface (A11)	___ Iron-Manganese Masses (F12)
___ Thick Dark Surface (A12)	___ Umbric Surface (F13)
___ Sandy Gleyed Matrix (S4)	___ Piedmont Floodplain Soils (F19)
___ Sandy Redox (S5)	___ Anomalous Bright Loamy Soils (F20)
___ Stripped Matrix (S6)	

Indicators for Problematic Hydric Soils[3]:

- ___ 2 cm Muck (A10)
- ___ Piedmont Floodplain Soils (F19)
- ___ Anomalous Bright Loamy Soils (F20)
- ___ Red Parent Material (F21)
- ___ Very Shallow Dark Surface (TF12)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):
Type:
Depth (inches):

Hydric Soil Present? **NO**

Remarks: **No hydric soil indicators present and soil does not meet NTCHS definition of hydric soil; parameter is not met.**

VEGETATION - Use scientific names of plants. Sampling Point: 6

Tree Stratum (Plot size: 30' radius)	Absolute % Cover	Dom. Sp?	Indicator Status
1.			
2.			
3.			
4.			
5.			
6.			
7.			
		= Total Cover	

Sapling Stratum (Plot size: 30' radius)	Absolute % Cover	Dom. Sp?	Indicator Status
1.			
2.			
3.			
4.			
5.			
6.			
7.			
		= Total Cover	

Shrub Stratum (Plot size: 15' radius)	Absolute % Cover	Dom. Sp?	Indicator Status
1.			
2.			
3.			
4.			
5.			
6.			
7.			
		= Total Cover	

Herb Stratum (Plot size: 10' radius)	Absolute % Cover	Dom. Sp?	Indicator Status
1. **Cynodon dactylon**	**38**	**X**	**FACU**
2. **Phragmites australis**	**15**	**X**	**FACW**
3. **Stellaria media**	**15**	**X**	**FACU**
4. **Taraxacum officinale**	**15**	**X**	**FACU**
5. **Trifolium repens**	**15**	**X**	**FACU**
6. **Vicia sativa**	**3**		**FACU**
7. **Cardamine parviflora**	**3**		**FACU**
8. **Lamium purpureum**	**3**		**UPL**
9. **Schedonorus arundinaceus**	**3**		**FAC**
10. **Poa pratensis**	**3**		**FACU**
11.			
12.			
	113	= Total Cover	

Woody Vines (Plot size: 30' radius)	Absolute % Cover	Dom. Sp?	Indicator Status
1.			
2.			
3.			
4.			
5.			
		= Total Cover	

Dominance Test Worksheet:

# Dominants OBL, FACW, FAC:	**1**	(A)
# Dominants across all strata:	**5**	(B)
% Dominants OBL, FACW, FAC:	**20%**	(A/B)

Prevalence Index Worksheet:

Total % Cover of:			Multiply By:	
OBL		x 1 =		
FACW	**15**	x 2 =	**30**	
FAC	**3**	x 3 =	**9**	
FACU	**92**	x 4 =	**368**	
UPL	**3**	x 5 =	**15**	
Sum:	**113** (A)		**422**	(B)

Prevalence Index = B/A = **3.73**

Hydrophytic Vegetation Indicators:

- ____ Dominance Test is > 50%
- ____ Prevalence Index is <= 3.0
- ____ Problematic Hydrophytic Vegetation[1] (explain)
- ____ Rapid Test for Hydrophytic Vegetation
- ____ Morphological Adaptations

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definitions of Vegetation Strata:

Tree - Woody plants, excluding woody vines, approximately 20ft (6m) or more in height and 3in (7.6cm) or larger in diameter at breast height (DBH).

Sapling - Woody plants, excluding woody vines, approximately 20ft (6m) or more in height and less than 3in (7.6cm) DBH.

Shrub - Woody plants, excluding woody vines, approximately 3 to 20ft (1 to 6m) in height.

Herb - All herbaceous (non-woody) plants, including herbaceous vines, regardless of size. Includes woody plants, except woody vines, less than approximately 3ft (1m) in height.

Woody vine - All woody vines, regardless of height.

Hydrophytic Vegetation Present? **NO**

Remarks: (If observed, list morphological adaptations below).

No hydrophytic vegetation indicators present; parameter is not met.

WETLAND DETERMINATION DATA FORM - Atlantic and Gulf Coastal Plain Region

7

Project Site: **NASA Wallops Tower Site - Study Area 1** City/County: **Accomack County** Samp. Date: **4/23/2015**
Applicant/Owner: **LJT & Associates, Inc./NASA Wallops Island** State: **VA** Sampling Point: **7**
Investigator(s): **C. Senfield, PWS, PWD** Section, Township, Range: **NA**
Landform (hillslope, terrace, etc.): **Depression** Local relief (concave, convex, none): **Concave** Slope (%): **0-1**
Subregion (LRR or MLRA): **LRR T, MLRA 153D** Lat: **37 50 31 N** Long: **75 58 24 W** Datum: **WGS 1984**
Soil Map Unit: **Camocca fine sand, 0 to 2 percent slopes, frequently flooded** NWI Map Unit: **PEM1/SS3Cd**
Are climatic/hydrologic conditions on the site typical for this time of year? **Yes** (If no, explain in Remarks.)
Are Vegetation, Soil, or Hydrology significantly disturbed? **No** Normal Circumstances? **Yes**
Are Vegetation, Soil, or Hydrology naturally problematic? **No** (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS - Attach site map showing sample point locations, transects, important features, etc.

Hydrophytic Vegetation Present? **YES**
Hydric Soil Present? **YES**
Wetland Hydrology Present? **YES**

Is This Sample Area Within a Wetland? **YES**

Remarks: **All parameters are met. Area is classified as a palustrine emergent (PEM) wetland.**
Observation point taken near flag A-12.

HYDROLOGY

Wetland Hydrology Indicators:
Primary Indicators (minimum of one is required; check all that apply)

	Surface Water (A1)		Aquatic Fauna (B13)
X	High Water Table (A2)		Marl Deposits (B15)
X	Saturation (A3)		Hydrogen Sulfide Odor (C1)
	Water Marks (B1)	X	Oxidized Rhizospheres on Living Roots (C3)
	Sediment Deposits (B2)		Presence of Reduced Iron (C4)
	Drift Deposits (B3)		Recent Iron Reduction in Tilled Soils (C6)
	Algal Mat or Crust (B4)		Thin Muck Surface (C7)
	Iron Deposits (B5)		Other (Explain in Remarks)
	Inundation Visible on Aerial (B7)		
	Water-Stained Leaves (B9)		

Secondary Indicators (minimum of two required)

	Surface Soil Cracks (B6)
	Sparsely Vegetated Concave Surface (B8)
	Drainage Patterns (B10)
	Moss Trim Lines (B16)
	Dry-Season Water Table (C2)
	Crayfish Burrows (C8)
	Saturation Visible on Aerial Imagery (C9)
	Geomorphic Position (D2)
	Shallow Aquitard (D3)
	FAC-Neutral Test (D5)
	Sphagnum Moss (D8)

Field Observations:
Surface Water Present? Depth (inches):
Water Table Present? **YES** Depth (inches): **SURFACE**
Saturation Present? **YES** Depth (inches): **SURFACE**

Wetland Hydrology Present? **YES**

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:
Primary indicators of wetland hydrology present; parameter is met.

SOIL

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (in)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox %	Type[1]	Loc[2]	Texture	Remarks
0-16	**10YR 4/2**	**85**	**7.5YR 5/8**	**15**	**C**	**M**	**sandy loam**	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, MS=Masked Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

	Histosol (A1)		Dark Surface (S7)
	Histic Epipedon (A2)		Polyvalue Below Surface (S8)
	Black Histic (A3)		Thin Dark Surface (S9)
	Hydrogen Sulfide (A4)		Loamy Gleyed Matrix (F2)
	Stratified Layers (A5)	X	Depleted Matrix (F3)
	Organic Bodies (A6)		Redox Dark Surface (F6)
	5cm Mucky Mineral (A7)		Depleted Dark Surface (F7)
	1cm Muck (A9)		Redox Depressions (F8)
	Depleted Below Dark Surface (A11)		Iron-Manganese Masses (F12)
	Thick Dark Surface (A12)		Umbric Surface (F13)
	Sandy Gleyed Matrix (S4)		Piedmont Floodplain Soils (F19)
	Sandy Redox (S5)		Anomalous Bright Loamy Soils (F20)
	Stripped Matrix (S6)		

Indicators for Problematic Hydric Soils[3]:

	2 cm Muck (A10)
	Piedmont Floodplain Soils (F19)
	Anomalous Bright Loamy Soils (F20)
	Red Parent Material (F21)
	Very Shallow Dark Surface (TF12)
	Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):
Type:
Depth (inches):

Hydric Soil Present? **YES**

Remarks: **Indicator F3 (Depleted Matrix) present and soil meets NTCHS definition of hydric soil; parameter is met.**

VEGETATION - Use scientific names of plants. Sampling Point: **7**

Tree Stratum (Plot size: **30' radius**)	Absolute % Cover	Dom. Sp?	Indicator Status
1.			
2.			
3.			
4.			
5.			
6.			
7.			
		= Total Cover	
Sapling Stratum (Plot size: 30' radius)			
1.			
2.			
3.			
4.			
5.			
6.			
7.			
		= Total Cover	
Shrub Stratum (Plot size: 15' radius)			
1.			
2.			
3.			
4.			
5.			
6.			
7.			
		= Total Cover	
Herb Stratum (Plot size: 10' radius)			
1. **Phragmites australis**	**95**	**X**	**FACW**
2. **Salix nigra**	**3**		**OBL**
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
12.			
	98	= Total Cover	
Woody Vines (Plot size: 30' radius)			
1.			
2.			
3.			
4.			
5.			
		= Total Cover	

Dominance Test Worksheet:

Dominants OBL, FACW, FAC: **1** (A)

Dominants across all strata: **1** (B)

% Dominants OBL, FACW, FAC: **100%** (A/B)

Prevalence Index Worksheet:

Total % Cover of:			Multiply By:
OBL	**3**	x 1 =	**3**
FACW	**95**	x 2 =	**190**
FAC		x 3 =	
FACU		x 4 =	
UPL		x 5 =	
Sum:	**98** (A)		**193** (B)

Prevalence Index = B/A = **1.97**

Hydrophytic Vegetation Indicators:

- **X** Dominance Test is > 50%
- **X** Prevalence Index is <= 3.0
- ___ Problematic Hydrophytic Vegetation[1] (explain)
- ___ Rapid Test for Hydrophytic Vegetation
- ___ Morphological Adaptations

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definitions of Vegetation Strata:

Tree - Woody plants, excluding woody vines, approximately 20ft (6m) or more in height and 3in (7.6cm) or larger in diameter at breast height (DBH).

Sapling - Woody plants, excluding woody vines, approximately 20ft (6m) or more in height and less than 3in (7.6cm) DBH.

Shrub - Woody plants, excluding woody vines, approximately 3 to 20ft (1 to 6m) in height.

Herb - All herbaceous (non-woody) plants, including herbaceous vines, regardless of size. Includes woody plants, except woody vines, less than approximately 3ft (1m) in height.

Woody vine - All woody vines, regardless of height.

Hydrophytic Vegetation Present? **YES**

Remarks: (If observed, list morphological adaptations below).

Indicator 1 (Rapid Test) present due to dominance of FACW or OBL species.

Other indicators calculated for reference only.

WETLAND DETERMINATION DATA FORM - Atlantic and Gulf Coastal Plain Region

Project Site: **NASA Wallops Tower Site - Study Area 1** City/County: **Accomack County** Samp. Date: **4/23/2015**
Applicant/Owner: **LJT & Associates, Inc./NASA Wallops Island** State: **VA** Sampling Point: **8**
Investigator(s): **C. Senfield, PWS, PWD** Section, Township, Range: **NA**
Landform (hillslope, terrace, etc.): **Manmade Dome** Local relief (concave, convex, none): **Convex** Slope (%): **0-1**
Subregion (LRR or MLRA): **LRR T, MLRA 153D** Lat: **37 50 31 N** Long: **75 58 24 W** Datum: **WGS 1984**
Soil Map Unit: **Fisherman-Camocca complex, 0 to 6 percent slopes, frequently flooded** NWI Map Unit: **PEM1/SS3Cd**
Are climatic/hydrologic conditions on the site typical for this time of year? **Yes** (If no, explain in Remarks.)
Are Vegetation, Soil, or Hydrology significantly disturbed? **No** Normal Circumstances? **Yes**
Are Vegetation, Soil, or Hydrology naturally problematic? **No** (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS - Attach site map showing sample point locations, transects, important features, etc.

Hydrophytic Vegetation Present? **NO**
Hydric Soil Present? **NO**
Wetland Hydrology Present? **NO**

Is This Sample Area Within a Wetland? **NO**

Remarks: **One or more parameters lacking. Area is not a jurisdictional wetland.**
Observation point taken in forested upland atop old fill material near flag D-18.

HYDROLOGY

Wetland Hydrology Indicators:
Primary Indicators (minimum of one is required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Inundation Visible on Aerial (B7)
- ___ Water-Stained Leaves (B9)
- ___ Aquatic Fauna (B13)
- ___ Marl Deposits (B15)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres on Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Drainage Patterns (B10)
- ___ Moss Trim Lines (B16)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ FAC-Neutral Test (D5)
- ___ Sphagnum Moss (D8)

Field Observations:
Surface Water Present? ___ Depth (inches): ___
Water Table Present? ___ Depth (inches): ___
Saturation Present? Depth (inches):

Wetland Hydrology Present? **NO**

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks: **No primary or secondary indicators of wetland hydrology present; parameter is not met.**

SOIL

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (in)	Matrix Color (moist)	Matrix %	Redox Color (moist)	Redox %	Type[1]	Loc[2]	Texture	Remarks
0-3	**10YR 3/2**	**100**					**sandy loam**	
3-12	**10YR 4/3**	**100**					**loamy sand**	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, MS=Masked Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5)
- ___ Organic Bodies (A6)
- ___ 5cm Mucky Mineral (A7)
- ___ 1cm Muck (A9)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Dark Surface (S7)
- ___ Polyvalue Below Surface (S8)
- ___ Thin Dark Surface (S9)
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)
- ___ Iron-Manganese Masses (F12)
- ___ Umbric Surface (F13)
- ___ Piedmont Floodplain Soils (F19)
- ___ Anomalous Bright Loamy Soils (F20)

Indicators for Problematic Hydric Soils[3]:

- ___ 2 cm Muck (A10)
- ___ Piedmont Floodplain Soils (F19)
- ___ Anomalous Bright Loamy Soils (F20)
- ___ Red Parent Material (F21)
- ___ Very Shallow Dark Surface (TF12)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):
Type:
Depth (inches):

Hydric Soil Present? **NO**

Remarks: **No hydric soil indicators present and soil does not meet NTCHS definition of hydric soil; parameter is not met.**

VEGETATION - Use scientific names of plants.

Sampling Point: **8**

Tree Stratum (Plot size: 30' radius)	Absolute % Cover	Dom. Sp?	Indicator Status
1. **Prunus serotina**	**63**	**X**	**FACU**
2. **Celtis occidentalis**	**15**		**FACU**
3.			
4.			
5.			
6.			
7.			
	78	= Total Cover	
Sapling Stratum (Plot size: 30' radius)			
1.			
2.			
3.			
4.			
5.			
6.			
7.			
		= Total Cover	
Shrub Stratum (Plot size: 15' radius)			
1. **Baccharis halimifolia**	**3**	**X**	**FAC**
2.			
3.			
4.			
5.			
6.			
7.			
	3	= Total Cover	
Herb Stratum (Plot size: 10' radius)			
1. **Schedonorus arundinaceus**	**38**	**X**	**FAC**
2. **Lonicera japonica**	**15**	**X**	**FACU**
3. **Achillea millefolium**	**15**	**X**	**FACU**
4. **Smilax rotundifolia**	**15**	**X**	**FAC**
5. **Juniperus virginiana**	**3**		**FACU**
6. **Dichanthelium clandestinum**	**3**		**FACW**
7.			
8.			
9.			
10.			
11.			
12.			
	89	= Total Cover	
Woody Vines (Plot size: 30' radius)			
1. **Toxicodendron radicans**	**3**	**X**	**FAC**
2. **Lonicera japonica**	**3**	**X**	**FACU**
3.			
4.			
5.			
	6	= Total Cover	

Dominance Test Worksheet:

# Dominants OBL, FACW, FAC:	**4**	(A)
# Dominants across all strata:	**8**	(B)
% Dominants OBL, FACW, FAC:	**50%**	(A/B)

Prevalence Index Worksheet:

Total % Cover of:			Multiply By:
OBL		x 1 =	
FACW	**3**	x 2 =	**6**
FAC	**59**	x 3 =	**177**
FACU	**114**	x 4 =	**456**
UPL		x 5 =	
Sum:	**176** (A)		**639** (B)

Prevalence Index = B/A = **3.63**

Hydrophytic Vegetation Indicators:

___ Dominance Test is > 50%
___ Prevalence Index is <= 3.0
___ Problematic Hydrophytic Vegetation[1] (explain)
___ Rapid Test for Hydrophytic Vegetation
___ Morphological Adaptations

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definitions of Vegetation Strata:

Tree - Woody plants, excluding woody vines, approximately 20ft (6m) or more in height and 3in (7.6cm) or larger in diameter at breast height (DBH).

Sapling - Woody plants, excluding woody vines, approximately 20ft (6m) or more in height and less than 3in (7.6cm) DBH.

Shrub - Woody plants, excluding woody vines, approximately 3 to 20ft (1 to 6m) in height.

Herb - All herbaceous (non-woody) plants, including herbaceous vines, regardless of size. Includes woody plants, except woody vines, less than approximately 3ft (1m) in height.

Woody vine - All woody vines, regardless of height.

Hydrophytic Vegetation Present? **NO**

Remarks: (If observed, list morphological adaptations below).

No hydrophytic vegetation indicators present; parameter is not met.

Other indicators calculated for reference only.

WETLAND DETERMINATION DATA FORM - Atlantic and Gulf Coastal Plain Region

Project Site: **NASA Wallops Tower Site - Study Area 1** City/County: **Accomack County** Samp. Date: **4/23/2015**
Applicant/Owner: **LJT & Associates, Inc./NASA Wallops Island** State: **VA** Sampling Point: **9**
Investigator(s): **C. Senfield, PWS, PWD** Section, Township, Range: **NA**
Landform (hillslope, terrace, etc.): **Depression** Local relief (concave, convex, none): **Concave** Slope (%): **0-1**
Subregion (LRR or MLRA): **LRR T, MLRA 153D** Lat: **37 50 31 N** Long: **75 58 24 W** Datum: **WGS 1984**
Soil Map Unit: **Fisherman-Camocca complex, 0 to 6 percent slopes, frequently flooded** NWI Map Unit: **None**
Are climatic/hydrologic conditions on the site typical for this time of year? **Yes** (If no, explain in Remarks.)
Are Vegetation, Soil, or Hydrology significantly disturbed? **No** Normal Circumstances? **Yes**
Are Vegetation, Soil, or Hydrology naturally problematic? **No** (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS - Attach site map showing sample point locations, transects, important features, etc.

Hydrophytic Vegetation Present? **YES**
Hydric Soil Present? **YES**
Wetland Hydrology Present? **YES**

Is This Sample Area Within a Wetland? **YES**

Remarks: **All parameters are met. Area is classified as a palustrine emergent (PEM) wetland.**
Observation point taken in wetland near flag D-18.

HYDROLOGY

Wetland Hydrology Indicators:
Primary Indicators (minimum of one is required; check all that apply)

- [ ] Surface Water (A1)
- [x] High Water Table (A2)
- [x] Saturation (A3)
- [ ] Water Marks (B1)
- [ ] Sediment Deposits (B2)
- [ ] Drift Deposits (B3)
- [ ] Algal Mat or Crust (B4)
- [ ] Iron Deposits (B5)
- [ ] Inundation Visible on Aerial (B7)
- [ ] Water-Stained Leaves (B9)
- [ ] Aquatic Fauna (B13)
- [ ] Marl Deposits (B15)
- [ ] Hydrogen Sulfide Odor (C1)
- [x] Oxidized Rhizospheres on Living Roots (C3)
- [ ] Presence of Reduced Iron (C4)
- [ ] Recent Iron Reduction in Tilled Soils (C6)
- [ ] Thin Muck Surface (C7)
- [ ] Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- [ ] Surface Soil Cracks (B6)
- [ ] Sparsely Vegetated Concave Surface (B8)
- [ ] Drainage Patterns (B10)
- [ ] Moss Trim Lines (B16)
- [ ] Dry-Season Water Table (C2)
- [ ] Crayfish Burrows (C8)
- [ ] Saturation Visible on Aerial Imagery (C9)
- [ ] Geomorphic Position (D2)
- [ ] Shallow Aquitard (D3)
- [ ] FAC-Neutral Test (D5)
- [ ] Sphagnum Moss (D8)

Field Observations:
Surface Water Present? Depth (inches):
Water Table Present? **YES** Depth (inches): **SURFACE**
Saturation Present? **YES** Depth (inches): **SURFACE**

Wetland Hydrology Present? **YES**

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:
Primary indicators of wetland hydrology present; parameter is met.

SOIL

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (in)	Matrix Color (moist)	Matrix %	Redox Color (moist)	Redox %	Type[1]	Loc[2]	Texture	Remarks
0-16	2.5Y 4/2	90	7.5YR 5/8	10	C	M	sandy loam	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, MS=Masked Sand Grains.
[2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

- [ ] Histosol (A1)
- [ ] Histic Epipedon (A2)
- [ ] Black Histic (A3)
- [ ] Hydrogen Sulfide (A4)
- [ ] Stratified Layers (A5)
- [ ] Organic Bodies (A6)
- [ ] 5cm Mucky Mineral (A7)
- [ ] 1cm Muck (A9)
- [ ] Depleted Below Dark Surface (A11)
- [ ] Thick Dark Surface (A12)
- [ ] Sandy Gleyed Matrix (S4)
- [ ] Sandy Redox (S5)
- [ ] Stripped Matrix (S6)
- [ ] Dark Surface (S7)
- [ ] Polyvalue Below Surface (S8)
- [ ] Thin Dark Surface (S9)
- [ ] Loamy Gleyed Matrix (F2)
- [x] Depleted Matrix (F3)
- [ ] Redox Dark Surface (F6)
- [ ] Depleted Dark Surface (F7)
- [ ] Redox Depressions (F8)
- [ ] Iron-Manganese Masses (F12)
- [ ] Umbric Surface (F13)
- [ ] Piedmont Floodplain Soils (F19)
- [ ] Anomalous Bright Loamy Soils (F20)

Indicators for Problematic Hydric Soils[3]:

- [ ] 2 cm Muck (A10)
- [ ] Piedmont Floodplain Soils (F19)
- [ ] Anomalous Bright Loamy Soils (F20)
- [ ] Red Parent Material (F21)
- [ ] Very Shallow Dark Surface (TF12)
- [ ] Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):
Type:
Depth (inches):

Hydric Soil Present? **YES**

Remarks: **Indicator F3 (Depleted Matrix) present and soil meets NTCHS definition of hydric soil; parameter is met.**

VEGETATION - Use scientific names of plants.

Sampling Point: 9

Tree Stratum (Plot size: 30' radius)	Absolute % Cover	Dom. Sp?	Indicator Status
1.			
2.			
3.			
4.			
5.			
6.			
7.			
		= Total Cover	
Sapling Stratum (Plot size: 30' radius)			
1.			
2.			
3.			
4.			
5.			
6.			
7.			
		= Total Cover	
Shrub Stratum (Plot size: 15' radius)			
1.			
2.			
3.			
4.			
5.			
6.			
7.			
		= Total Cover	
Herb Stratum (Plot size: 10' radius)			
1. **Phragmites australis**	**95**	**X**	**FACW**
2.			
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
12.			
	95	= Total Cover	
Woody Vines (Plot size: 30' radius)			
1.			
2.			
3.			
4.			
5.			
		= Total Cover	

Dominance Test Worksheet:

# Dominants OBL, FACW, FAC:	**1**	(A)
# Dominants across all strata:	**1**	(B)
% Dominants OBL, FACW, FAC:	**100%**	(A/B)

Prevalence Index Worksheet:

Total % Cover of:			Multiply By:
OBL		x 1 =	
FACW	**95**	x 2 =	**190**
FAC		x 3 =	
FACU		x 4 =	
UPL		x 5 =	
Sum:	**95** (A)		**190** (B)

Prevalence Index = B/A = **2.00**

Hydrophytic Vegetation Indicators:

- **X** Dominance Test is > 50%
- **X** Prevalence Index is <= 3.0
- ___ Problematic Hydrophytic Vegetation[1] (explain)
- ___ Rapid Test for Hydrophytic Vegetation
- ___ Morphological Adaptations

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definitions of Vegetation Strata:

Tree - Woody plants, excluding woody vines, approximately 20ft (6m) or more in height and 3in (7.6cm) or larger in diameter at breast height (DBH).

Sapling - Woody plants, excluding woody vines, approximately 20ft (6m) or more in height and less than 3in (7.6cm) DBH.

Shrub - Woody plants, excluding woody vines, approximately 3 to 20ft (1 to 6m) in height.

Herb - All herbaceous (non-woody) plants, including herbaceous vines, regardless of size. Includes woody plants, except woody vines, less than approximately 3ft (1m) in height.

Woody vine - All woody vines, regardless of height.

Hydrophytic Vegetation Present? **YES**

Remarks: (If observed, list morphological adaptations below).

Indicator 1 (Rapid Test) present due to dominance of FACW or OBL species.

Other indicators calculated for reference only.

WETLAND DETERMINATION DATA FORM - Atlantic and Gulf Coastal Plain Region

Project Site:	NASA Wallops Tower Site - Study Area 1	City/County:	Accomack County	Samp. Date:	4/23/2015
Applicant/Owner:	LJT & Associates, Inc./NASA Wallops Island	State:	VA	Sampling Point:	10
Investigator(s):	C. Senfield, PWS, PWD	Section, Township, Range:	NA		
Landform (hillslope, terrace, etc.):	Maintained Field	Local relief (concave, convex, none):	Concave	Slope (%):	0-1
Subregion (LRR or MLRA):	LRR T, MLRA 153D	Lat: 37 50 31 N	Long: 75 58 24 W	Datum:	WGS 1984
Soil Map Unit:	Fisherman-Camocca complex, 0 to 6 percent slopes, frequently flooded			NWI Map Unit:	None

Are climatic/hydrologic conditions on the site typical for this time of year? **Yes** (If no, explain in Remarks.)

Are Vegetation, Soil, or Hydrology significantly disturbed? **No** Normal Circumstances? **Yes**

Are Vegetation, Soil, or Hydrology naturally problematic? **No** (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS - Attach site map showing sample point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	YES	Is This Sample Area Within a Wetland? **NO**
Hydric Soil Present?	NO	
Wetland Hydrology Present?	NO	

Remarks: **One or more parameters lacking. Area is not a jurisdictional wetland.**
Observation point taken in upland field approaching dune.

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

___	Surface Water (A1)	___	Aquatic Fauna (B13)
___	High Water Table (A2)	___	Marl Deposits (B15)
___	Saturation (A3)	___	Hydrogen Sulfide Odor (C1)
___	Water Marks (B1)	___	Oxidized Rhizospheres on Living Roots (C3)
___	Sediment Deposits (B2)	___	Presence of Reduced Iron (C4)
___	Drift Deposits (B3)	___	Recent Iron Reduction in Tilled Soils (C6)
___	Algal Mat or Crust (B4)	___	Thin Muck Surface (C7)
___	Iron Deposits (B5)	___	Other (Explain in Remarks)
___	Inundation Visible on Aerial (B7)		
___	Water-Stained Leaves (B9)		

Secondary Indicators (minimum of two required)

___	Surface Soil Cracks (B6)
___	Sparsely Vegetated Concave Surface (B8)
___	Drainage Patterns (B10)
___	Moss Trim Lines (B16)
___	Dry-Season Water Table (C2)
___	Crayfish Burrows (C8)
___	Saturation Visible on Aerial Imagery (C9)
___	Geomorphic Position (D2)
___	Shallow Aquitard (D3)
___	FAC-Neutral Test (D5)
___	Sphagnum Moss (D8)

Field Observations:

Surface Water Present?	___	Depth (inches):	___
Water Table Present?	___	Depth (inches):	___
Saturation Present?		Depth (inches):	

Wetland Hydrology Present? **NO**

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks: **No primary and only one secondary indicator of wetland hydrology present; parameter is not met.**

SOIL

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth	Matrix		Redox Features					
(in)	Color (moist)	%	Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-2	10YR 4/3	85	7.5YR 5/8	15	C	M	loamy sand	
2-4	10YR 3/2	85	7.5YR 5/8	15	C	M	loamy sand	
4-15	10YR 3/3	85	7.5YR 5/8	15	C	M	sandy loam	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, MS=Masked Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

___	Histosol (A1)	___	Dark Surface (S7)
___	Histic Epipedon (A2)	___	Polyvalue Below Surface (S8)
___	Black Histic (A3)	___	Thin Dark Surface (S9)
___	Hydrogen Sulfide (A4)	___	Loamy Gleyed Matrix (F2)
___	Stratified Layers (A5)	___	Depleted Matrix (F3)
___	Organic Bodies (A6)	___	Redox Dark Surface (F6)
___	5cm Mucky Mineral (A7)	___	Depleted Dark Surface (F7)
___	1cm Muck (A9)	___	Redox Depressions (F8)
___	Depleted Below Dark Surface (A11)	___	Iron-Manganese Masses (F12)
___	Thick Dark Surface (A12)	___	Umbric Surface (F13)
___	Sandy Gleyed Matrix (S4)	___	Piedmont Floodplain Soils (F19)
___	Sandy Redox (S5)	___	Anomalous Bright Loamy Soils (F20)
	Stripped Matrix (S6)		

Indicators for Problematic Hydric Soils[3]:

___	2 cm Muck (A10)
___	Piedmont Floodplain Soils (F19)
___	Anomalous Bright Loamy Soils (F20)
___	Red Parent Material (F21)
___	Very Shallow Dark Surface (TF12)
___	Other (Explain in Remarks)

[3] Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):
Type:
Depth (inches):

Hydric Soil Present? **NO**

Remarks: **No hydric soil indicators present and soil does not meet NTCHS definition of hydric soil; parameter is not met.**

VEGETATION - Use scientific names of plants.

Sampling Point: **10**

Tree Stratum (Plot size: **30' radius**)	Absolute % Cover	Dom. Sp?	Indicator Status
1.			
2.			
3.			
4.			
5.			
6.			
7.			
		= Total Cover	

Sapling Stratum (Plot size: **30' radius**)	Absolute % Cover	Dom. Sp?	Indicator Status
1.			
2.			
3.			
4.			
5.			
6.			
7.			
		= Total Cover	

Shrub Stratum (Plot size: **15' radius**)	Absolute % Cover	Dom. Sp?	Indicator Status
1.			
2.			
3.			
4.			
5.			
6.			
7.			
		= Total Cover	

Herb Stratum (Plot size: **10' radius**)	Absolute % Cover	Dom. Sp?	Indicator Status
1. **Cynodon dactylon**	**38**	**X**	**FACU**
2. **Baccharis halimifolia**	**15**	**X**	**FAC**
3. **Phragmites australis**	**15**	**X**	**FACW**
4. **Solidago sempervirens**	**15**	**X**	**FACW**
5. **Plantago lanceolata**	**3**		**FACU**
6. **Trifolium repens**	**3**		**FACU**
7.			
8.			
9.			
10.			
11.			
12.			
	89	= Total Cover	

Woody Vines (Plot size: **30' radius**)	Absolute % Cover	Dom. Sp?	Indicator Status
1.			
2.			
3.			
4.			
5.			
		= Total Cover	

Dominance Test Worksheet:

# Dominants OBL, FACW, FAC:	**3**	(A)
# Dominants across all strata:	**4**	(B)
% Dominants OBL, FACW, FAC:	**75%**	(A/B)

Prevalence Index Worksheet:

Total % Cover of:			Multiply By:	
OBL		x 1 =		
FACW	**30**	x 2 =	**60**	
FAC	**15**	x 3 =	**45**	
FACU	**44**	x 4 =	**176**	
UPL		x 5 =		
Sum:	**89**	(A)	**281**	(B)

Prevalence Index = B/A = **3.16**

Hydrophytic Vegetation Indicators:

X	Dominance Test is > 50%
	Prevalence Index is <= 3.0
	Problematic Hydrophytic Vegetation[1] (explain)
	Rapid Test for Hydrophytic Vegetation
	Morphological Adaptations

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definitions of Vegetation Strata:

Tree - Woody plants, excluding woody vines, approximately 20ft (6m) or more in height and 3in (7.6cm) or larger in diameter at breast height (DBH).

Sapling - Woody plants, excluding woody vines, approximately 20ft (6m) or more in height and less than 3in (7.6cm) DBH.

Shrub - Woody plants, excluding woody vines, approximately 3 to 20ft (1 to 6m) in height.

Herb - All herbaceous (non-woody) plants, including herbaceous vines, regardless of size. Includes woody plants, except woody vines, less than approximately 3ft (1m) in height.

Woody vine - All woody vines, regardless of height.

Hydrophytic Vegetation Present? **YES**

Remarks: (If observed, list morphological adaptations below).

Indicator 2 (Dominance Test) present with >50% of dominant species across all vegetation strata FAC or wetter.

Other indicators calculated for reference only.

WETLAND DETERMINATION DATA FORM - Atlantic and Gulf Coastal Plain Region

Project Site: NASA Wallops Tower Site - Study Area 2 City/County: Accomack County Samp. Date: 4/23/2015
Applicant/Owner: LJT & Associates, Inc./NASA Wallops Island State: VA Sampling Point: 1
Investigator(s): C. Senfield, PWS, PWD Section, Township, Range: NA
Landform (hillslope, terrace, etc.): Estuary Local relief (concave, convex, none): None Slope (%): 0-1
Subregion (LRR or MLRA): LRR T, MLRA 153D Lat: 37 50 50 N Long: 75 28 31 W Datum: WGS 1984
Soil Map Unit: Chincoteague silt loam, 0 to 1 percent slopes, frequently flooded NWI Map Unit: E2EM1P
Are climatic/hydrologic conditions on the site typical for this time of year? Yes (If no, explain in Remarks.)
Are Vegetation, Soil, or Hydrology significantly disturbed? No Normal Circumstances? Yes
Are Vegetation, Soil, or Hydrology naturally problematic? No (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS - Attach site map showing sample point locations, transects, important features, etc.

Hydrophytic Vegetation Present? YES
Hydric Soil Present? YES
Wetland Hydrology Present? YES

Is This Sample Area Within a Wetland? YES

Remarks:
All parameters are met. Area is classified as a estuarine scrub-shrub (E2SS) wetland. Observation point taken near flag D-5.

HYDROLOGY

Wetland Hydrology Indicators:
Primary Indicators (minimum of one is required; check all that apply)

- ___ Surface Water (A1)
- X High Water Table (A2)
- X Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Inundation Visible on Aerial (B7)
- ___ Water-Stained Leaves (B9)
- ___ Aquatic Fauna (B13)
- ___ Marl Deposits (B15)
- X Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres on Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Drainage Patterns (B10)
- ___ Moss Trim Lines (B16)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ FAC-Neutral Test (D5)
- ___ Sphagnum Moss (D8)

Field Observations:
Surface Water Present? ___ Depth (inches): ___
Water Table Present? YES Depth (inches): SURFACE
Saturation Present? YES Depth (inches): SURFACE

Wetland Hydrology Present? YES

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:
Primary indicators of wetland hydrology present; parameter is met.

SOIL

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (in)	Matrix Color (moist)	Matrix %	Redox Color (moist)	Redox %	Type[1]	Loc[2]	Texture	Remarks
3-0							mucky peat	ORGANIC
0-4	10YR 4/2	100					sand	
4-10	5GY 4/1	100					sand	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, MS=Masked Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5)
- ___ Organic Bodies (A6)
- ___ 5cm Mucky Mineral (A7)
- ___ 1cm Muck (A9)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- X Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Dark Surface (S7)
- ___ Polyvalue Below Surface (S8)
- ___ Thin Dark Surface (S9)
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)
- ___ Iron-Manganese Masses (F12)
- ___ Umbric Surface (F13)
- ___ Piedmont Floodplain Soils (F19)
- ___ Anomalous Bright Loamy Soils (F20)

Indicators for Problematic Hydric Soils[3]:

- ___ 2 cm Muck (A10)
- ___ Piedmont Floodplain Soils (F19)
- ___ Anomalous Bright Loamy Soils (F20)
- ___ Red Parent Material (F21)
- ___ Very Shallow Dark Surface (TF12)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):
Type:
Depth (inches):

Hydric Soil Present? YES

Remarks:
Indicator S4 (Sandy Gleyed Matrix) present and soil meets NTCHS definition of hydric soil; parameter is met.

VEGETATION - Use scientific names of plants.

Sampling Point: 1

Tree Stratum (Plot size: 30' radius)	Absolute % Cover	Dom. Sp?	Indicator Status
1.			
2.			
3.			
4.			
5.			
6.			
7.			
		= Total Cover	
Sapling Stratum (Plot size: 30' radius)			
1.			
2.			
3.			
4.			
5.			
6.			
7.			
		= Total Cover	
Shrub Stratum (Plot size: 15' radius)			
1. Baccharis halimifolia	38	X	FAC
2.			
3.			
4.			
5.			
6.			
7.			
	38	= Total Cover	
Herb Stratum (Plot size: 10' radius)			
1. Phragmites australis	38	X	FACW
2. Baccharis halimifolia	15	X	FAC
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
12.			
	53	= Total Cover	
Woody Vines (Plot size: 30' radius)			
1.			
2.			
3.			
4.			
5.			
		= Total Cover	

Dominance Test Worksheet:

# Dominants OBL, FACW, FAC:	3	(A)
# Dominants across all strata:	3	(B)
% Dominants OBL, FACW, FAC:	100%	(A/B)

Prevalence Index Worksheet:

Total % Cover of:			Multiply By:
OBL		x 1 =	
FACW	38	x 2 =	76
FAC	53	x 3 =	159
FACU		x 4 =	
UPL		x 5 =	
Sum:	91 (A)		235 (B)

Prevalence Index = B/A = 2.58

Hydrophytic Vegetation Indicators:

- X Dominance Test is > 50%
- X Prevalence Index is <= 3.0
- Problematic Hydrophytic Vegetation[1] (explain)
- Rapid Test for Hydrophytic Vegetation
- Morphological Adaptations

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definitions of Vegetation Strata:

Tree - Woody plants, excluding woody vines, approximately 20ft (6m) or more in height and 3in (7.6cm) or larger in diameter at breast height (DBH).

Sapling - Woody plants, excluding woody vines, approximately 20ft (6m) or more in height and less than 3in (7.6cm) DBH.

Shrub - Woody plants, excluding woody vines, approximately 3 to 20ft (1 to 6m) in height.

Herb - All herbaceous (non-woody) plants, including herbaceous vines, regardless of size. Includes woody plants, except woody vines, less than approximately 3ft (1m) in height.

Woody vine - All woody vines, regardless of height.

Hydrophytic Vegetation Present? **YES**

Remarks: (If observed, list morphological adaptations below).

Indicator 2 (Dominance Test) present with >50% of dominant species across all vegetation strata FAC or wetter.

Other indicators calculated for reference only.

WETLAND DETERMINATION DATA FORM - Atlantic and Gulf Coastal Plain Region

Project Site: **NASA Wallops Tower Site - Study Area 2** City/County: **Accomack County** Samp. Date: **4/23/2015**
Applicant/Owner: **LJT & Associates, Inc./NASA Wallops Island** State: **VA** Sampling Point: **2**
Investigator(s): **C. Senfield, PWS, PWD** Section, Township, Range: **NA**
Landform (hillslope, terrace, etc.): **Hillslope** Local relief (concave, convex, none): **Convex** Slope (%): **0-1**
Subregion (LRR or MLRA): **LRR T, MLRA 153D** Lat: **37 50 50 N** Long: **75 28 31 W** Datum: **WGS 1984**
Soil Map Unit: **Udorthent and Udipsamment soils, 0 to 30 percent slopes** NWI Map Unit: **PEM1/SS3Cd**
Are climatic/hydrologic conditions on the site typical for this time of year? **Yes** (If no, explain in Remarks.)
Are Vegetation, Soil, or Hydrology significantly disturbed? **No** Normal Circumstances? **Yes**
Are Vegetation, Soil, or Hydrology naturally problematic? **No** (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS - Attach site map showing sample point locations, transects, important features, etc.

Hydrophytic Vegetation Present? **NO**
Hydric Soil Present? **NO**
Wetland Hydrology Present? **NO**

Is This Sample Area Within a Wetland? **NO**

Remarks: **One or more parameters lacking. Area is not a jurisdictional wetland.**
Observation point taken in forested upland near flag C-14.

HYDROLOGY

Wetland Hydrology Indicators:
Primary Indicators (minimum of one is required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Inundation Visible on Aerial (B7)
- ___ Water-Stained Leaves (B9)
- ___ Aquatic Fauna (B13)
- ___ Marl Deposits (B15)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres on Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Drainage Patterns (B10)
- ___ Moss Trim Lines (B16)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ FAC-Neutral Test (D5)
- ___ Sphagnum Moss (D8)

Field Observations:
Surface Water Present? ___ Depth (inches): ___
Water Table Present? ___ Depth (inches): ___
Saturation Present? Depth (inches):

Wetland Hydrology Present? **NO**

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks: **No primary or secondary indicators of wetland hydrology present; parameter is not met.**

SOIL

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (in)	Matrix Color (moist)	Matrix %	Redox Color (moist)	Redox %	Type[1]	Loc[2]	Texture	Remarks
0-3	10YR 3/3	100					sandy loam	
3-10	2.5Y 5/2	99	7.5YR 4/4	1	C	M	loamy sand	
10-16	10YR 2/1	100					loam	DRY

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, MS=Masked Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5)
- ___ Organic Bodies (A6)
- ___ 5cm Mucky Mineral (A7)
- ___ 1cm Muck (A9)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Dark Surface (S7)
- ___ Polyvalue Below Surface (S8)
- ___ Thin Dark Surface (S9)
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)
- ___ Iron-Manganese Masses (F12)
- ___ Umbric Surface (F13)
- ___ Piedmont Floodplain Soils (F19)
- ___ Anomalous Bright Loamy Soils (F20)

Indicators for Problematic Hydric Soils[3]:

- ___ 2 cm Muck (A10)
- ___ Piedmont Floodplain Soils (F19)
- ___ Anomalous Bright Loamy Soils (F20)
- ___ Red Parent Material (F21)
- ___ Very Shallow Dark Surface (TF12)
- ___ Other (Explain in Remarks)

[3] Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):
Type: ___
Depth (inches):

Hydric Soil Present? **NO**

Remarks: **No hydric soil indicators present and soil does not meet NTCHS definition of hydric soil; parameter is not met.**

VEGETATION - Use scientific names of plants. Sampling Point: 2

Tree Stratum (Plot size: 30' radius)	Absolute % Cover	Dom. Sp?	Indicator Status
1. Prunus serotina	15	X	FACU
2.			
3.			
4.			
5.			
6.			
7.			
	15	= Total Cover	
Sapling Stratum (Plot size: 30' radius)			
1. Morella pensylvanica	15	X	FAC
2.			
3.			
4.			
5.			
6.			
7.			
	15	= Total Cover	
Shrub Stratum (Plot size: 15' radius)			
1.			
2.			
3.			
4.			
5.			
6.			
7.			
		= Total Cover	
Herb Stratum (Plot size: 10' radius)			
1. Morella cerifera	15	X	FAC
2. Toxicodendron radicans	3		FAC
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
12.			
	18	= Total Cover	
Woody Vines (Plot size: 30' radius)			
1. Lonicera japonica	38	X	FACU
2. Smilax rotundifolia	3		FAC
3.			
4.			
5.			
	41	= Total Cover	

Dominance Test Worksheet:

Dominants OBL, FACW, FAC: 2 (A)

Dominants across all strata: 4 (B)

% Dominants OBL, FACW, FAC: 50% (A/B)

Prevalence Index Worksheet:

Total % Cover of:			Multiply By:
OBL		x 1 =	
FACW		x 2 =	
FAC	36	x 3 =	108
FACU	53	x 4 =	212
UPL		x 5 =	
Sum:	89 (A)		320 (B)

Prevalence Index = B/A = 3.60

Hydrophytic Vegetation Indicators:

___ Dominance Test is > 50%

___ Prevalence Index is <= 3.0

___ Problematic Hydrophytic Vegetation[1] (explain)

___ Rapid Test for Hydrophytic Vegetation

___ Morphological Adaptations

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definitions of Vegetation Strata:

Tree - Woody plants, excluding woody vines, approximately 20ft (6m) or more in height and 3in (7.6cm) or larger in diameter at breast height (DBH).

Sapling - Woody plants, excluding woody vines, approximately 20ft (6m) or more in height and less than 3in (7.6cm) DBH.

Shrub - Woody plants, excluding woody vines, approximately 3 to 20ft (1 to 6m) in height.

Herb - All herbaceous (non-woody) plants, including herbaceous vines, regardless of size. Includes woody plants, except woody vines, less than approximately 3ft (1m) in height.

Woody vine - All woody vines, regardless of height.

Hydrophytic Vegetation Present? NO

Remarks: (If observed, list morphological adaptations below).

No hydrophytic vegetation indicators present; parameter is not met.

WETLAND DETERMINATION DATA FORM - Atlantic and Gulf Coastal Plain Region

Project Site: **NASA Wallops Tower Site - Study Area 2** City/County: **Accomack County** Samp. Date: **4/23/2015**
Applicant/Owner: **LJT & Associates, Inc./NASA Wallops Island** State: **VA** Sampling Point: **3**
Investigator(s): **C. Senfield, PWS, PWD** Section, Township, Range: **NA**
Landform (hillslope, terrace, etc.): **Depression** Local relief (concave, convex, none): **Concave** Slope (%): **0-1**
Subregion (LRR or MLRA): **LRR T, MLRA 153D** Lat: **37 50 50 N** Long: **75 28 31 W** Datum: **WGS 1984**
Soil Map Unit: **Chincoteague silt loam, 0 to 1 percent slopes, frequently flooded** NWI Map Unit: **PEM1/SS3Cd**
Are climatic/hydrologic conditions on the site typical for this time of year? **Yes** (If no, explain in Remarks.)
Are Vegetation, Soil, or Hydrology significantly disturbed? **No** Normal Circumstances? **Yes**
Are Vegetation, Soil, or Hydrology naturally problematic? **No** (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS - Attach site map showing sample point locations, transects, important features, etc.

Hydrophytic Vegetation Present? **YES**
Hydric Soil Present? **YES**
Wetland Hydrology Present? **YES**

Is This Sample Area Within a Wetland? **YES**

Remarks: **All parameters are met. Area is classified as a palustrine scrub-shrub (PSS) wetland. Observation point taken in wetland near flag A-37.**

HYDROLOGY

Wetland Hydrology Indicators:
Primary Indicators (minimum of one is required; check all that apply)

	Surface Water (A1)		Aquatic Fauna (B13)
X	High Water Table (A2)		Marl Deposits (B15)
X	Saturation (A3)		Hydrogen Sulfide Odor (C1)
	Water Marks (B1)		Oxidized Rhizospheres on Living Roots (C3)
	Sediment Deposits (B2)		Presence of Reduced Iron (C4)
	Drift Deposits (B3)		Recent Iron Reduction in Tilled Soils (C6)
	Algal Mat or Crust (B4)		Thin Muck Surface (C7)
	Iron Deposits (B5)		Other (Explain in Remarks)
	Inundation Visible on Aerial (B7)		
	Water-Stained Leaves (B9)		

Secondary Indicators (minimum of two required)

	Surface Soil Cracks (B6)
	Sparsely Vegetated Concave Surface (B8)
	Drainage Patterns (B10)
	Moss Trim Lines (B16)
	Dry-Season Water Table (C2)
	Crayfish Burrows (C8)
	Saturation Visible on Aerial Imagery (C9)
	Geomorphic Position (D2)
	Shallow Aquitard (D3)
	FAC-Neutral Test (D5)
	Sphagnum Moss (D8)

Field Observations:
Surface Water Present? Depth (inches):
Water Table Present? **YES** Depth (inches): **SURFACE**
Saturation Present? **YES** Depth (inches): **SURFACE**

Wetland Hydrology Present? **YES**

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks: **Primary indicators of wetland hydrology present; parameter is met.**

SOIL

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (in)	Matrix Color (moist)	Matrix %	Redox Color (moist)	Redox %	Type[1]	Loc[2]	Texture	Remarks
0-16	2.5Y 4/2	80	7.5YR 5/8	20	C	M	sandy loam	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, MS=Masked Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

	Histosol (A1)		Dark Surface (S7)
	Histic Epipedon (A2)		Polyvalue Below Surface (S8)
	Black Histic (A3)		Thin Dark Surface (S9)
	Hydrogen Sulfide (A4)		Loamy Gleyed Matrix (F2)
	Stratified Layers (A5)	X	Depleted Matrix (F3)
	Organic Bodies (A6)		Redox Dark Surface (F6)
	5cm Mucky Mineral (A7)		Depleted Dark Surface (F7)
	1cm Muck (A9)		Redox Depressions (F8)
	Depleted Below Dark Surface (A11)		Iron-Manganese Masses (F12)
	Thick Dark Surface (A12)		Umbric Surface (F13)
	Sandy Gleyed Matrix (S4)		Piedmont Floodplain Soils (F19)
	Sandy Redox (S5)		Anomalous Bright Loamy Soils (F20)
	Stripped Matrix (S6)		

Indicators for Problematic Hydric Soils[3]:

	2 cm Muck (A10)
	Piedmont Floodplain Soils (F19)
	Anomalous Bright Loamy Soils (F20)
	Red Parent Material (F21)
	Very Shallow Dark Surface (TF12)
	Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):
Type:
Depth (inches):

Hydric Soil Present? **YES**

Remarks: **Indicator F3 (Depleted Matrix) present and soil meets NTCHS definition of hydric soil; parameter is met.**

VEGETATION - Use scientific names of plants.

Sampling Point: 3

Tree Stratum (Plot size: 30' radius)	Absolute % Cover	Dom. Sp?	Indicator Status
1.			
2.			
3.			
4.			
5.			
6.			
7.			
		= Total Cover	
Sapling Stratum (Plot size: 30' radius)			
1.			
2.			
3.			
4.			
5.			
6.			
7.			
		= Total Cover	
Shrub Stratum (Plot size: 15' radius)			
1. Morella cerifera	38	X	FAC
2.			
3.			
4.			
5.			
6.			
7.			
	38	= Total Cover	
Herb Stratum (Plot size: 10' radius)			
1. Phragmites australis	85	X	FACW
2.			
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
12.			
	85	= Total Cover	
Woody Vines (Plot size: 30' radius)			
1.			
2.			
3.			
4.			
5.			
		= Total Cover	

Dominance Test Worksheet:

# Dominants OBL, FACW, FAC:	2	(A)
# Dominants across all strata:	2	(B)
% Dominants OBL, FACW, FAC:	100%	(A/B)

Prevalence Index Worksheet:

Total % Cover of:			Multiply By:	
OBL		x 1 =		
FACW	85	x 2 =	170	
FAC	38	x 3 =	114	
FACU		x 4 =		
UPL		x 5 =		
Sum:	123	(A)	284	(B)

Prevalence Index = B/A = 2.31

Hydrophytic Vegetation Indicators:

- X Dominance Test is > 50%
- X Prevalence Index is <= 3.0
- ___ Problematic Hydrophytic Vegetation[1] (explain)
- ___ Rapid Test for Hydrophytic Vegetation
- ___ Morphological Adaptations

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definitions of Vegetation Strata:

Tree - Woody plants, excluding woody vines, approximately 20ft (6m) or more in height and 3in (7.6cm) or larger in diameter at breast height (DBH).

Sapling - Woody plants, excluding woody vines, approximately 20ft (6m) or more in height and less than 3in (7.6cm) DBH.

Shrub - Woody plants, excluding woody vines, approximately 3 to 20ft (1 to 6m) in height.

Herb - All herbaceous (non-woody) plants, including herbaceous vines, regardless of size. Includes woody plants, except woody vines, less than approximately 3ft (1m) in height.

Woody vine - All woody vines, regardless of height.

Hydrophytic Vegetation Present? YES

Remarks: (If observed, list morphological adaptations below).

Indicator 2 (Dominance Test) present with >50% of dominant species across all vegetation strata FAC or wetter.

Other indicators calculated for reference only.

WETLAND DETERMINATION DATA FORM - Atlantic and Gulf Coastal Plain Region

Project Site: **NASA Wallops Tower Site - Study Area 2** City/County: **Accomack County** Samp. Date: **4/23/2015**
Applicant/Owner: **LJT & Associates, Inc./NASA Wallops Island** State: **VA** Sampling Point: **4**
Investigator(s): **C. Senfield, PWS, PWD** Section, Township, Range: **NA**
Landform (hillslope, terrace, etc.): **Manmade Berm** Local relief (concave, convex, none): **Convex** Slope (%): **0-1**
Subregion (LRR or MLRA): **LRR T, MLRA 153D** Lat: **37 50 50 N** Long: **75 28 31 W** Datum: **WGS 1984**
Soil Map Unit: **Camocca fine sand, 0 to 2 percent slopes, frequently flooded** NWI Map Unit: **PEM1/SS3Cd**
Are climatic/hydrologic conditions on the site typical for this time of year? **Yes** (If no, explain in Remarks.)
Are Vegetation, Soil, or Hydrology significantly disturbed? **No** Normal Circumstances? **Yes**
Are Vegetation, Soil, or Hydrology naturally problematic? **No** (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS - Attach site map showing sample point locations, transects, important features, etc.

Hydrophytic Vegetation Present? **NO**
Hydric Soil Present? **NO**
Wetland Hydrology Present? **NO**

Is This Sample Area Within a Wetland? **NO**

Remarks: **One or more parameters lacking. Area is not a jurisdictional wetland.**
Observation point taken in near flag B-8.

HYDROLOGY

Wetland Hydrology Indicators:
Primary Indicators (minimum of one is required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Inundation Visible on Aerial (B7)
- ___ Water-Stained Leaves (B9)
- ___ Aquatic Fauna (B13)
- ___ Marl Deposits (B15)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres on Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Drainage Patterns (B10)
- ___ Moss Trim Lines (B16)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ FAC-Neutral Test (D5)
- ___ Sphagnum Moss (D8)

Field Observations:
Surface Water Present? ___ Depth (inches): ___
Water Table Present? ___ Depth (inches): ___
Saturation Present? Depth (inches):

Wetland Hydrology Present? **NO**

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks: **No primary or secondary indicators of wetland hydrology present; parameter is not met.**

SOIL

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth	Matrix		Redox Features					
(in)	Color (moist)	%	Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-2	**10YR 3/2**	**100**					**loamy sand**	
2-5	**2.5Y 4/3**	**100**					**loamy sand**	
5-8	**2.5Y 3/3**	**100**					**loamy sand**	
8-16	**2.5Y 4/3**	**100**					**loamy sand**	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, MS=Masked Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5)
- ___ Organic Bodies (A6)
- ___ 5cm Mucky Mineral (A7)
- ___ 1cm Muck (A9)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Dark Surface (S7)
- ___ Polyvalue Below Surface (S8)
- ___ Thin Dark Surface (S9)
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)
- ___ Iron-Manganese Masses (F12)
- ___ Umbric Surface (F13)
- ___ Piedmont Floodplain Soils (F19)
- ___ Anomalous Bright Loamy Soils (F20)

Indicators for Problematic Hydric Soils[3]:

- ___ 2 cm Muck (A10)
- ___ Piedmont Floodplain Soils (F19)
- ___ Anomalous Bright Loamy Soils (F20)
- ___ Red Parent Material (F21)
- ___ Very Shallow Dark Surface (TF12)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):
Type: ___
Depth (inches): ___

Hydric Soil Present? **NO**

Remarks: **No hydric soil indicators present and soil does not meet NTCHS definition of hydric soil; parameter is not met.**
Evidence of disturbance in soil profile.

VEGETATION - Use scientific names of plants.

Sampling Point: 4

Tree Stratum (Plot size: 30' radius)	Absolute % Cover	Dom. Sp?	Indicator Status
1.			
2.			
3.			
4.			
5.			
6.			
7.			
		= Total Cover	

Sapling Stratum (Plot size: 30' radius)	Absolute % Cover	Dom. Sp?	Indicator Status
1.			
2.			
3.			
4.			
5.			
6.			
7.			
		= Total Cover	

Shrub Stratum (Plot size: 15' radius)	Absolute % Cover	Dom. Sp?	Indicator Status
1.			
2.			
3.			
4.			
5.			
6.			
7.			
		= Total Cover	

Herb Stratum (Plot size: 10' radius)	Absolute % Cover	Dom. Sp?	Indicator Status
1. **Phragmites australis**	**38**	**X**	**FACW**
2. **Achillea millefolium**	**38**	**X**	**FACU**
3. **Cardamine parviflora**	**15**		**FACU**
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
12.			
	91	= Total Cover	

Woody Vines (Plot size: 30' radius)	Absolute % Cover	Dom. Sp?	Indicator Status
1.			
2.			
3.			
4.			
5.			
		= Total Cover	

Dominance Test Worksheet:

# Dominants OBL, FACW, FAC:	**1**	(A)
# Dominants across all strata:	**2**	(B)
% Dominants OBL, FACW, FAC:	**50%**	(A/B)

Prevalence Index Worksheet:

Total % Cover of:			Multiply By:
OBL		x 1 =	
FACW	**38**	x 2 =	**76**
FAC		x 3 =	
FACU	**53**	x 4 =	**212**
UPL		x 5 =	
Sum:	**91** (A)		**288** (B)
Prevalence Index		= B/A =	**3.16**

Hydrophytic Vegetation Indicators:

- ___ Dominance Test is > 50%
- ___ Prevalence Index is <= 3.0
- ___ Problematic Hydrophytic Vegetation[1] (explain)
- ___ Rapid Test for Hydrophytic Vegetation
- ___ Morphological Adaptations

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definitions of Vegetation Strata:

Tree - Woody plants, excluding woody vines, approximately 20ft (6m) or more in height and 3in (7.6cm) or larger in diameter at breast height (DBH).

Sapling - Woody plants, excluding woody vines, approximately 20ft (6m) or more in height and less than 3in (7.6cm) DBH.

Shrub - Woody plants, excluding woody vines, approximately 3 to 20ft (1 to 6m) in height.

Herb - All herbaceous (non-woody) plants, including herbaceous vines, regardless of size. Includes woody plants, except woody vines, less than approximately 3ft (1m) in height.

Woody vine - All woody vines, regardless of height.

Hydrophytic Vegetation Present? **NO**

Remarks: (If observed, list morphological adaptations below).

No hydrophytic vegetation indicators present; parameter is not met.

Other indicators calculated for reference only.

WETLAND DETERMINATION DATA FORM - Atlantic and Gulf Coastal Plain Region

Project Site: **NASA Wallops Tower Site - Study Area 2** City/County: **Accomack County** Samp. Date: **4/23/2015**
Applicant/Owner: **LJT & Associates, Inc./NASA Wallops Island** State: **VA** Sampling Point: **5**
Investigator(s): **C. Senfield, PWS, PWD** Section, Township, Range: **NA**
Landform (hillslope, terrace, etc.): **Depression** Local relief (concave, convex, none): **Concave** Slope (%): **0-1**
Subregion (LRR or MLRA): **LRR T, MLRA 153D** Lat: **37 50 50 N** Long: **75 28 31 W** Datum: **WGS 1984**
Soil Map Unit: **Camocca fine sand, 0 to 2 percent slopes, frequently flooded** NWI Map Unit: **PEM1/SS3Cd**
Are climatic/hydrologic conditions on the site typical for this time of year? **Yes** (If no, explain in Remarks.)
Are Vegetation, Soil, or Hydrology significantly disturbed? **No** Normal Circumstances? **Yes**
Are Vegetation, Soil, or Hydrology naturally problematic? **No** (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS - Attach site map showing sample point locations, transects, important features, etc.

Hydrophytic Vegetation Present? **YES**
Hydric Soil Present? **YES**
Wetland Hydrology Present? **YES**

Is This Sample Area Within a Wetland? **YES**

Remarks: **All parameters are met. Area is classified as a palustrine emergent (PEM) wetland.**
Observation point taken in wetland near flag B-7.

HYDROLOGY

Wetland Hydrology Indicators:
Primary Indicators (minimum of one is required; check all that apply)

	Surface Water (A1)		Aquatic Fauna (B13)
X	High Water Table (A2)		Marl Deposits (B15)
X	Saturation (A3)		Hydrogen Sulfide Odor (C1)
	Water Marks (B1)		Oxidized Rhizospheres on Living Roots (C3)
	Sediment Deposits (B2)		Presence of Reduced Iron (C4)
	Drift Deposits (B3)		Recent Iron Reduction in Tilled Soils (C6)
	Algal Mat or Crust (B4)		Thin Muck Surface (C7)
	Iron Deposits (B5)		Other (Explain in Remarks)
	Inundation Visible on Aerial (B7)		
	Water-Stained Leaves (B9)		

Secondary Indicators (minimum of two required)

	Surface Soil Cracks (B6)
	Sparsely Vegetated Concave Surface (B8)
	Drainage Patterns (B10)
	Moss Trim Lines (B16)
	Dry-Season Water Table (C2)
	Crayfish Burrows (C8)
	Saturation Visible on Aerial Imagery (C9)
	Geomorphic Position (D2)
	Shallow Aquitard (D3)
	FAC-Neutral Test (D5)
	Sphagnum Moss (D8)

Field Observations:
Surface Water Present? Depth (inches):
Water Table Present? **YES** Depth (inches): **SURFACE**
Saturation Present? **YES** Depth (inches): **SURFACE**

Wetland Hydrology Present? **YES**

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:
Primary indicators of wetland hydrology present; parameter is met.

SOIL

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth	Matrix		Redox Features					
(in)	Color (moist)	%	Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-4	2.5Y 5/2	100					sand	
4-12	2.5Y 4/2	95	7.5YR 5/6	5	C	M	sand	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, MS=Masked Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

	Histosol (A1)		Dark Surface (S7)
	Histic Epipedon (A2)		Polyvalue Below Surface (S8)
	Black Histic (A3)		Thin Dark Surface (S9)
	Hydrogen Sulfide (A4)		Loamy Gleyed Matrix (F2)
	Stratified Layers (A5)		Depleted Matrix (F3)
	Organic Bodies (A6)		Redox Dark Surface (F6)
	5cm Mucky Mineral (A7)		Depleted Dark Surface (F7)
	1cm Muck (A9)		Redox Depressions (F8)
	Depleted Below Dark Surface (A11)		Iron-Manganese Masses (F12)
	Thick Dark Surface (A12)		Umbric Surface (F13)
	Sandy Gleyed Matrix (S4)		Piedmont Floodplain Soils (F19)
X	Sandy Redox (S5)		Anomalous Bright Loamy Soils (F20)
	Stripped Matrix (S6)		

Indicators for Problematic Hydric Soils[3]:

	2 cm Muck (A10)
	Piedmont Floodplain Soils (F19)
	Anomalous Bright Loamy Soils (F20)
	Red Parent Material (F21)
	Very Shallow Dark Surface (TF12)
	Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):
Type:
Depth (inches):

Hydric Soil Present? **YES**

Remarks: **Indicator S5 (Sandy Redox) present and soil meets NTCHS definition of hydric soil; parameter is met.**

VEGETATION - Use scientific names of plants. VHB Sampling Point: 5

Tree Stratum (Plot size: 30' radius)	Absolute % Cover	Dom. Sp?	Indicator Status
1.			
2.			
3.			
4.			
5.			
6.			
7.			
		= Total Cover	
Sapling Stratum (Plot size: 30' radius)			
1.			
2.			
3.			
4.			
5.			
6.			
7.			
		= Total Cover	
Shrub Stratum (Plot size: 15' radius)			
1.			
2.			
3.			
4.			
5.			
6.			
7.			
		= Total Cover	
Herb Stratum (Plot size: 10' radius)			
1. **Phragmites australis**	**63**	**X**	**FACW**
2. **Morella cerifera**	**15**		**FAC**
3. **Juncus scirpoides**	**15**		**FACW**
4. **Baccharis halimifolia**	**3**		**FAC**
5. **Toxicodendron radicans**	**3**		**FAC**
6.			
7.			
8.			
9.			
10.			
11.			
12.			
	99	= Total Cover	
Woody Vines (Plot size: 30' radius)			
1.			
2.			
3.			
4.			
5.			
		= Total Cover	

Dominance Test Worksheet:

# Dominants OBL, FACW, FAC:	**1**	(A)
# Dominants across all strata:	**1**	(B)
% Dominants OBL, FACW, FAC:	**100%**	(A/B)

Prevalence Index Worksheet:

Total % Cover of:			Multiply By:	
OBL		x 1 =		
FACW	**78**	x 2 =	**156**	
FAC	**21**	x 3 =	**63**	
FACU		x 4 =		
UPL		x 5 =		
Sum:	**99** (A)		**219**	(B)

Prevalence Index = B/A = **2.21**

Hydrophytic Vegetation Indicators:

- **X** Dominance Test is > 50%
- **X** Prevalence Index is <= 3.0
- ___ Problematic Hydrophytic Vegetation[1] (explain)
- ___ Rapid Test for Hydrophytic Vegetation
- ___ Morphological Adaptations

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definitions of Vegetation Strata:

Tree - Woody plants, excluding woody vines, approximately 20ft (6m) or more in height and 3in (7.6cm) or larger in diameter at breast height (DBH).

Sapling - Woody plants, excluding woody vines, approximately 20ft (6m) or more in height and less than 3in (7.6cm) DBH.

Shrub - Woody plants, excluding woody vines, approximately 3 to 20ft (1 to 6m) in height.

Herb - All herbaceous (non-woody) plants, including herbaceous vines, regardless of size. Includes woody plants, except woody vines, less than approximately 3ft (1m) in height.

Woody vine - All woody vines, regardless of height.

Hydrophytic Vegetation Present? **YES**

Remarks: (If observed, list morphological adaptations below).

Indicator 2 (Dominance Test) present with >50% of dominant species across all vegetation strata FAC or wetter.

Other indicators calculated for reference only.

WETLAND DETERMINATION DATA FORM - Atlantic and Gulf Coastal Plain Region

Project Site: **NASA Wallops Tower Site - Study Area 2** City/County: **Accomack County** Samp. Date: **4/23/2015**
Applicant/Owner: **LJT & Associates, Inc./NASA Wallops Island** State: **VA** Sampling Point: **6**
Investigator(s): **C. Senfield, PWS, PWD** Section, Township, Range: **NA**
Landform (hillslope, terrace, etc.): **Hillslope** Local relief (concave, convex, none): **Convex** Slope (%): **0-1**
Subregion (LRR or MLRA): **LRR T, MLRA 153D** Lat: **37 50 50 N** Long: **75 28 31 W** Datum: **WGS 1984**
Soil Map Unit: **Camocca fine sand, 0 to 2 percent slopes, frequently flooded** NWI Map Unit: **None**
Are climatic/hydrologic conditions on the site typical for this time of year? **Yes** (If no, explain in Remarks.)
Are Vegetation, Soil, or Hydrology significantly disturbed? **No** Normal Circumstances? **Yes**
Are Vegetation, Soil, or Hydrology naturally problematic? **No** (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS - Attach site map showing sample point locations, transects, important features, etc.

Hydrophytic Vegetation Present? **NO**
Hydric Soil Present? **NO**
Wetland Hydrology Present? **NO**

Is This Sample Area Within a Wetland? **NO**

Remarks: **One or more parameters lacking. Area is not a jurisdictional wetland.**
Observation point taken in forested upland near flag A-12.

HYDROLOGY

Wetland Hydrology Indicators:
Primary Indicators (minimum of one is required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Inundation Visible on Aerial (B7)
- ___ Water-Stained Leaves (B9)
- ___ Aquatic Fauna (B13)
- ___ Marl Deposits (B15)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres on Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Drainage Patterns (B10)
- ___ Moss Trim Lines (B16)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ FAC-Neutral Test (D5)
- ___ Sphagnum Moss (D8)

Field Observations:
Surface Water Present? ___ Depth (inches): ___
Water Table Present? ___ Depth (inches): ___
Saturation Present? Depth (inches):

Wetland Hydrology Present? **NO**

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks: **No primary or secondary indicators of wetland hydrology present; parameter is not met.**

SOIL

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (in)	Matrix Color (moist)	Matrix %	Redox Color (moist)	Redox %	Type[1]	Loc[2]	Texture	Remarks
0-4	10YR 3/3	100					loamy sand	
4-16	10YR 4/4	100					loamy sand	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, MS=Masked Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5)
- ___ Organic Bodies (A6)
- ___ 5cm Mucky Mineral (A7)
- ___ 1cm Muck (A9)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Dark Surface (S7)
- ___ Polyvalue Below Surface (S8)
- ___ Thin Dark Surface (S9)
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)
- ___ Iron-Manganese Masses (F12)
- ___ Umbric Surface (F13)
- ___ Piedmont Floodplain Soils (F19)
- ___ Anomalous Bright Loamy Soils (F20)

Indicators for Problematic Hydric Soils[3]:

- ___ 2 cm Muck (A10)
- ___ Piedmont Floodplain Soils (F19)
- ___ Anomalous Bright Loamy Soils (F20)
- ___ Red Parent Material (F21)
- ___ Very Shallow Dark Surface (TF12)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):
Type:
Depth (inches):

Hydric Soil Present? **NO**

Remarks: **No hydric soil indicators present and soil does not meet NTCHS definition of hydric soil; parameter is not met.**

VEGETATION - Use scientific names of plants. Sampling Point: 6

Tree Stratum (Plot size: 30' radius)	Absolute % Cover	Dom. Sp?	Indicator Status
1. Prunus serotina	38	X	FACU
2. Juniperus virginiana	15	X	FACU
3.			
4.			
5.			
6.			
7.			
	53	= Total Cover	
Sapling Stratum (Plot size: 30' radius)			
1.			
2.			
3.			
4.			
5.			
6.			
7.			
		= Total Cover	
Shrub Stratum (Plot size: 15' radius)			
1. Prunus serotina	3	X	FACU
2.			
3.			
4.			
5.			
6.			
7.			
	3	= Total Cover	
Herb Stratum (Plot size: 10' radius)			
1. Phragmites australis	15	X	FACW
2. Lonicera japonica	15	X	FACU
3. Toxicodendron radicans	15	X	FAC
4. Aristida dichotoma	15	X	FACU
5. Rubus argutus	3		FAC
6. Achillea millefolium	3		FACU
7.			
8.			
9.			
10.			
11.			
12.			
	66	= Total Cover	
Woody Vines (Plot size: 30' radius)			
1. Toxicodendron radicans	3	X	FAC
2.			
3.			
4.			
5.			
	3	= Total Cover	

Dominance Test Worksheet:

# Dominants OBL, FACW, FAC:	3	(A)
# Dominants across all strata:	8	(B)
% Dominants OBL, FACW, FAC:	38%	(A/B)

Prevalence Index Worksheet:

Total % Cover of:			Multiply By:
OBL		x 1 =	
FACW	15	x 2 =	30
FAC	21	x 3 =	63
FACU	89	x 4 =	356
UPL		x 5 =	
Sum:	125 (A)		449 (B)

Prevalence Index = B/A = 3.59

Hydrophytic Vegetation Indicators:

- ___ Dominance Test is > 50%
- ___ Prevalence Index is <= 3.0
- ___ Problematic Hydrophytic Vegetation[1] (explain)
- ___ Rapid Test for Hydrophytic Vegetation
- ___ Morphological Adaptations

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definitions of Vegetation Strata:

Tree - Woody plants, excluding woody vines, approximately 20ft (6m) or more in height and 3in (7.6cm) or larger in diameter at breast height (DBH).

Sapling - Woody plants, excluding woody vines, approximately 20ft (6m) or more in height and less than 3in (7.6cm) DBH.

Shrub - Woody plants, excluding woody vines, approximately 3 to 20ft (1 to 6m) in height.

Herb - All herbaceous (non-woody) plants, including herbaceous vines, regardless of size. Includes woody plants, except woody vines, less than approximately 3ft (1m) in height.

Woody vine - All woody vines, regardless of height.

Hydrophytic Vegetation Present? **NO**

Remarks: (If observed, list morphological adaptations below).

No hydrophytic vegetation indicators present; parameter is not met.

WETLAND DETERMINATION DATA FORM - Atlantic and Gulf Coastal Plain Region

Project Site: **NASA Wallops Tower Site - Study Area 2** City/County: **Accomack County** Samp. Date: **4/23/2015**
Applicant/Owner: **LJT & Associates, Inc./NASA Wallops Island** State: **VA** Sampling Point: **7**
Investigator(s): **C. Senfield, PWS, PWD** Section, Township, Range: **NA**
Landform (hillslope, terrace, etc.): **Depression** Local relief (concave, convex, none): **Concave** Slope (%): **0-1**
Subregion (LRR or MLRA): **LRR T, MLRA 153D** Lat: **37 50 50 N** Long: **75 28 31 W** Datum: **WGS 1984**
Soil Map Unit: **Chincoteague silt loam, 0 to 1 percent slopes, frequently flooded** NWI Map Unit: **PEM1/SS3Cd**
Are climatic/hydrologic conditions on the site typical for this time of year? **Yes** (If no, explain in Remarks.)
Are Vegetation, Soil, or Hydrology significantly disturbed? **No** Normal Circumstances? **Yes**
Are Vegetation, Soil, or Hydrology naturally problematic? **No** (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS - Attach site map showing sample point locations, transects, important features, etc.

Hydrophytic Vegetation Present? **YES**
Hydric Soil Present? **YES**
Wetland Hydrology Present? **YES**

Is This Sample Area Within a Wetland? **YES**

Remarks: **All parameters are met. Area is classified as a palustrine scrub-shrub (PSS) wetland.**
Observation point taken in wetland near flag A-12.

HYDROLOGY

Wetland Hydrology Indicators:
Primary Indicators (minimum of one is required; check all that apply)

- ___ Surface Water (A1)
- X High Water Table (A2)
- X Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Inundation Visible on Aerial (B7)
- ___ Water-Stained Leaves (B9)
- ___ Aquatic Fauna (B13)
- ___ Marl Deposits (B15)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres on Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Drainage Patterns (B10)
- ___ Moss Trim Lines (B16)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ FAC-Neutral Test (D5)
- ___ Sphagnum Moss (D8)

Field Observations:
Surface Water Present? ___ Depth (inches): ___
Water Table Present? **YES** Depth (inches): **SURFACE**
Saturation Present? **YES** Depth (inches): **SURFACE**

Wetland Hydrology Present? **YES**

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:
Primary indicators of wetland hydrology present; parameter is met.

SOIL

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (in)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox %	Type[1]	Loc[2]	Texture	Remarks
0-16	**10YR 3/2**	**80**	**7.5YR 5/8**	**20**	**C**	**M**	**sandy loam**	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, MS=Masked Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5)
- ___ Organic Bodies (A6)
- ___ 5cm Mucky Mineral (A7)
- ___ 1cm Muck (A9)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Dark Surface (S7)
- ___ Polyvalue Below Surface (S8)
- ___ Thin Dark Surface (S9)
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- X Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)
- ___ Iron-Manganese Masses (F12)
- ___ Umbric Surface (F13)
- ___ Piedmont Floodplain Soils (F19)
- ___ Anomalous Bright Loamy Soils (F20)

Indicators for Problematic Hydric Soils[3]:

- ___ 2 cm Muck (A10)
- ___ Piedmont Floodplain Soils (F19)
- ___ Anomalous Bright Loamy Soils (F20)
- ___ Red Parent Material (F21)
- ___ Very Shallow Dark Surface (TF12)
- ___ Other (Explain in Remarks)

[3] Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):
Type:
Depth (inches):

Hydric Soil Present? **YES**

Remarks: **Indicator F6 (Redox Dark Surface) present and soil meets NTCHS definition of hydric soil; parameter is met.**

Atlantic and Gulf Coastal Plain Region - Version 2.0
(Adapted By: Douglas A. DeBerry, PhD, PWS, PWD)

VEGETATION - Use scientific names of plants. Sampling Point: **7**

Tree Stratum (Plot size: **30' radius**)	Absolute % Cover	Dom. Sp?	Indicator Status
1.			
2.			
3.			
4.			
5.			
6.			
7.			
		= Total Cover	
Sapling Stratum (Plot size: **30' radius**)			
1. **Morella cerifera**	**15**	**X**	**FAC**
2.			
3.			
4.			
5.			
6.			
7.			
	15	= Total Cover	
Shrub Stratum (Plot size: **15' radius**)			
1. **Morella cerifera**	**15**	**X**	**FAC**
2.			
3.			
4.			
5.			
6.			
7.			
	15	= Total Cover	
Herb Stratum (Plot size: **10' radius**)			
1. **Phragmites australis**	**85**	**X**	**FACW**
2.			
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
12.			
	85	= Total Cover	
Woody Vines (Plot size: **30' radius**)			
1.			
2.			
3.			
4.			
5.			
		= Total Cover	

Dominance Test Worksheet:

# Dominants OBL, FACW, FAC:	**3**	(A)
# Dominants across all strata:	**3**	(B)
% Dominants OBL, FACW, FAC:	**100%**	(A/B)

Prevalence Index Worksheet:

Total % Cover of:			Multiply By:
OBL		x 1 =	
FACW	**85**	x 2 =	**170**
FAC	**30**	x 3 =	**90**
FACU		x 4 =	
UPL		x 5 =	
Sum:	**115** (A)		**260** (B)

Prevalence Index = B/A = **2.26**

Hydrophytic Vegetation Indicators:

- **X** Dominance Test is > 50%
- **X** Prevalence Index is <= 3.0
- ___ Problematic Hydrophytic Vegetation[1] (explain)
- ___ Rapid Test for Hydrophytic Vegetation
- ___ Morphological Adaptations

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definitions of Vegetation Strata:

Tree - Woody plants, excluding woody vines, approximately 20ft (6m) or more in height and 3in (7.6cm) or larger in diameter at breast height (DBH).

Sapling - Woody plants, excluding woody vines, approximately 20ft (6m) or more in height and less than 3in (7.6cm) DBH.

Shrub - Woody plants, excluding woody vines, approximately 3 to 20ft (1 to 6m) in height.

Herb - All herbaceous (non-woody) plants, including herbaceous vines, regardless of size. Includes woody plants, except woody vines, less than approximately 3ft (1m) in height.

Woody vine - All woody vines, regardless of height.

Hydrophytic Vegetation Present? **YES**

Remarks: (If observed, list morphological adaptations below).

Indicator 2 (Dominance Test) present with >50% of dominant species across all vegetation strata FAC or wetter.

Other indicators calculated for reference only.

WETLAND DETERMINATION DATA FORM - Atlantic and Gulf Coastal Plain Region

Project Site: **NASA Wallops Tower Site - Study Area 2** City/County: **Accomack County** Samp. Date: **4/23/2015**
Applicant/Owner: **LJT & Associates, Inc./NASA Wallops Island** State: **VA** Sampling Point: **8**
Investigator(s): **C. Senfield, PWS, PWD** Section, Township, Range: **NA**
Landform (hillslope, terrace, etc.): **Depression** Local relief (concave, convex, none): **Concave** Slope (%): **0-1**
Subregion (LRR or MLRA): **LRR T, MLRA 153D** Lat: **37 50 50 N** Long: **75 28 31 W** Datum: **WGS 1984**
Soil Map Unit: **Camocca fine sand, 0 to 2 percent slopes, frequently flooded** NWI Map Unit: **None**
Are climatic/hydrologic conditions on the site typical for this time of year? **Yes** (If no, explain in Remarks.)
Are Vegetation, Soil, or Hydrology significantly disturbed? **No** Normal Circumstances? **Yes**
Are Vegetation, Soil, or Hydrology naturally problematic? **No** (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS - Attach site map showing sample point locations, transects, important features, etc.

Hydrophytic Vegetation Present? **YES**
Hydric Soil Present? **YES**
Wetland Hydrology Present? **YES**

Is This Sample Area Within a Wetland? **YES**

Remarks: **All parameters are met. Area is classified as a palustrine emergent (PEM) wetland. Observation point taken in jurisdictional ditch near flag JD-1-5.**

HYDROLOGY

Wetland Hydrology Indicators:
Primary Indicators (minimum of one is required; check all that apply)

	Surface Water (A1)		Aquatic Fauna (B13)
X	High Water Table (A2)		Marl Deposits (B15)
X	Saturation (A3)		Hydrogen Sulfide Odor (C1)
	Water Marks (B1)		Oxidized Rhizospheres on Living Roots (C3)
	Sediment Deposits (B2)		Presence of Reduced Iron (C4)
	Drift Deposits (B3)		Recent Iron Reduction in Tilled Soils (C6)
	Algal Mat or Crust (B4)		Thin Muck Surface (C7)
	Iron Deposits (B5)		Other (Explain in Remarks)
	Inundation Visible on Aerial (B7)		
	Water-Stained Leaves (B9)		

Secondary Indicators (minimum of two required)

	Surface Soil Cracks (B6)
	Sparsely Vegetated Concave Surface (B8)
	Drainage Patterns (B10)
	Moss Trim Lines (B16)
	Dry-Season Water Table (C2)
	Crayfish Burrows (C8)
	Saturation Visible on Aerial Imagery (C9)
	Geomorphic Position (D2)
	Shallow Aquitard (D3)
	FAC-Neutral Test (D5)
	Sphagnum Moss (D8)

Field Observations:
Surface Water Present? Depth (inches):
Water Table Present? **YES** Depth (inches): **SURFACE**
Saturation Present? **YES** Depth (inches): **SURFACE**

Wetland Hydrology Present? **YES**

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks: **Primary indicators of wetland hydrology present; parameter is met.**

SOIL

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (in)	Matrix Color (moist)	Matrix %	Redox Color (moist)	Redox %	Type[1]	Loc[2]	Texture	Remarks
0-10	10YR 3/1	95	7.5YR 4/4	5	C	M	silt loam	
10-16	2.5Y 5/1	100					sand	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, MS=Masked Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

	Histosol (A1)		Dark Surface (S7)
	Histic Epipedon (A2)		Polyvalue Below Surface (S8)
	Black Histic (A3)		Thin Dark Surface (S9)
	Hydrogen Sulfide (A4)		Loamy Gleyed Matrix (F2)
	Stratified Layers (A5)		Depleted Matrix (F3)
	Organic Bodies (A6)	X	Redox Dark Surface (F6)
	5cm Mucky Mineral (A7)		Depleted Dark Surface (F7)
	1cm Muck (A9)		Redox Depressions (F8)
	Depleted Below Dark Surface (A11)		Iron-Manganese Masses (F12)
	Thick Dark Surface (A12)		Umbric Surface (F13)
	Sandy Gleyed Matrix (S4)		Piedmont Floodplain Soils (F19)
	Sandy Redox (S5)		Anomalous Bright Loamy Soils (F20)
	Stripped Matrix (S6)		

Indicators for Problematic Hydric Soils[3]:

	2 cm Muck (A10)
	Piedmont Floodplain Soils (F19)
	Anomalous Bright Loamy Soils (F20)
	Red Parent Material (F21)
	Very Shallow Dark Surface (TF12)
	Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):
Type:
Depth (inches):

Hydric Soil Present? **YES**

Remarks: **Indicator F6 (Redox Dark Surface) present and soil meets NTCHS definition of hydric soil; parameter is met.**

Atlantic and Gulf Coastal Plain Region - Version 2.0
(Adapted By: Douglas A. DeBerry, PhD, PWS, PWD)

VEGETATION - Use scientific names of plants. Sampling Point: **8**

Tree Stratum (Plot size: **30' radius**)	Absolute % Cover	Dom. Sp?	Indicator Status
1.			
2.			
3.			
4.			
5.			
6.			
7.			
		= Total Cover	
Sapling Stratum (Plot size: **30' radius**)			
1.			
2.			
3.			
4.			
5.			
6.			
7.			
		= Total Cover	
Shrub Stratum (Plot size: **15' radius**)			
1.			
2.			
3.			
4.			
5.			
6.			
7.			
		= Total Cover	
Herb Stratum (Plot size: **10' radius**)			
1. **Ludwigia palustris**	**38**	**X**	**OBL**
2. **Juncus effusus**	**15**	**X**	**OBL**
3. **Hydrocotyle umbellata**	**3**		**OBL**
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
12.			
	56	= Total Cover	
Woody Vines (Plot size: **30' radius**)			
1.			
2.			
3.			
4.			
5.			
		= Total Cover	

Dominance Test Worksheet:

# Dominants OBL, FACW, FAC:	**2**	(A)
# Dominants across all strata:	**2**	(B)
% Dominants OBL, FACW, FAC:	**100%**	(A/B)

Prevalence Index Worksheet:

Total % Cover of:			Multiply By:	
OBL	**56**	x 1 =	**56**	
FACW		x 2 =		
FAC		x 3 =		
FACU		x 4 =		
UPL		x 5 =		
Sum:	**56** (A)		**56**	(B)

Prevalence Index = B/A = **1.00**

Hydrophytic Vegetation Indicators:

X Dominance Test is > 50%

X Prevalence Index is <= 3.0

___ Problematic Hydrophytic Vegetation[1] (explain)

___ Rapid Test for Hydrophytic Vegetation

___ Morphological Adaptations

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definitions of Vegetation Strata:

Tree - Woody plants, excluding woody vines, approximately 20ft (6m) or more in height and 3in (7.6cm) or larger in diameter at breast height (DBH).

Sapling - Woody plants, excluding woody vines, approximately 20ft (6m) or more in height and less than 3in (7.6cm) DBH.

Shrub - Woody plants, excluding woody vines, approximately 3 to 20ft (1 to 6m) in height.

Herb - All herbaceous (non-woody) plants, including herbaceous vines, regardless of size. Includes woody plants, except woody vines, less than approximately 3ft (1m) in height.

Woody vine - All woody vines, regardless of height.

Hydrophytic Vegetation Present? **YES**

Remarks: (If observed, list morphological adaptations below).

Indicator 1 (Rapid Test) present due to dominance of FACW or OBL species.

Other indicators calculated for reference only.

WETLAND DETERMINATION DATA FORM - Atlantic and Gulf Coastal Plain Region

Project Site: **NASA Wallops Tower Site - Study Area 2** City/County: **Accomack County** Samp. Date: **4/23/2015**
Applicant/Owner: **LJT & Associates, Inc./NASA Wallops Island** State: **VA** Sampling Point: **9**
Investigator(s): **C. Senfield, PWS, PWD** Section, Township, Range: **NA**
Landform (hillslope, terrace, etc.): **Maintained Field** Local relief (concave, convex, none): **None** Slope (%): **0-1**
Subregion (LRR or MLRA): **LRR T, MLRA 153D** Lat: **37 50 50 N** Long: **75 28 31 W** Datum: **WGS 1984**
Soil Map Unit: **Camocca fine sand, 0 to 2 percent slopes, frequently flooded** NWI Map Unit: **None**
Are climatic/hydrologic conditions on the site typical for this time of year? **Yes** (If no, explain in Remarks.)
Are Vegetation, Soil, or Hydrology significantly disturbed? **No** Normal Circumstances? **Yes**
Are Vegetation, Soil, or Hydrology naturally problematic? **No** (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS - Attach site map showing sample point locations, transects, important features, etc.

Hydrophytic Vegetation Present? **YES**
Hydric Soil Present? **NO**
Wetland Hydrology Present? **NO**

Is This Sample Area Within a Wetland? **NO**

Remarks: **One or more parameters lacking. Area is not a jurisdictional wetland.**
Observation point taken in upland field above jurisdictional ditch near flag JD-1-6.

HYDROLOGY

Wetland Hydrology Indicators:
Primary Indicators (minimum of one is required; check all that apply)

___ Surface Water (A1)
___ High Water Table (A2)
___ Saturation (A3)
___ Water Marks (B1)
___ Sediment Deposits (B2)
___ Drift Deposits (B3)
___ Algal Mat or Crust (B4)
___ Iron Deposits (B5)
___ Inundation Visible on Aerial (B7)
___ Water-Stained Leaves (B9)
___ Aquatic Fauna (B13)
___ Marl Deposits (B15)
___ Hydrogen Sulfide Odor (C1)
___ Oxidized Rhizospheres on Living Roots (C3)
___ Presence of Reduced Iron (C4)
___ Recent Iron Reduction in Tilled Soils (C6)
___ Thin Muck Surface (C7)
___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

___ Surface Soil Cracks (B6)
___ Sparsely Vegetated Concave Surface (B8)
___ Drainage Patterns (B10)
___ Moss Trim Lines (B16)
___ Dry-Season Water Table (C2)
___ Crayfish Burrows (C8)
___ Saturation Visible on Aerial Imagery (C9)
___ Geomorphic Position (D2)
___ Shallow Aquitard (D3)
___ FAC-Neutral Test (D5)
___ Sphagnum Moss (D8)

Field Observations:
Surface Water Present? ___ Depth (inches): ___
Water Table Present? ___ Depth (inches): ___
Saturation Present? Depth (inches):

Wetland Hydrology Present? **NO**

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks: **No primary or secondary indicators of wetland hydrology present; parameter is not met.**

SOIL

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (in)	Matrix Color (moist)	Matrix %	Redox Color (moist)	Redox %	Type[1]	Loc[2]	Texture	Remarks
0-5	10YR 4/2	80	7.5YR 5/8	20	C	M	sandy clay loam	
5-11	10YR 4/2	80	7.5YR 5/8	20	C	M	sandy loam	
11-18	2.5Y 5/3	80	7.5YR 5/6	20	C	M	sandy loam	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, MS=Masked Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

___ Histosol (A1)
___ Histic Epipedon (A2)
___ Black Histic (A3)
___ Hydrogen Sulfide (A4)
___ Stratified Layers (A5)
___ Organic Bodies (A6)
___ 5cm Mucky Mineral (A7)
___ 1cm Muck (A9)
___ Depleted Below Dark Surface (A11)
___ Thick Dark Surface (A12)
___ Sandy Gleyed Matrix (S4)
___ Sandy Redox (S5)
Stripped Matrix (S6)
___ Dark Surface (S7)
___ Polyvalue Below Surface (S8)
___ Thin Dark Surface (S9)
___ Loamy Gleyed Matrix (F2)
___ Depleted Matrix (F3)
___ Redox Dark Surface (F6)
___ Depleted Dark Surface (F7)
___ Redox Depressions (F8)
___ Iron-Manganese Masses (F12)
___ Umbric Surface (F13)
___ Piedmont Floodplain Soils (F19)
___ Anomalous Bright Loamy Soils (F20)

Indicators for Problematic Hydric Soils[3]:

___ 2 cm Muck (A10)
___ Piedmont Floodplain Soils (F19)
___ Anomalous Bright Loamy Soils (F20)
___ Red Parent Material (F21)
___ Very Shallow Dark Surface (TF12)
___ Other (Explain in Remarks)

[3] Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):
Type:
Depth (inches):

Hydric Soil Present? **NO**

Remarks:
Soil meets hydric soil indicator but soil does not meet NTCHS definition of hydric soil; parameter is not met. Suspect dark colors in upper profile are indicative of relict conditions.

VEGETATION - Use scientific names of plants.

Sampling Point: 9

Tree Stratum (Plot size: 30' radius)	Absolute % Cover	Dom. Sp?	Indicator Status
1.			
2.			
3.			
4.			
5.			
6.			
7.			
		= Total Cover	
Sapling Stratum (Plot size: 30' radius)			
1.			
2.			
3.			
4.			
5.			
6.			
7.			
		= Total Cover	
Shrub Stratum (Plot size: 15' radius)			
1.			
2.			
3.			
4.			
5.			
6.			
7.			
		= Total Cover	
Herb Stratum (Plot size: 10' radius)			
1. Schedonorus arundinaceus	85	X	FAC
2. Taraxacum officinale	3		FACU
3. Cynodon dactylon	3		FACU
4. Vicia americana	3		FACU
5.			
6.			
7.			
8.			
9.			
10.			
11.			
12.			
	94	= Total Cover	
Woody Vines (Plot size: 30' radius)			
1.			
2.			
3.			
4.			
5.			
		= Total Cover	

Dominance Test Worksheet:

# Dominants OBL, FACW, FAC:	1	(A)
# Dominants across all strata:	1	(B)
% Dominants OBL, FACW, FAC:	100%	(A/B)

Prevalence Index Worksheet:

Total % Cover of:			Multiply By:	
OBL		x 1 =		
FACW		x 2 =		
FAC	85	x 3 =	255	
FACU	9	x 4 =	36	
UPL		x 5 =		
Sum:	94 (A)		291	(B)

Prevalence Index = B/A = 3.10

Hydrophytic Vegetation Indicators:

- X Dominance Test is > 50%
- ___ Prevalence Index is <= 3.0
- ___ Problematic Hydrophytic Vegetation[1] (explain)
- ___ Rapid Test for Hydrophytic Vegetation
- ___ Morphological Adaptations

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definitions of Vegetation Strata:

Tree - Woody plants, excluding woody vines, approximately 20ft (6m) or more in height and 3in (7.6cm) or larger in diameter at breast height (DBH).

Sapling - Woody plants, excluding woody vines, approximately 20ft (6m) or more in height and less than 3in (7.6cm) DBH.

Shrub - Woody plants, excluding woody vines, approximately 3 to 20ft (1 to 6m) in height.

Herb - All herbaceous (non-woody) plants, including herbaceous vines, regardless of size. Includes woody plants, except woody vines, less than approximately 3ft (1m) in height.

Woody vine - All woody vines, regardless of height.

Hydrophytic Vegetation Present? **YES**

Remarks: (If observed, list morphological adaptations below).

Indicator 2 (Dominance Test) present with >50% of dominant species across all vegetation strata FAC or wetter.

Other indicators calculated for reference only.

WETLAND DETERMINATION DATA FORM - Atlantic and Gulf Coastal Plain Region

Project Site: **NASA Wallops Tower Site - Study Area 2** City/County: **Accomack County** Samp. Date: **4/23/2015**
Applicant/Owner: **LJT & Associates, Inc./NASA Wallops Island** State: **VA** Sampling Point: **10**
Investigator(s): **C. Senfield, PWS, PWD** Section, Township, Range: **NA**
Landform (hillslope, terrace, etc.): **Maintained Field** Local relief (concave, convex, none): **None** Slope (%): **0-1**
Subregion (LRR or MLRA): **LRR T, MLRA 153D** Lat: **37 50 50 N** Long: **75 28 31 W** Datum: **WGS 1984**
Soil Map Unit: **Camocca fine sand, 0 to 2 percent slopes, frequently flooded** NWI Map Unit: **None**
Are climatic/hydrologic conditions on the site typical for this time of year? **Yes** (If no, explain in Remarks.)
Are Vegetation, Soil, or Hydrology significantly disturbed? **No** Normal Circumstances? **Yes**
Are Vegetation, Soil, or Hydrology naturally problematic? **No** (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS - Attach site map showing sample point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	**NO**	Is This Sample Area Within a Wetland? **NO**
Hydric Soil Present?	**NO**	
Wetland Hydrology Present?	**NO**	

Remarks: **One or more parameters lacking. Area is not a jurisdictional wetland.**
Observation point taken in upland field above jurisdictional ditch near flag JD-2-8.

HYDROLOGY

Wetland Hydrology Indicators:
Primary Indicators (minimum of one is required; check all that apply)

- Surface Water (A1)
- High Water Table (A2)
- Saturation (A3)
- Water Marks (B1)
- Sediment Deposits (B2)
- Drift Deposits (B3)
- Algal Mat or Crust (B4)
- Iron Deposits (B5)
- Inundation Visible on Aerial (B7)
- Water-Stained Leaves (B9)
- Aquatic Fauna (B13)
- Marl Deposits (B15)
- Hydrogen Sulfide Odor (C1)
- Oxidized Rhizospheres on Living Roots (C3)
- Presence of Reduced Iron (C4)
- Recent Iron Reduction in Tilled Soils (C6)
- Thin Muck Surface (C7)
- Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- Surface Soil Cracks (B6)
- Sparsely Vegetated Concave Surface (B8)
- Drainage Patterns (B10)
- Moss Trim Lines (B16)
- Dry-Season Water Table (C2)
- Crayfish Burrows (C8)
- Saturation Visible on Aerial Imagery (C9)
- Geomorphic Position (D2)
- Shallow Aquitard (D3)
- FAC-Neutral Test (D5)
- Sphagnum Moss (D8)

Field Observations:
Surface Water Present? Depth (inches):
Water Table Present? Depth (inches):
Saturation Present? Depth (inches):

Wetland Hydrology Present? **NO**

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks: **No primary or secondary indicators of wetland hydrology present; parameter is not met.**

SOIL

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth	Matrix		Redox Features					
(in)	Color (moist)	%	Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-4	**10YR 4/3**	**100**					**sandy loam**	
4-16	**10YR 4/4**	**100**					**sandy loam**	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, MS=Masked Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

- Histosol (A1)
- Histic Epipedon (A2)
- Black Histic (A3)
- Hydrogen Sulfide (A4)
- Stratified Layers (A5)
- Organic Bodies (A6)
- 5cm Mucky Mineral (A7)
- 1cm Muck (A9)
- Depleted Below Dark Surface (A11)
- Thick Dark Surface (A12)
- Sandy Gleyed Matrix (S4)
- Sandy Redox (S5)
- Stripped Matrix (S6)
- Dark Surface (S7)
- Polyvalue Below Surface (S8)
- Thin Dark Surface (S9)
- Loamy Gleyed Matrix (F2)
- Depleted Matrix (F3)
- Redox Dark Surface (F6)
- Depleted Dark Surface (F7)
- Redox Depressions (F8)
- Iron-Manganese Masses (F12)
- Umbric Surface (F13)
- Piedmont Floodplain Soils (F19)
- Anomalous Bright Loamy Soils (F20)

Indicators for Problematic Hydric Soils[3]:

- 2 cm Muck (A10)
- Piedmont Floodplain Soils (F19)
- Anomalous Bright Loamy Soils (F20)
- Red Parent Material (F21)
- Very Shallow Dark Surface (TF12)
- Other (Explain in Remarks)

[3] Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):
Type:
Depth (inches):

Hydric Soil Present? **NO**

Remarks: **No hydric soil indicators present and soil does not meet NTCHS definition of hydric soil; parameter is not met.**

VEGETATION - Use scientific names of plants. Sampling Point: **10**

Tree Stratum (Plot size: **30' radius**)	Absolute % Cover	Dom. Sp?	Indicator Status
1.			
2.			
3.			
4.			
5.			
6.			
7.			
		= Total Cover	
Sapling Stratum (Plot size: **30' radius**)			
1.			
2.			
3.			
4.			
5.			
6.			
7.			
		= Total Cover	
Shrub Stratum (Plot size: **15' radius**)			
1.			
2.			
3.			
4.			
5.			
6.			
7.			
		= Total Cover	
Herb Stratum (Plot size: **10' radius**)			
1. **Stellaria media**	**38**	**X**	**FACU**
2. **Rumex acetosella**	**38**	**X**	**FACU**
3. **Schedonorus arundinaceus**	**15**		**FAC**
4. **Cynodon dactylon**	**15**		**FACU**
5. **Dichanthelium clandestinum**	**3**		**FACW**
6.			
7.			
8.			
9.			
10.			
11.			
12.			
	109	= Total Cover	
Woody Vines (Plot size: **30' radius**)			
1.			
2.			
3.			
4.			
5.			
		= Total Cover	

Dominance Test Worksheet:

# Dominants OBL, FACW, FAC:	**O**	(A)
# Dominants across all strata:	**2**	(B)
% Dominants OBL, FACW, FAC:	**O**	(A/B)

Prevalence Index Worksheet:

Total % Cover of:			Multiply By:
OBL		x 1 =	
FACW	**3**	x 2 =	**6**
FAC	**15**	x 3 =	**45**
FACU	**91**	x 4 =	**364**
UPL		x 5 =	
Sum:	**109** (A)		**415** (B)

Prevalence Index = B/A = **3.81**

Hydrophytic Vegetation Indicators:

- ___ Dominance Test is > 50%
- ___ Prevalence Index is <= 3.0
- ___ Problematic Hydrophytic Vegetation[1] (explain)
- ___ Rapid Test for Hydrophytic Vegetation
- ___ Morphological Adaptations

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definitions of Vegetation Strata:

Tree - Woody plants, excluding woody vines, approximately 20ft (6m) or more in height and 3in (7.6cm) or larger in diameter at breast height (DBH).

Sapling - Woody plants, excluding woody vines, approximately 20ft (6m) or more in height and less than 3in (7.6cm) DBH.

Shrub - Woody plants, excluding woody vines, approximately 3 to 20ft (1 to 6m) in height.

Herb - All herbaceous (non-woody) plants, including herbaceous vines, regardless of size. Includes woody plants, except woody vines, less than approximately 3ft (1m) in height.

Woody vine - All woody vines, regardless of height.

Hydrophytic Vegetation Present? **NO**

Remarks: (If observed, list morphological adaptations below).

No hydrophytic vegetation indicators present; parameter is not met.

Other indicators calculated for reference only.

Attachment 3

2015 Representative Photographs

Photograph 1: View of Data Point 1 (Study Area 1) showing E2EM Wetlands.

Photograph 2: View of Data Point 2 (Study Area 1) showing upland shrub community.

Photograph 3: View of Data Point 3 (Study Area 1) showing forested upland island "H".

Photograph 4: View of Data Point 4 (Study Area 1) showing upland field near PEM wetlands dominated by common reed.

Photograph 5: View of Data Point 5 (Study Area 1) showing PEM wetland dominated by common reed.

Photograph 6: View of Data Point 6 (Study Area 1) showing maintained upland field.

Photograph 7: View of Data Point 7 (Study Area 1) showing PEM wetland dominated by common reed.

Photograph 8: View of Data Point 8 (Study Area 1) showing existing upland on old fill material.

Photograph 9: View of Data Point 9 (Study Area 1) showing PEM wetland dominated by common reed.

Photograph 10: View of Data Point 10 (Study Area 1) showing maintained upland field near dune.

Photograph 11: View of intertidal zone along Atlantic Ocean in Study Area 1.

Photograph 12: View of open waters (tidally influenced) draining PEM wetlands Study Area 1.

Photograph 13: View of Data Point 1 (Study Area 2) showing E2SS Wetlands.

Photograph 14: View of Data Point 2 (Study Area 2) showing upland forest community.

Photograph 15: View of Data Point 3 (Study Area 2) showing PSS wetlands.

Photograph 16: View of Data Point 4 (Study Area 2) showing manmade upland berm (at auger) above PEMx wetland.

Photograph 17: View of Data Point 5 (Study Area 2) showing PEMx wetland dominated by common reed.

Photograph 18: View of Data Point 6 (Study Area 2) showing forested upland adjacent to PEM/SS wetland complex.

Photograph 19: View of Data Point 7 (Study Area 2) showing PEM/SS wetland complex dominated by wax myrtle and common reed.

Photograph 20: View of Data Point 8 (Study Area 2) showing jurisdictional ditch (PEMx).

Photograph 21: View of Data Point 9 (Study Area 2) showing maintained field surrounding jurisdictional ditches.

Photograph 22: View of Data Point 10 (Study Area 2) showing maintained field surrounding jurisdictional ditches.

Photograph 23: View of intertidal zone along Atlantic Ocean in Study Area 2.

Photograph 24: View of open waters draining PEM/SS wetlands Study Area 2.

Attachment 4

USACE Jurisdictional Waters Request Form

NORFOLK DISTRICT REGULATORY OFFICE PRE-APPLICATION AND/OR JURISDICTIONAL WATERS DETERMINATION REQUEST FORM

This form is used when you want to determine if areas on your property fall under regulatory requirements of the U.S. Army Corps of Engineers (USACE). Please supply the following information and supporting documents described below. This form can be filled out online and/or printed and then mailed, faxed, or e-mailed to the Norfolk District. Submitting this request authorizes the US Army Corps of Engineers to field inspect the property site, if necessary, to help in the determination process. **THIS FORM MUST BE SIGNED BY THE PROPERTY OWNER TO BE CONSIDERED A FORMAL REQUEST.**

The printed form and supporting documents should be mailed to:

U.S. Army Corps of Engineers, Norfolk District
Regulatory Branch
803 Front Street
Norfolk, Virginia 23510-1096

Or faxed to (757) 201-7678

Or sent via e-mail to: CENAO.REG_ROD@usace.army.mil

Additional information on the Regulatory Program is available on our website at:
http://www.nao.usace.army.mil/
Please contact us at 757-201-7652 if you need any assistance with filling out this form.

Location and Information about Property to be subject to a Jurisdictional Determination:

1. Date of Request: June 1, 2015

2. Project Name: NASA Wallops Island Tower Sites

3. City or County where property located: Accomack County

4. Address of property and directions (attach a map of the property location and a copy of the property plat): See Figure 1 (Attachment 1) to PJD Request Package.

5. Coordinates of property (if known): Study Area 1: 37° 50' 31" N, 75° 58' 24" W; Study Area 2: 37° 50' 50" N, 75° 28' 31" W

6. Size of property in acres: ±69 acres

7. Tax Parcel Number / GPIN (if available): N/A

Revised: November 2013

8. Name of Nearest Waterway: Atlantic Ocean, Cat Creek

9. Brief Description of Proposed Activity, Reason for Preapplication Request, and/or Reason for Jurisdictional Waters Determination Request:

   Natural Resource planning needed to conduct impacts analysis during permitting process for two tower sites.

10. Has a wetland delineation/determination been completed by a consultant or the Corps on the property previously? ☒ YES ☐ NO ☐ UNKNOWN

    Study Area 1: PJD done in 2012 as part of remedial action; Consultant - Tetra Tech Corps RPM – Robert Cole; File No: NAO-2012-01273. **Study Area 2**: PJD done in 2009 for part of the area in support of a construction project; Consultant – Ellen Grimes, Coastal Resources, LLC; Corps RPM – Robert Cole; File No: NAO-2009-01004.

Property Owner Contact Information:

Property Owner Name: Joshua Bundick, NASA Wallops Flight Facility
Mailing Address: 34200 Fulton Street
City: State: Zip: Wallops Island, Virginia 23337
Daytime Telephone: 757-824-2319
E-mail Address: Joshua.a.bundick@nasa.gov

If the person requesting the Jurisdictional Determination is **NOT** the Property Owner, please also supply the Requestor's contact information here:

Requestor Name: VHB, Inc., c/o Christopher R. Senfield, PWS, PWD
Mailing Address: 351 McLaws Circle, Suite 3
City: State: Zip: Williamsburg, VA 23185
Daytime Telephone: 757-220-0500
E-mail Address: csenfield@vhb.com

Additionally, if you have any of the following information, please include it with your request: wetland delineation map, other relevant maps, drain tile survey, topographic survey, and/or site photographs.

CERTIFICATION: I am hereby requesting a preapplication consultation or jurisdictional waters and/or wetlands determination from the U.S. Army Corps of Engineers, for the property(ies) I have described herein. I agree to allow the duly authorized representatives of the Norfolk District Corps of Engineers and other regulatory or advisory agencies to enter upon the premises of the project site at reasonable times to evaluate inspect and photograph site conditions. This consent to enter the property is superior to, takes precedence over, and waives any communication to the contrary. For example, if the property is posted as "no trespassing" this consent specifically supercedes and waives that prohibition and grants permission to enter the property despite such posting. I hereby certify that the information contained in the Request for a Jurisdictional Determination is accurate and complete:

Property Owner's Signature 　　　　　　Date 6/1/2015

Revised: November 2013

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Draft Final Environmental Baseline Survey (EBS) for the Alternative 1 (Preferred Alternative) Site
(Executive Summary and Figure 2 only)

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EXECUTIVE SUMMARY

This Environmental Baseline Survey (EBS) has been prepared to document the environmental condition of a parcel of real property associated with the proposed construction and operation of an instrumentation tower on Wallops Island at the National Aeronautics and Space Administration (NASA) Goddard Space Flight Center's Wallops Flight Facility (WFF), Accomack County, Virginia.

E.1 Property Identification

The scope of the EBS is limited to an area of WFF on Wallops Island that has been identified as the future construction location of a proposed US Air Force (USAF) instrumentation tower. Preparation of an EBS is required by Department of Defense policy before any property can be sold, leased, transferred, or acquired. The "subject property" is located on Wallops Island approximately 6.5 miles south of the WFF Main Base and is comprised of approximately 26 acres of mixed use land in an area bounded by Causeway Road to the northeast, North Seawall Road to the southeast, an unnamed access road to the southwest, and North Bypass Road to the northwest (refer to **Figures 1** and **2** in **Appendix B**). The subject property encompasses the land area required for the proposed tower base and guy line anchors. The subject property includes several buildings that were evaluated as part of the EBS; however, construction of the proposed tower is not expected to impact these structures.

E-2 Site History and Operations

The subject property vicinity (i.e., NASA WFF on Wallops Island) was initially occupied by the US Coast Guard (USCG) and developed with various saving stations in 1883. The USCG constructed additional stations along Wallops Island in 1936, which were later decommissioned in 1947. In 1942, the US Navy acquired 2,230 acres on Wallops Neck and Wallops Island to use as an Auxiliary Air Station. The National Advisory Committee for Aeronautics, which was later renamed to NASA, first occupied Wallops Island in 1945. Over time, NASA continued to develop Wallops Island for research and surveillance purposes.

The buildings on the subject property were reportedly constructed between 1936 and 1965 (TEC, 2011). The subject buildings currently include administrative offices, mechanical storage and repair buildings, a fire response warehouse, vehicle garages, a painting operations facility, storage buildings, and pump houses. Several former structures on the subject property have been demolished and/or removed from the property, including the former Island Fueling Station (Building X-10) that stored various grades of fuel (i.e., diesel, #2 heating fuel, and gasoline), the Wind Tunnel, the former Power Generating Plant (Building X-20), and Building X-115.

E-3 Proposed Future Use

Proposed future uses of the subject property include continuing the current operations in the above-described buildings by NASA, as well as construction and operation of a proposed instrumentation tower by the USAF.

No deed transfer is anticipated for the parcel of real property associated with the proposed construction and operation of the instrumentation tower. It is understood that NASA will remain as the landowner, and the USAF will sign an agreement stating that it understands the liabilities, if any, posed by construction in a former restoration site.

E-4 Factors Evaluated

The EBS was conducted in accordance with USAF Instruction 32-7066, *Environmental Baseline Surveys in Real Estate Transactions*, as well as the American Society for Testing and Materials standards for conducting EBSs and property assessments. The scope of the EBS included a document search, review of available documentation, interviews with site personnel, and a visual site inspection to evaluate the potential for environmental contamination associated with the subject property. Aspects that were evaluated for potential environmental impacts related to the subject property included: hazardous substances; petroleum products and derivatives; environmental restoration sites; areas of concern; storage tanks and associated piping; oil-water separators; grease traps; wash racks; waste tanks; pesticides; military munitions/ordinance; medical or bio-hazardous waste; radioactive waste; solid/municipal waste; indoor air quality; groundwater; wastewater treatment, collection, and disposal; drinking water quality; utilities; asbestos-containing material (ACM); polychlorinated biphenyls (PCBs); radon; lead-based paint (LBP); cultural resources; and natural/biological resources.

E-5 Property Categorization

Given that no deed transfer is proposed in association with the instrumentation tower site, special consideration was given when assigning categories to various areas within the subject property. Areas within the subject property that have known or potential contamination that are not going to be impacted by the construction and/or operation of the proposed instrumentation tower were assigned a lower category than they may have been if a deed transfer were proposed.

Based on documented areas of contamination associated with historical activities conducted on the subject property, the areas designated as Sites 5, 6, and 12 on the subject property were classified as Category 4, which is defined as an area where a release of hazardous substances has occurred and all remedial actions necessary to protect human health and the environment have been taken, for the following reasons:

- **Site 5**: The approximately 2-acre area of the subject property designated as Site 5 where former paint booth (Building X-30) operations resulted in soils impacted by concentrations of total petroleum hydrocarbons (TPH), PCBs, pesticides, volatile organic compounds (VOCs), semi-volatile organic compounds (SVOCs), polycyclic aromatic hydrocarbons (PAHs), and metal. Remediation at the site was completed resulting in issuance of a No Further Action (NFA) status by the US Environmental Protection Agency (USEPA) and Virginia Department of Environmental Quality (VDEQ). Site 5 is located approximately 185 feet east of the planned excavation footprint of the tower base.

- **Site 6:** The petroleum-impacted soils identified at the location of the former Island Fueling Station and Buildings X-5 and X-10. Building X-5 underwent remediation and was granted closure by the VDEQ in 2000. Soil remediation activities for the remainder of Site 6 were conducted, and site closure was obtained from the VDEQ in 2008. Site 6 is located approximately 400 feet southeast of the planned excavation footprint of the tower base.

- **Site 12:** The approximately 3.4-acre area on the subject property designated as Site 12 where groundwater at the former Power Generating Plant was found to be impacted with TPH-Diesel Range Organics. The site was issued closure under the VDEQ Spills Program in 2008. In addition, the following two areas located within Site 12 are considered a Category 4 as long as no land disturbances associated with the construction and operation of the instrumentation tower occur within the two areas:
    - The approximately 0.15-acre area where backfill used at the Former Power Generating Plant was found to contain munitions. A surface sweep of the area was completed and anomalies were excavated to 2 feet below ground surface (bgs). No soil contaminant testing specific to munitions has reportedly been conducted, and a dig restriction was recommended by an environmental consultant to be implemented for any activities that would disturb the soil of the backfill area and immediately surrounding areas. The backfill area is located approximately 165 feet southeast of the planned excavation footprint of the tower base.
    - PAH-contaminated soil associated with four creosote-soaked wooden pilings that remain in place underneath the previous concrete pad located next to the former location of Building X-115 and was addressed as part of the Site 5 and 12 remedial actions. The PAH contamination was determined not to be a Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) release during remedial actions. The wood pilings are located approximately 200 feet northeast of the planned excavation footprint of the tower base.

As Category 4 is the highest category identified on the subject property, the overall classification for the subject property is Category 4. However, if land disturbance impacts associated with the planned development of the proposed instrumentation tower are anticipated to occur at either of the two above-described areas located within Site 12, these areas would likely warrant reclassification as a Category 7.

E-6 Findings and Recommendations

<u>Findings</u>

Sites 5 and 12: Soils on the subject property were found to be impacted with various contaminants related to former on-site operations as described below. Several contamination issues were identified for an approximately 2-acre area, known as Site 5, and an approximately 3.4-acre area, known as Site 12, (refer to **Figure 2** in **Appendix B**) as follows:

- ***CERCLA Clean-up (Sites 5 & 12):*** Sites 5 and 12 were found to have soils impacted with TPH, PCBs, pesticides, volatile organic compounds, semi-volatile organic compounds, PAHs, and metals. A CERCLA clean-up program was initiated under the Site ID VA8800010763 and a ROD for a remedial method was selected. All components of the selected remedy were completed and accomplished in accordance with the ROD. Sites 5 and 12 were issued a NFA status by the USEPA and VDEQ. No institutional or engineering controls were implemented at the sites.

- ***Former Power Generating Plant (Site 12):*** Soil and groundwater at the former Power Generating Plant (Site 12) was found to be impacted with TPH-Diesel Range Organics. A 2008 Site Characterization Addendum Report confirmed that petroleum contaminant concentrations were below state action levels and confirmed that groundwater sources were not impacted. The site was issued closure under the VDEQ Spills Program in 2008.

- ***Wood Pilings (Site 12):*** PAH-contaminated soil associated with wood pilings preserved with creosote compounds was discovered underneath the previous concrete pad located next to the former location of Building X-115 and was addressed in the Site 5 and 12 remedial action. The four creosote soaked wooden pilings still remain in place at the subject property and is not considered a CERCLA issue.

- ***Munitions and Explosives of Concern (Site 12):*** Munitions and explosives of concern (MEC) were identified within the backfill material from the Former Power Generating Plant. The survey addressed the observable surface area of the target area and removed magnetic anomalies from the top 2 feet of soil in the approximately 0.15-acre backfill area. A surface sweep of the area was completed and anomalies were excavated down to 2 feet. NASA has implemented a land use control for MEC.

Site 6: Petroleum-impacted soils were identified at the location of the former Island Fueling Station and Buildings X-5 and X-10, all of which were located in the area designated as Site 6. Building X-5 underwent remediation for petroleum contamination in 2000 and was granted closure by the VDEQ on October 25, 2000. Soil remediation activities for the remainder of Site 6, including the demolition of Building X-10, were conducted from 2004 through 2008; site closure was obtained from the VDEQ in 2008.

Asbestos-Containing Materials and Lead-Based Paint: No previous ACM or LBP sampling reports were available or provided for review. Given the estimated construction dates of the subject buildings from 1936 to 1965, the presence of ACM and LBP in building materials and/or mechanical equipment is likely. However, construction of the proposed tower is not expected to impact these buildings and/or materials.

Possible Polychlorinated Biphenyls Containing Materials: Fluorescent lamps and ballasts were observed throughout Buildings X-30, X-15 and X-35 that could potentially contain PCBs or PCB replacement chemicals based on the construction dates of the buildings. However, the lamps and ballasts were in working condition and are not expected to pose an environmental concern to the planned excavation footprint of the tower base and guy line anchors at this time.

Recommendations

Based on the findings of this EBS, no additional investigations or actions are recommended at this time. However, if the approximately 0.15-acre area containing the abandoned wood pilings or the approximately 0.15-acre backfill area associated with the 2008 MEC clean-up (both of which are located in the areas designated as Site 12) may be impacted by the planned development of the proposed instrumentation tower, further investigations or actions may be warranted.

1.0 PURPOSE OF THE ENVIRONMENTAL BASELINE SURVEY

1.1 INTRODUCTION

The information presented in this Environmental Baseline Survey (EBS) is complete and accurate as of February 2017. This EBS is based on available environmental information related to past and present storage, release, or disposal of hazardous substances and petroleum products on the site identified by the US Air Force (USAF) for construction of a proposed instrumentation tower (subject property). The subject property encompasses approximately 26 acres on Wallops Island at the National Aeronautics and Space Administration's (NASA) Goddard Space Flight Center (GSFC) Wallops Flight Facility (WFF) in Accomack County on the eastern shore of the Commonwealth of Virginia (see **Appendix B, Figure 1**). The subject property is located on Wallops Island approximately 6.5 miles south of the WFF Main Base located in Wattsville, Virginia.

The purpose of this EBS is to: (1) document the nature, magnitude, and extent of any environmental contamination on the subject property; and (2) identify potential environmental contamination liabilities associated with the subject property. This EBS will be used by the USAF, along with other available information, to:

- Develop sufficient information to assess the health and safety risks;
- Ensure adequate protection of human health and the environment; and
- Support decisions related to the preferred alternative location of the proposed tower.

This EBS is based on information obtained through a records search, interviews, and a visual site inspection (VSI) conducted in January 2017. The records search included a review of available NASA and other agency records, including environmental restoration and compliance reports; records, audits, surveys, and inspection reports for the subject property; and an analysis of historic aerial photographs. NASA GSFC WFF personnel were consulted to obtain known historical information regarding past activities on the subject property.

The EBS includes an assessment of environmental conditions of adjacent properties contiguous to or within 0.25 mile of the subject property that could pose environmental concerns to and/or affect the subject property. Visual inspections of adjacent properties were conducted from the subject property or public roads.

1.2 BOUNDARIES OF THE PROPERTY AND SURVEY AREA

The subject property is located within the WFF property in Accomack County on the eastern shore of the Commonwealth of Virginia (see **Appendix B, Figure 1**). The WFF property is composed of three detached areas: the Main Base, Mainland, and Wallops Island. The subject property is located on Wallops Island approximately 6.5 miles south of the Main Base (see **Appendix B, Figure 2**). The subject property consists of approximately 26 acres of mixed use land in an area bounded by Causeway Road to the northeast, North Seawall Road to the southeast, an unnamed access road to the southwest, and North Bypass Road to the northwest. The subject property is developed with several buildings, which were evaluated as part of the EBS; however, construction of the proposed tower is not expected to impact these structures.

The findings of this EBS are based on a review of available information for, and inspection of, the following:

- The proposed instrumentation tower site (subject property);
- Properties immediately adjacent to the subject property (i.e., having borders contiguous with the boundaries of the subject property); and
- Properties within 0.25 mile of the subject property boundaries with potential environmental concerns.

The results of the survey for the subject property and adjacent properties are discussed in **Sections 5.0** and **7.0**, respectively.

Approximate Subject Property Boundary
Approximate Footprint for Proposed Tower and Guy Cables
Palustrine Wetland

Plan Not to Scale

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FIGURE 2
SITE PLAN
WALLOPS ISLAND TOWER
WALLOPS ISLAND, VIRGINIA

URS

Environmental Baseline Survey
AECOM Job No. 60529853

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