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
Lead, Environmental Planning

3 Enclosures:

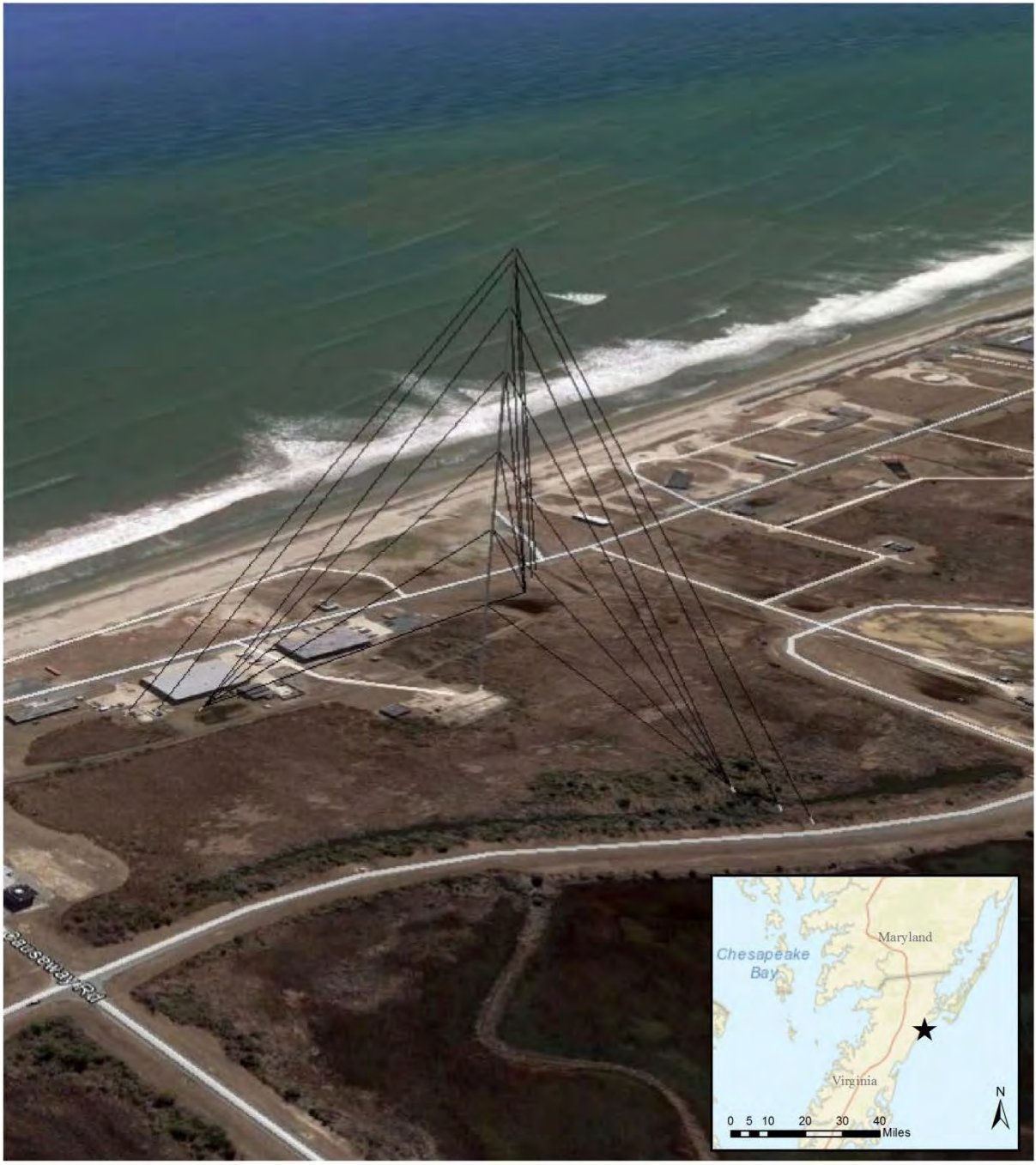
1. Aerial view map depicting proposed action site
2. Conceptual rendering of proposed action
3. Project Review Package

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

Literature Cited

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. 184pp.

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)

Enclosure 1

U.S. AIR FORCE

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0 12.5 25 50 75 100
Yards

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-079 Site (Action Alternative)

X-015 Study Area

X-079 Study Area

U.S. AIR FORCE

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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.

Cohen, J. B., Gerber, B. D., Karpanty, S. M., Fraser, J. D., & Truitt, B. R. (2011). Day and Night Foraging of Red Knots (*Calidris canutus*) during Spring Stopover in Virginia, USA. *Waterbirds*, *34*(3), 352-356.

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

United States Department of Interior
Fish and Wildlife Service

Project name: Tower Project

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.

United States Department of Interior
Fish and Wildlife Service

Project name: Tower Project

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

July 6, 2017

MEMORANDUM FOR: Ms. Laura Lavernia
Virginia Department of Historic Resources
2801 Kensington Avenue
Richmond, VA 23221

SUBJECT: Air Force Tower Construction Project on Wallops Island, VA
DHR File No. 2014 – 0946

In response to the Virginia Department of Historic Resources (DHR) letter dated April 4, 2017 (Attachment 1), a Phase II- Cultural Resources Analysis (Attachment 2) was completed based on the information that you requested.

The Phase II work included: 1) a reconnaissance-level survey following the DHR's *Guidelines for Conducting Historic Resources survey in Virginia*, October 2011; 2) amending Figure 1 (from the prior Phase I report) to further identify the locations, names, and total heights of existing vertical structures that share the coastline with the proposed tower; and 3) representative photographs with visual simulations of the proposed tower geo-located and to scale on the alternative sites to determine if the historic properties' higher surrounding elevations and vegetation would "screen" the proposed tower.

As requested, the attached report includes a reconnaissance level survey to support the potential historic district determination. The report also provides visual simulations and representative photographs that clarify the rationale in support of the determination that there would be no adverse effect to cultural resources. The Air Force requests your review of the attached report and confirmation that we have provided your office with the necessary information to comply with Section 106 of the National Historic Preservation Act.

We 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.

Sincerely,

MICHAEL ACKERMAN
Air Force Civil Engineering Center
NEPA Division (AFCEC/CZN)

2 Attachments:
1. April 4, 2017 Letter
2. Phase II Cultural Resources Analysis

April 4, 2017

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

RE: Air Force Instrumented Tower Project on NASA Wallops Island Flight Facility
Wallops Island, Accomack County, VA
DHR File No. 2014 – 0946

Dear Mr. Ackerman:

The Virginia Department of Historic Resources (DHR) has received additional 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 Island Flight, Facility, Wallops Island, Accomack County, VA*. DHR understands that the project scope consists of the construction of a 750-ft. guyed communications tower.

This correspondence is in response to materials submitted on March 9, 2017, and also serves as a general recapitulation of this application submitted for review:

1) **Area of Potential Effect (APE) determination:** In a letter dated January 14, 2016 written by Roger Kirchen, Director of Review and Compliance, DHR concurred with NASA's Area of Direct Effect to be the "circle of the proposed guy wires." Insofar as indirect effects, DHR concurs with the Indirect APE identified in URS Figure 1, which extends the original 3 mile buffer an additional 3.5 miles to include the NRHP-listed Assateague Beach Coast Guard Station (DHR ID #001-0172).

2) **Wisharts Point Road, potential historic district:** URS consultants identified a potential historic district. In order for these determinations to be reviewed, a reconnaissance level survey needs to be completed. Survey documentation needs to be recorded in the Virginia Cultural Resource Information System (VCRIS). Link to VCRIS/Survey Guidance: http://www.dhr.virginia.gov/survey/Survey_guidance.htm. DHR's survey guidelines are found here: http://www.dhr.virginia.gov/pdf_files/Survey%20Manual-RevOct.2011Final.pdf. Please note, since 2011 we no longer require printing on archival paper, and the most recent photo survey guidelines are found here: http://dhr.virginia.gov/pdf_files/DHR_Architectural_Survey_Photograph_Policy_2016.pdf

3) **Visual effects of the proposed guyed tower structure:** In order to make an informed recommendation on the indirect visual impact, our office kindly requests the following:

   a. URS Figure 1 points out the location of existing vertical structures that share the coast-line with the proposed tower. Please amend Figure 1 to further identify these keyed items providing their names and total heights.
   b. **Further clarification of the rationale for no adverse effect.** In the report provided, URS states that the tower will be visible, but its effects will not be adverse. Three (3) historic structures fall within the agreed-upon Indirect APE identified in Figure 1, in addition to the proposed Wisharts Road Historic District and the Assateague Beach Coast Guard Station. Please provide representative photos from these historic sites with a geo-located tower to scale depicting effect, if possible. For example, regarding Wharton Place (DHR ID #001-0050), this simulation would assist in determining if the historic property's higher elevation and surrounding vegetation would, in fact, make the proposed tower not visible.

We look forward to receiving this information, thank you for your efforts and work thus far. If you have any questions regarding these comments, please do not hesitate to contact me at (804) 325-8473 or email Laura.Lavernia@dhr.virginia.gov

Sincerely,

Laura Lavernia, Architectural Historian
Review and Compliance Division

Wallops Island Tower Cultural Resources Analysis – Phase II
Task Order 08-12-2017 / GSA Environmental Services (ES) Schedule GS-00F-188CA
Technical Memorandum
June 2017

URS Group, Inc. (URS) completed follow-up work under Task Order 08-12-2017 related to our prior cultural resources analysis performed in support of the United States Air Force's (USAF) proposed action to build and operate an approximately 750-foot tall, guyed instrumentation tower on Wallops Island at WFF (i.e., the undertaking). The undertaking has not changed since the review response provided by the Virginia Department of Historic Resources (DHR, or State Historic Preservation Office [SHPO]), dated April 4, 2017. Per a request by the Virginia SHPO, URS conducted a reconnaissance-level architectural survey of Wisharts Point Road potential historic district, consisting of eight architectural properties, within the project Area of Potential Effects (APE) for visual effects, defined as the project area plus any area with a potential for visual effects. Additionally, URS amended Figure 1 (attachment 1; prepared for the previous Phase I report) at the request of the SHPO to further identify the locations, names, and total heights of existing vertical structures that share the coastline with the proposed tower, and is providing representative photographs with the proposed tower geo-located and to scale to depict the potential visual effects from the locations of three (3) historic structures. The results of this survey are detailed in this technical memorandum.

Project Background

Consideration of effects on cultural resources is mandated both by NEPA and by Section 106 of the National Historic Preservation Act (NHPA) of 1966, as amended (16 U.S.C. 470-470w-6). Section 106 requires federal agencies to take into account the effects of their undertakings on historic properties and to afford the Advisory Council on Historic Preservation (ACHP) an opportunity to comment on such undertakings. The procedures for implementing Section 106 are contained in 36 CFR Part 800, Protection of Historic Properties.

The purpose of this Phase II work was to assist USAF in obtaining SHPO concurrence on the determination of no affect to historic properties from the undertaking at NASA WFF in Accomack County, Virginia. The proposed galvanized steel tower would be approximately 750 feet tall 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 in accordance with Federal Aviation Administration guidelines.

URS previously was contracted by LJT on behalf of NASA to review the potential for the undertaking to effect historic properties within the direct and indirect APE. Upon recommendations from the SHPO, URS developed a 3-mile radius indirect (visual) APE. The direct APE consisted of the proposed tower footprint and associated cable runs and equipment shelters.

On January 14, 2016, the SHPO concurred with the direct and indirect APE, with the recommendation that the indirect APE be extended 3.5 miles to the northeast to include the National Register of Historic Places (NRHP)-listed Assateague Beach Coast Guard Station

(DHR ID #001-0172) due to the relatively unimpeded view from the Station to the proposed tower location.

The Phase I cultural resources analysis was provided to the SHPO for review and concurrence on March 9, 2017. The URS finding determined that while the proposed communications tower may have a visual effect on the six above-ground historic properties and the potential historic district at Wisharts Point Road, any effects would not be adverse. In a letter dated April 4, 2017, the SHPO responded to the Phase I cultural resources analysis concerning the undertaking. In that letter, the SHPO requested additional information concerning the undertaking and its potential effects on historic properties.

Therefore, this Phase II work addresses the items requested by the SHPO in the April 4, 2017 letter, including: 1) conducting a reconnaissance-level survey of the Wisharts Point Road potential historic district following the DHR's *Guidelines for Conducting Historic Resources survey in Virginia*, October 2011; 2) amending Figure 1 (from the prior Phase I report; see Attachment 1) to further identify the locations, names, and total heights of existing vertical structures that share the coast-line with the proposed tower; and 3) providing representative photographs with visual simulations of the proposed tower geo-located and to scale to depict the potential visual effects from three (3) historic structures, the proposed Wisharts Point Road Historic District, and the Assateague Beach Life-Saving Station, to assist in determining if the historic properties' higher surrounding elevations and vegetation would "screen" the proposed tower.

Project Methodology

Prior to fieldwork, URS completed a background review, which consisted of searching DHR's Virginia Cultural Resource Information System (VCHRIS) website and survey file records, as well as examining historic maps and photographs, aerial imagery, and historical publications. In addition, URS utilized online research from various regional and national libraries, including the Library of Congress, Library of Virginia, Virginia Historical Society, and the Chesapeake Bay Maritime Museum. This research included a review of records on the proposed Wisharts Point Road Historic District.

Communications were conducted with the Collections Manager at the Eastern Shore of Virginia Historical Society in Onancock, and the Executive Director at the Eastern Shore Watermen's Museum and Research Center for relevant materials on the proposed Wisharts Point Road Historic District. Since the Wisharts Point Road Historic District is located in the Chesapeake/Atlantic Preservation Area (CAPA), contact was also made with the Accomack County Department of Planning and Community Development to determine if any previous surveys took place in or near the project APE.

A reconnaissance-level architectural survey was completed on resources that met the NRHP age criteria of 50 years or older by the year of 2020 (construction date of 1970). During the survey, each of the eight historic houses located in the proposed historic district were documented through photographs capturing the primary elevation, oblique angles, and the general setting. The historic district was evaluated for NRHP potential under three criteria: Criterion A, for its

association with events that have made a contribution to the broad patterns of our history; Criterion B, for its association with people significant in our nation's history; and Criterion C, for its embodiment of distinctive characteristics of a type, period, or method of construction, or that represent the work of a master, or possess high artistic values. Criterion D, the potential to yield information important in history, was not evaluated as part of this investigation. NRHP criteria considerations were taken into account only where necessary.

Visits to local Accomack County archival repositories that had the highest potential for containing relevant historical materials on the proposed Wisharts Point Road Historic District occurred simultaneously with the reconnaissance-level survey. Once the reconnaissance-level architectural survey was completed, research was conducted in the Eastern Shore Room of the Eastern Shore Public Library in the Town of Accomac. Using information obtained during the survey, URS generated a new DHR VCRIS form and made recommendations on NRHP potential for the proposed Wisharts Point Road Historic District. Fieldwork was conducted by Lorin Farris and Brian Cleven on May 19, 2017. Ms. Farris and Mr. Cleven exceed the *Secretary of the Interior's Professional Qualification Standards* (36 CFR Part 61) in the disciplines of architectural history and/or history (see Attachment 2 for resumes).

Representative Photographs with Geo-Located Tower to Scale

Per a request by the SHPO, URS was contracted to provide representative photographs with geo-located visual simulations of the proposed tower to scale to depict effects from five historic properties: the proposed Wisharts Point Road Historic District, Assateague Beach Coast Guard Station (VDHR ID #001-0172), Wharton Place (DHR ID #001-0050), Mount Wharton (DHR ID #001-0052), and 31545 Point Breeze Lane, a dwelling built in circa 1890 that is located within the indirect APE and is eligible for the NRHP and Virginia Landmarks Registry [VLR]. Photographs used to create computer-simulated images of the proposed instrumentation tower to convey the visual impacts on the historic resources required using a camera with a 50mm lens. Photographs were taken on May 19, 2017. The day was notable for its clear skies and low humidity.

If vegetation was blocking the view of the proposed tower, the geo-located visual simulations of the proposed tower were illustrated on a white screen to depict their relationship to the landscape. These simulations are shown on Figures 1 through 6. Each illustration is to scale and depicts the USAF's proposed tower. From each of the locations identified by the SHPO, photographs were taken of representational views from main entrances toward the project site to evaluate potential visual impacts. Assessing the visual effects from main entrances of historic properties is a standard practice, as the façade is typically the location of the historic property's significant historic features (36 CFR Part 800.5). The proposed Wisharts Point Road Historic District was the exception to this methodology. In the district, the houses face away from the proposed tower location. Consequently, photographs were taken from a point on the public right-of-way (ROW) directly across from the front entrance. Within the District, the visual simulation of the proposed tower's appearance is from 33362 Wisharts Point Road, since it has the highest possibility of visibility from the ROW as it is located closest to the tower. At 31545 Point Breeze Lane, the rear addition side entrance appears to be the primary entrance used by the house's residents. Consequently, a representative photograph was also taken from this location, as shown on Figure 6.

Figure 1. View from Wisharts Point Historic District (33362 Wisharts Point Road; with and without white screen simulation).

Figure 2. View from Assateague Beach Life Saving Station

Figure 3. View from Wharton Place (13485 Wharton Drive)

Figure 4. View from Mt. Wharton (32339 Mt. Wharton Road)

Figure 5. View from 31545 Point Breeze Road (from Front Door)

Figure 6. View from 31545 Point Breeze Road (from Rear Addition, Side Door; with and without white screen simulation)

Visual Simulation Results

Visual simulations of the proposed tower are to scale within the landscape of the five historic resources are depicted in Figures 1-6. Based on the findings, the five historic resources will not be adversely affected by the undertaking, as vegetation and/or topography has completely blocked views from the historic resources to the project area.

Background Review

As a component of this study, URS conducted a background literature and records review of the proposed Wisharts Point Road Historic District. Following VCRIS/DHR Survey Guidance and *DHR Guidelines* for survey projects, URS generated an architectural description, historic context, and statement of significance of the proposed Wisharts Point Road Historic District. Additionally, URS provided recommendations on whether the potential historic district should be given further inspection at the intensive level, and recommendations concerning potential NRHP eligibility. These findings are discussed in further detail below.

Architectural Description: Wisharts Point Historic District

Near the southeast end of Wisharts Point Road is a former agricultural and 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 (Figure 7). 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 (Figure 8).

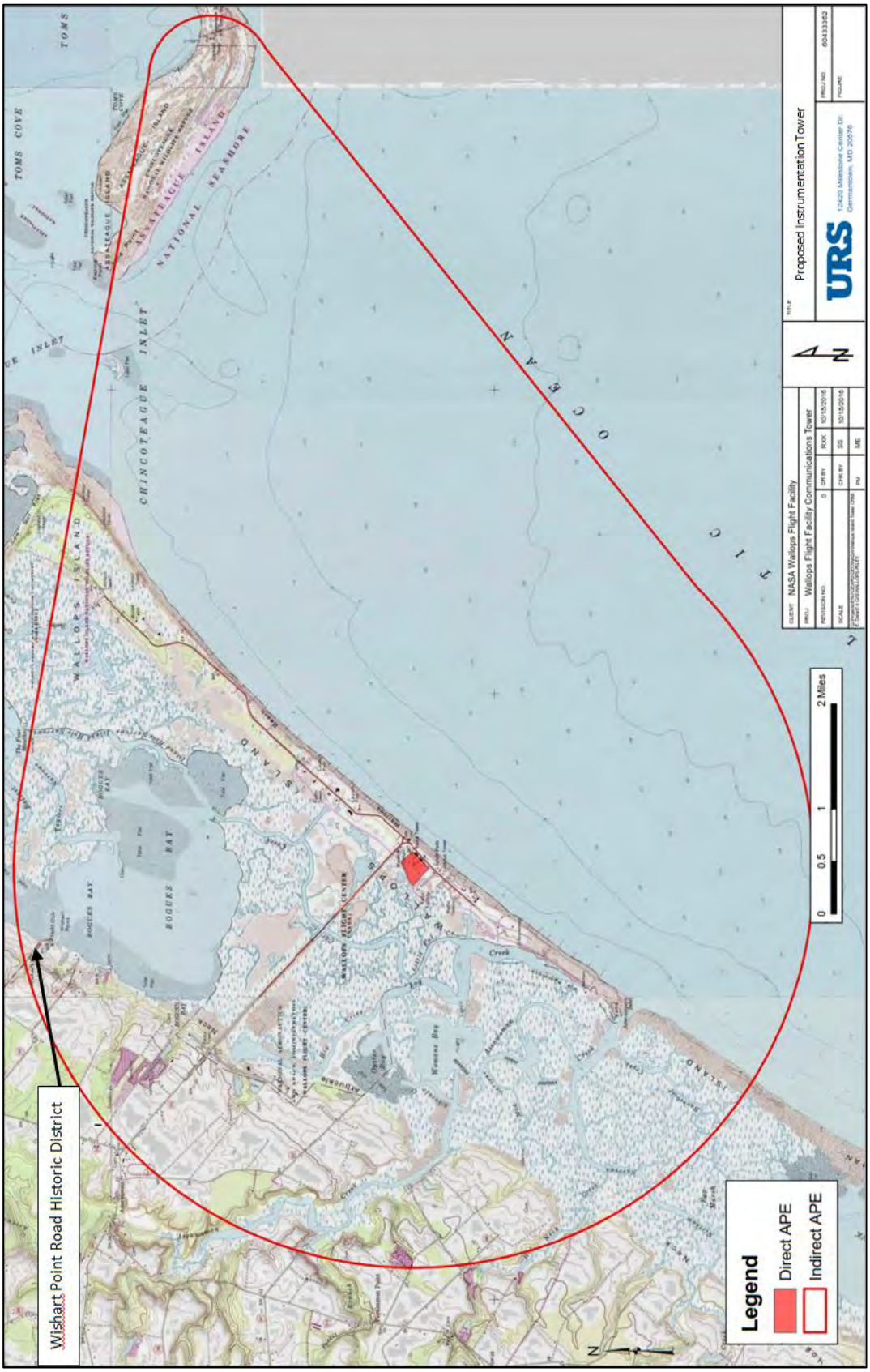

Figure 7. Project Area of Potential Effects (APE)

Figure 8. Wisharts Point Road Historic District, Aerial View (Bing)

The vernacular architecture expressed by the buildings at Wisharts Point reflects the frugality of the rural population that worked as farmers or watermen. Best described as the architecture that most people built or used during a specific time period, vernacular architecture is often evaluated in a broader context when located within a historic district, rather than at the individual building level. Although vernacular buildings lack stylistic ornamentation, they often have stylistic influences. It is also easier to describe vernacular architecture by a building's function, floor plan,

or overall building shape. Vernacular buildings are based on building traditions passed down over time and reflect the local skills, technology, and materials of the community in which they are built. Generally, builders and craftspeople, not professional architects, have led the design process (KCI 1999:D-15-16; Lanier and Herman 1997:124, 127, 138, 145, 159, 161). In vernacular architecture of the late nineteenth century and early twentieth century, builders commonly began with basic house forms and plans and then applied simplified ornamentation inspired by the fashionable styles of the time.

Ornamentation, when present, was simple and a building may have only exhibited one or two features, usually the most obvious characteristics of a style, such as porches supported by columns, pilasters, or a rectangular transom over the door flanked by sidelights inspired by the Greek Revival style; decorative, mass-produced verge boards like those found in the Gothic Revival style; decorative cornice with dentils, ornate entry with pilasters or transom, asymmetrical façade, and windows topped with cornices to the Colonial Revival style; and open floor plans, low-pitched roofs, and a large front porch by the Bungalow style (KCI 1999: D-15-16; Lanier and Herman 1997:124, 127, 138, 145, 159, 161; McAlester 2006:321).

The following brief architectural descriptions of the eight houses are presented from northwest to southeast along Wisharts Point Road, and include the identification of each building's vernacular style.

House at 33260 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 (Figures 9-13). The house is two bays in length and one bay in depth, and has a rectangular plan. Its roof is clad with asphalt shingles. Notable features include an interior brick chimney, and pedimented gable ends. The southeast (side) elevation has a one-and-one-half-story, gable roof extension. Alterations include vinyl siding and windows, and a one-story side and rear addition.

Figure 9. House at 33260 Wisharts Point Road, Looking Southeast

Figure 10. House at 33260 Wisharts Point Road, Looking Northwest

Figure 11. House at 33260 Wisharts Point Road, Looking North

Figure 12. Shed at 33260 Wisharts Point Road, Looking Southwest

Figure 13. Side Yard of House at 33260 Wisharts Point Road, Looking Southeast Towards the Proposed Tower Location

33288 Wisharts Point Road

The two-story, cross-gable roofed house at this location was constructed in 1920 in the vernacular interpretation of the Greek Revival style (Figures 14-17). 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, the gable ends have returned eaves, and the rear extension has an interior brick chimney. 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.

Figure 14. House at 33288 Wisharts Point Road, Looking South

Figure 15. House at 33288 Wisharts Point Road, Looking North

Figure 16. House at 33288 Wisharts Point Road, Looking Northeast

Figure 17. Rear Yard of House at 33288 Wisharts Point Road, Looking Southeast Towards the Proposed Tower Location

House at 33298 Wisharts Point Road

The one-and-one-half-story, cross-gable roofed house at this location was constructed in 1920 in the Bungalow style (Figures 18-20). 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.

Figure 18. House at 33298 Wisharts Point Road, Looking Southwest

Figure 19. House at 33298 Wisharts Point Road, Looking Northeast

Figure 20. Rear Yard of House at 33298 Wisharts Point Road, Looking Southeast Towards the Proposed Tower Location

House at 33322 Wisharts Point Road

The two-story house at this location was constructed in 1920 in the vernacular interpretation of the Gothic Revival style (Figures 21-23). 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.

Figure 21. House at 33322 Wisharts Point Road, Looking Southeast

Figure 22. House at 33322 Wisharts Point Road, Looking Southwest

Figure 23. View from House at 33322 Wisharts Point Road, Looking Southeast Towards the Proposed Tower Location

House at 33332 Wisharts Point Road

The two-story house with a side-gable roof at this location was constructed in 1920 in the vernacular interpretation of the Greek Revival style (Figures 24-26). 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.

Figure 24. House at 33332 Wisharts Point Road, Looking Southeast

Figure 25. House at 33332 Wisharts Point Road, Looking North

Figure 26. Rear Yard of House at 33332 Wisharts Point Road, Looking Southeast Towards the Proposed Tower Location

House at 33340 Wisharts Point Road

The two-and-one-half-story house with a front-gable roof at this location was constructed in 1900 in the vernacular interpretation of the Greek Revival style (Figures 27-29). 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.

Figure 27. House at 33340 Wisharts Point Road, Looking Southeast

Figure 28. House at 33340 Wisharts Point Road, Looking Southwest

Figure 29. Side Yard of House at 33340 Wisharts Point Road, Looking Southeast Towards the Proposed Tower Location

House at 33348 Wisharts Point Road

The one-and-one-half-story house with a front-gable roof at this location was constructed in 1920 in the Bungalow style (Figures 30-32). 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.

Figure 30. House at 33348 Wisharts Point Road, Looking Southeast

Figure 31. House at 33348 Wisharts Point Road, Looking Southwest

Figure 32. Rear Yard of House at 33348 Wisharts Point Road, Looking Southeast Towards the Proposed Tower Location

House at 33362 Wisharts Point Road

The two-and-one-half-story house with a side-gable roof at this location was constructed in 1900 in the vernacular interpretation of the Greek Revival style (Figures 33-36). 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 main entry is also 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.

Figure 33. House at 33362 Wisharts Point Road, Looking Southeast

Figure 34. House at 33362 Wisharts Point Road, Looking Southwest

Figure 35. House at 33362 Wisharts Point Road, Looking Northwest

Figure 36. Side and Rear Yard of House at 33362 Wisharts Point Road, Looking Southeast Towards the Proposed Tower Location

Summary: Historic Significance

The potential historic district located at Wisharts Point Road consists of eight vernacular historic properties constructed at the beginning of the twentieth century. During this time period, Accomack County, Virginia was profiting from a plentiful seafood industry and agricultural economy. The region depended on water transportation, such as steamboats, to move seafood products and produce to larger markets. With the arrival of the New York, Pennsylvania and Norfolk Railroad in 1884, Accomack County would continue to prosper economically and with the opening of new markets and the beginning of the tourist industry. During the early 1880s, a wharf was constructed at the end of Wisharts Point Road that was used by steamboats to transport goods, mail, and passengers. Wisharts Point was a stop on the mail and passenger route to Franklin City and Chincoteague Island. By 1910, majority of the population that lived on Wisharts Point Road were white, rented their houses, and worked as general farmers or watermen. There was a small African-American or mixed-race population living on Wisharts Point Road as well who also worked as laborers or watermen. In 1910, a small hotel was built at Wisharts Point wharf, which was later moved in the 1920s to Chincoteague Island to service the sports fishermen during the autumn months. With the completion of the Chincoteague Causeway in 1922, and the U.S. government's replacement of mail-boat routes from Wisharts Point to Chincoteague, the wharf at Wisharts Point Road became obsolete. The period of significance for the potential historic district located at Wisharts Point Road is 1881, with the first mention of steamboats stopping at Wisharts Point, to 1923, when the wharf was no longer used for mail or passenger service. The potential historic district located at Wisharts Point Road is eligible for listing in the NRHP under Criterion A because of its association with events that have made a

contribution to the broad patterns of Accomack County, Virginia's maritime and transportation history.

Wisharts Point Historic Context

The potential historic district is located at Wisharts Point Road, route 695, in the northeast portion of Accomack County, Virginia. The wharf located at the end of Wisharts Point Road provides access to Bogues Bay to the southeast, Watts Bay to the northeast, and eventually to the Atlantic Ocean. The nearest populated area to Wisharts Point Road is the town of Atlantic to the northwest, and from the water is Chincoteague Island to the northeast. Accomack County's principal industries have been agriculture and the seafood industry. The fertile lands provided a wealth of vegetables, grains, and potatoes, while the shallow waters and tidal flats supplied oysters, clams, crabs, and fish (Badger 2009:7). Wisharts Point was a convenient location for farmers and watermen because of the fast and nearby access to the bay and the ocean. These water highways delivered such products to eager markets in Baltimore, Philadelphia, Norfolk, and other cities. In 1884, the New York, Pennsylvania and Norfolk Railroad (NYP&N) came through Accomack County and became the dominant way of getting food to markets well into the 1920s and 1930s (Badger 2009:7). These larger markets, speedy rail travel, and refrigerated railroad cars gave the seafood industry in Accomack County national attention (Badger 2009:10). The railroad would also trigger the modern era of tourism in Accomack County. Although the railroad brought hard competition for steamboats, they continued to play a role in the transportation of people, goods, and mail until the arrival of the U.S. Route 13 in 1926 and State Route 175 in 1930 (Whitelaw 1989: 46).

The eight historic properties located at the southeast end of Wisharts Point Road are possibly associated with the small town of Atlantic, Virginia. Located northwest of Wishart's Point Road, the town of Atlantic for many years was a one road town (Mariner 2008:104). The main thoroughfare of Atlantic was originally identified as Seaside Road; by the early 1900s it was called Main Street, and most recently Atlantic Road. The town during the early 1900s consisted of two churches, the Atlantic United Methodist Church and St. Johns Methodist Church, about a dozen wood-frame residential buildings, two segregated school buildings (African-American children attended the Oaks Colored School located south of the village in the section known as "the Oaks" and white children attended a school building [name unknown] located in the center of town), and the Warner general store (burned in 1954) (Mariner 2008:104 & 106). Although the town of Atlantic was the closest to Wisharts Point, the small cluster of buildings also had a close association with Chincoteague Island because of mail-boat routes back and forth between Wisharts Point and Franklin City to Chincoteague.

During the third quarter of the 19th century, the property around Wisharts Point Road was originally owned by the Taylor family. Instead of having the property stay in the family, the land was auctioned off because the family was split on who should receive ownership (Mascari 1996). As early as August 1881, steamboats would leave Franklin City for Wisharts Point on Wednesdays and Fridays at 6:30 A.M. and return for Franklin City by 12 M (sic) with stopovers at Chincoteague Island and Bloodgood's Wharf (*Peninsula Enterprise* August 18, 1881). The route was run by the Old Dominion Steamship Company. Later in 1883, the Old Dominion

Steamship Company replaced the existing wharf at Wisharts Point with a larger one to handle the increased trade (*Peninsula Enterprise* April 5, 1883).

The wharf at Wisharts Point was also a lifeline for local farmers to tap into other markets. One major crop in Virginia's Eastern Shore was Irish potatoes. In 1895, farmers could load their potatoes at Wisharts Point for 20 cents per barrel onto a schooner bound for the Philadelphia market, and for 5 cents more farmers could tap into the New York market (*Peninsula Enterprise* July 13, 1895). Businesses would establish themselves at Wisharts Point to profit from the seafood industry. In 1895, the oyster shucking house of Emory & Dutton would build a large oyster packing house at Wisharts Point (*Peninsula Enterprise* November 30, 1895). In September 1902, the oyster shucking house of Taylor & Lockwood opened for business at Wisharts Point (*Peninsula Enterprise* September 20, 1902). The firm would eventually become Lockwood & Company, and would leave Wisharts Point in 1912 to expand their business at a larger scale (*Peninsula Enterprise* August 17, 1912). Wisharts Point was also a public location where business disputes were resolved. In 1907, Wisharts Point was the location where the State Oyster Inspector of District No. 1 heard arguments from two men and their attorneys that had the same claim over an oyster bed (*Peninsula Enterprise* May 4, 1907).

Wisharts Point provided a way for the surrounding population to travel to other areas of the Eastern Shore. In August 1882, the steamer *Widgeon* was advertised with a special excursion from Wisharts Point to Chincoteague and Franklin City for a fare of 30 cents. Passengers could expect meals, ice cream, and confectioneries at moderate prices and would leave at 8:30 a.m. (*Peninsula Enterprise* August 3, 1882). The following year, towards the end of the summer, there were excursions from Wisharts Point to Ocean City via Chincoteague and Franklin City. The roundtrip would cost 75 cents with passengers leaving at 8:00 a.m. and returning by 7:00 p.m. (*Peninsula Enterprise* August 9, 1883). The steamer *Lillie*, under the control of Captain S.E. Matthews, towed a barge to accommodate 150 people from Wisharts Point to Chincoteague for special events (*Peninsula Enterprise* July 18, 1896). Wisharts Point was also a popular location for entertainment. In August of 1893, the public enjoyed boat races that were followed by a large picnic with delicacies of the season (*Peninsula Enterprise* August 12, 1893).

In October 1896, the Wisharts Point wharf would have to be rebuilt after a strong storm destroyed the wharf. The storm carried away wood and lumber owned by the company of Matthews & Taylor, and it caused damage to boats and other property at or near the wharf (*Peninsula Enterprise* October 17, 1896). Another storm in 1897 caused damage to nearby boats and the wharf at Wisharts Point. The company of Matthews & Taylor was affected again with over 100 cords of wood and other materials were carried away by the high tide. The Wishart Point Transportation Company, who had a house and dock at Wisharts Point, were both swept away with nothing remaining except for the dock's pilings (*Peninsula Enterprise* October 30, 1897). The Wishart Point Transportation Company recovered from the 1897 storm and by 1899 the company was being praised for providing continued service of mail delivery during a deep freeze with frigid temperatures of 4 degrees below freezing (*Peninsula Enterprise* February 25, 1899). In 1902, under a partnership formed by Jonathan H. Matthews and Peter J. Gillespie, the Wishart Point Transportation Company would carry mail and passengers from the NYP&N to Chincoteague and return via Wisharts Point. Passengers would pay 75 cents for the journey (*Peninsula Enterprise* October 4, 1902).

As early as 1896, public support was being gathered to ask the post office to establish a mail route from Chincoteague via Wisharts Point to connect with the railroad at Oak Hall station (*Peninsula Enterprise* August 15, 1896). In October 1896, more petitions for support of a mail route from Bloomtown via Wisharts Point circulated locally (*Peninsula Enterprise* October 31, 1896). The establishment of these mail routes would support faster delivery of the mail from southern areas that had to go through Philadelphia or New York and took three or four days for delivery. By 1899, Wisharts Point became part of a new mail route that traveled to Chincoteague and continued up to Franklin City (*Peninsula Enterprise* January 14, 1899; Mariner 1996:80). Delivering the mail was a profitable business because mail-boats could carry both the mail and passengers. In 1913, the mail/passenger route was so popular that Captain Willard Taylor agreed to ferry the mail for less than one dollar, and later mentioned he would have paid as much as $50 a year to run the profitable route (Mariner 1996:80).

The majority of the people living along Wisharts Point Road at the turn of the twentieth century worked as general farmers or watermen, and rented their properties. The 1910 U.S. Federal Census shows a total of eighteen households along Wisharts Point Road (1910 U.S. Federal Census). Most of the population living on Wisharts Point Road were white and were Virginia born. These white families worked as net fishermen, hucksters that sell fish, coopers that made truck barrels, boarding house managers, and general store workers and owners. Out of the fifteen white households, five owned their homes. There were three African-American or mixed-race families living on Wisharts Point Road in 1910 (1910 U.S. Federal Census). These African-American and mixed-race families were Virginia born, had little to no education, rented their houses, and worked as laborers or as watermen.

By 1910, Wisharts Point wharf had a hotel that was sometimes referenced as Wisharts Point Hotel, or Hotel Massey (Mascari 1996). Described as having a long front porch and facing the water, the hotel was possibly owned by Lee W. Massey, who is noted in 1911 as owning a store at Wisharts Point near the town of Atlantic (*Peninsula Enterprise* November 25, 1911). The Wisharts Point Hotel changed ownership over the years. In 1918, there is a reference of the hotel being owned by S. Wilkins Matthews, and in the 1920s the hotel was purchased by William C. Bunting, Jr. (Mascari 1996).

The glory days of the steamboat route between Chincoteague and Wisharts Point Wharf would come to a close with the completion of the Chincoteague Causeway in 1922. In 1919, John B. Whealton established the Chincoteague Toll Road and Bridge Company with the goal of connecting the mainland of the Eastern Shore to Chincoteague. Whealton was a native of Chincoteague Island who owned his own construction company in Florida that specialized in building roads with a mixture of oyster shells and dirt (Turman 1964:225). In 1918, he returned to Chincoteague and organized a stock company to build a road and bridge system to connect the island to the mainland. By the winter of 1918, Whealton submitted an application to the State Corporation Commission for a charter for the Chincoteague Toll Road and Bridge Company. In January 1919, the charter was granted and in September 1919 a permit to cross the marshes and salt water creeks was approved by the Virginia General Assembly. Whealton was awarded a $144,000 contract for the construction of the road and bridge system and began work on March 1, 1920 (Turman 1964: 226 ; Mariner 1996:106).

On November 15, 1922, the Chincoteague Toll Road and Bridge opened to the public with over 3,000 visitors attending the ceremony, many of which were eager to drive their automobiles over the causeway (Mariner 1996:111). The day of the opening ceremony unfortunately was plagued by rain, making the causeway muddy and impassable (Mariner 1996:112). The poor road conditions caused ninety-six cars to be stranded in the middle of the marshlands (Turman 1964:226). The next two days following the opening ceremony were spent using barges to ferry the stranded cars to Wisharts Point or Franklin City (Turman 1964:227). This would be the last time cars from Chincoteague would cross to the mainland to Wisharts Point and Franklin City (Mariner 1996:113). The causeway's initial construction consisted of soil pumped from creeks and marshes that was then trapped between pilings sunk into the marsh, and overlaid with oyster shells and stones (Mariner 1996:106). By December 1922, Whealton's company rebuilt and reinforced the causeway by adding oyster shells covered with soil (Turman 1964:227). During the spring of 1923, the success of the Chincoteague Causeway was affirmed when the U.S. government replaced mail-boat routes from Franklin City and Wisharts Point to Chincoteague through use of the Chincoteague Causeway (Mariner 1996:113).

During the 1920s, the Chincoteague Causeway made the island more accessible to tourists and it eventually became a popular destination for sports fishermen during the autumn months. This created a need for "tourist homes" that would take in temporary boarders or "roomers" (Mariner 1996:124). William Bunting, the owner of the hotel at Wisharts Point, moved the hotel building on a monitor from Wisharts Point to Chincoteague Island. The hotel was newly situated opposite the Carnival Grounds at 3639/3641 Main Street (Mariner 1996:124). Eventually, the hotel was sold in 1930 by William Bunting to two couples for $1,800: Samuel and Atlanta Jones Taylor, and Irving W. and Amy Bowden (Land Records of Accomack County, Virginia A138:187). Atlanta Jones Taylor and Irving W. Bowden were half brother and sister (Mascari 1996). The Taylors continued to rent rooms to fishing parties during the 1950s (Mascari 1996).

National Register of Historic Places Evaluation

The potential historic district located at Wisharts Point Road is eligible for listing in the NRHP under Criterion A because of its association with events that have made a contribution to the broad patterns of Accomack County, Virginia's maritime and transportation history. Although the community at Wisharts Point Road is a relatively small fishing and farming community from the late nineteenth and early twentieth centuries, the eight historic houses help convey the community's association with Accomack County's maritime and transportation history, especially because the wharf and historic hotel no longer exist at Wisharts Point. The historic houses are the only tangible elements remaining that reflect why farmers and watermen chose to live near Wisharts Point wharf to ship their produce to market and have access to water. Additionally, Wisharts Point Road extends to a man-made landmass where the wharf and historic hotel was located and is a tangible remnant of the maritime transportation route from Wisharts Point Road to Chincoteague Island. For over forty years, the wharf at Wisharts Point Road connected the general population with larger populated areas at Franklin City and Chincoteague Island, and opened up new markets for local farmers and watermen.

The Wisharts Point community retains integrity of location, setting, feeling and association. The community has not been moved from its original location. Although the setting has become more developed since the community was constructed, it has not changed substantially from the small rural farming and waterfront setting that the community original represented. The community continues to be associated with an agricultural lifestyle and retains the road and causeway representative of its maritime transportation history. Wisharts Point retains its historical community development patterns and feeling of a small waterfront agricultural community.

Archival research completed as part of this project does not indicate that the potential historic district located at Wisharts Point Road is associated with person(s) of historic significance, and thus is not eligible under NRHP criterion B.

The potential historic district located at Wisharts Point Road does not retain its integrity of design, materials, and workmanship due to the use of modern materials through alterations such as small additions, modern window replacement, and siding. Additionally, the historic significance of Wisharts Point Road revolved around the wharf and small hotel, both of which are no longer physically standing or intact. As a result, the lack of these significant structures has left a gap in the architectural integrity of Wisharts Point Road, and has lost its integrity of feeling, setting, association, and location to convey the community's former purpose as a maritime and transportation hub for the region during the late nineteenth and early twentieth centuries. Therefore, the potential historic district located at Wisharts Point Road is not eligible under Criterion C for NRHP listing as having architecturally significant building types, periods, or methods of construction.

NRHP Criterion D was not investigated as part of this study.

Survey Results

The architectural investigation of the undertaking's APE for visual effects involved a reconnaissance survey of the potential historic district at Wisharts Point Road, near Wallops Island, Virginia. The potential historic district contains a total of eight architectural resources within the project APE for visual effects. The main entrances of the eight architectural resources located in the proposed historic district face northeast. The project site is located 3.0 miles southeast from the proposed historic district. The prior cultural resources analysis of the potential historic district at Wisharts Point Road was completed during the winter in February 2016, and this reconnaissance-level architectural survey was completed towards the end of spring in May 2017. Based on the findings from both surveys, the line of sight to the project site is blocked by the overgrowth of vegetation from the eight architectural resources' southwest property lines. Therefore, the undertaking will have No Adverse Effect on the potential NRHP-eligible historic district. Additionally, URS does not recommend further inspection of the potential historic district at the intensive level, as the research conducted during this survey was exhaustive and did not yield any undiscovered significant aspects of Virginia's maritime history for the time period or region.

Summary

In April 2016, URS completed a cultural resources analysis performed in support of the USAF proposed action to build and operate an approximately 750-foot tall, guyed instrumentation tower on Wallops Island at WFF (i.e., the undertaking). URS developed aerial maps and simulations to show the visibility of the tower from different mile markers, and reviewed the potential for the proposed project to affect historic properties within the direct and indirect APE. Based on the reconnaissance survey, five historic resources and one potential historic district were within the Indirect APE. It was determined that trees and vegetation overgrowth acted as visual buffers between the historic properties and the proposed tower's location. Consequently, the proposed tower's location would have no adverse visual effects on the six above-ground historic properties. Concerning the direct APE, the proposed undertaking would have no potential to impact significant archeological sites and would have no effect on archaeological historic properties.

After submittal of these findings, the Virginia SHPO requested that URS conduct a reconnaissance-level architectural survey of Wisharts Point Road potential historic district within the project APE for visual effects. It was also requested that URS amend Figure 1 from the 2016 cultural resource analysis to further identify the locations, names, and total heights of existing vertical structures that share the coastline with the proposed tower, and provide representative photographs with the proposed tower geo-located and to scale to depict the potential visual effects from the locations of three (3) historic structures.

In May 2017, URS documented and evaluated the potential historic district at Wisharts Point Road, and assessed the visual effects of the undertaking on resources within this historic district. The potential historic district is recommended for listing in the NRHP under Criterion A because of its association with events that have made a contribution to the broad patterns of Accomack County, Virginia's maritime and transportation history. After further analysis of the project area APE, the proposed Wisharts Point Road Historic District will not be adversely affected by the undertaking. As was previously determined during the 2016 cultural resources analysis, the eight historic resources' primary northeast views are in the opposite direction of the project site, and the view from the properties' southwest (rear) property lines are blocked from vegetation and do not have a view of the project site. In conclusion, the undertaking will have no effect on the potential NRHP-eligible historic district. Furthermore, the representative photographs with the proposed tower geo-located and to scale have strengthened the findings that the proposed tower would not have an effect on the following historic structures: Assateague Beach Coast Guard Station (VDHR ID #001-0172), Wharton Place (DHR ID #001-0050), Mount Wharton (DHR ID #001-0052), and 31545 Point Breeze Lane, a dwelling eligible for the NRHP and Virginia Landmarks Registry [VLR].

References Cited

Badger, Tom, and Badger, Curtis. *Images of America: Accomack County*. Charleston, SC: Arcadia Publishing, 2009.

KCI Technologies, Inc. Suburbanization Historic Context and Survey Methodology: I-495/ I-95 Capital Beltway Corridor Transportation Study, 1999. Montgomery and Prince George's Counties, Maryland, Volume I. Prepared for the Maryland Department of Transportation State Highway Administration

Lanier, Gabrielle M., and Herman, Bernard L. *Everyday Architecture of the Mid-Atlantic*. Baltimore: Johns Hopkins University Press, 1997.

Mariner, Kirk. *Glimpses of a Vanished Eastern Shore*. Onancock, Virginia: Miona Publications, 2008.

Mariner, Kirk. *Once Upon an Island: The History of Chincoteague*. New Church, Virginia: Miona Publications, 1996.

Mascari, Ruth Bowden. *Wishart's Point Hotel*. Eastern Shore Public Library Eastern Shore Room. Photocopy. Box 13 Number 13, 1996.

National Cooperative Highway Research Program, Report 723: A Model for Identifying and Evaluating the Historic Significance of Post-World War II Housing, 2012. Washington, D.C. Transportation Research Board of the National Academies.

Peninsula Enterprise Newspaper. Accomac Courthouse. 1881-1928.

Turman, Nora Miller. *The Eastern Shore of Virginia: 1603-1964*. Onancock, Virginia: The Eastern Shore News, Inc., 1964.

36 CFR Part 800 – *Protection of Historic Properties*. Advisory Council on Historic Preservation, Washington, D.C. Electronic document, www.achp.gov/regs-rev04.pdf, accessed March 28, 2016.

ATTACHMENT 1
REVISED FIGURE 1

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 Tower, Phase II
SCALE 1:45,000
SOURCE ESRI 2017
Q:\Projects\ENV\IAP\CRM\NASA - Wallops Tower, CR Analysis, Task 2\900-GIS and Graphics\920 GIS\Figure 1 proposed communications tower.mxd

TITLE
Proposed Instrumentation Tower

URS
12420 Milestone Center Dr.
Germantown, MD 20876

PROJ NO 60544517
FIGURE 1

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

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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

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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** **Accomack County**

City **Town** **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**

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

---

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.

---

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

The following information <u>must</u> 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

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.

13485 Wharton Drive – NRHP and VLR Listed

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.

Assateague Beach Coast Guard Station - NRHP and VLR Listed

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.

Assateague Lighthouse - NRHP and VLR Listed

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.

<u>31545 Point Breeze Lane – NRHP Eligible</u>

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.

Wisharts Point Historic District - NRHP Eligible

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.

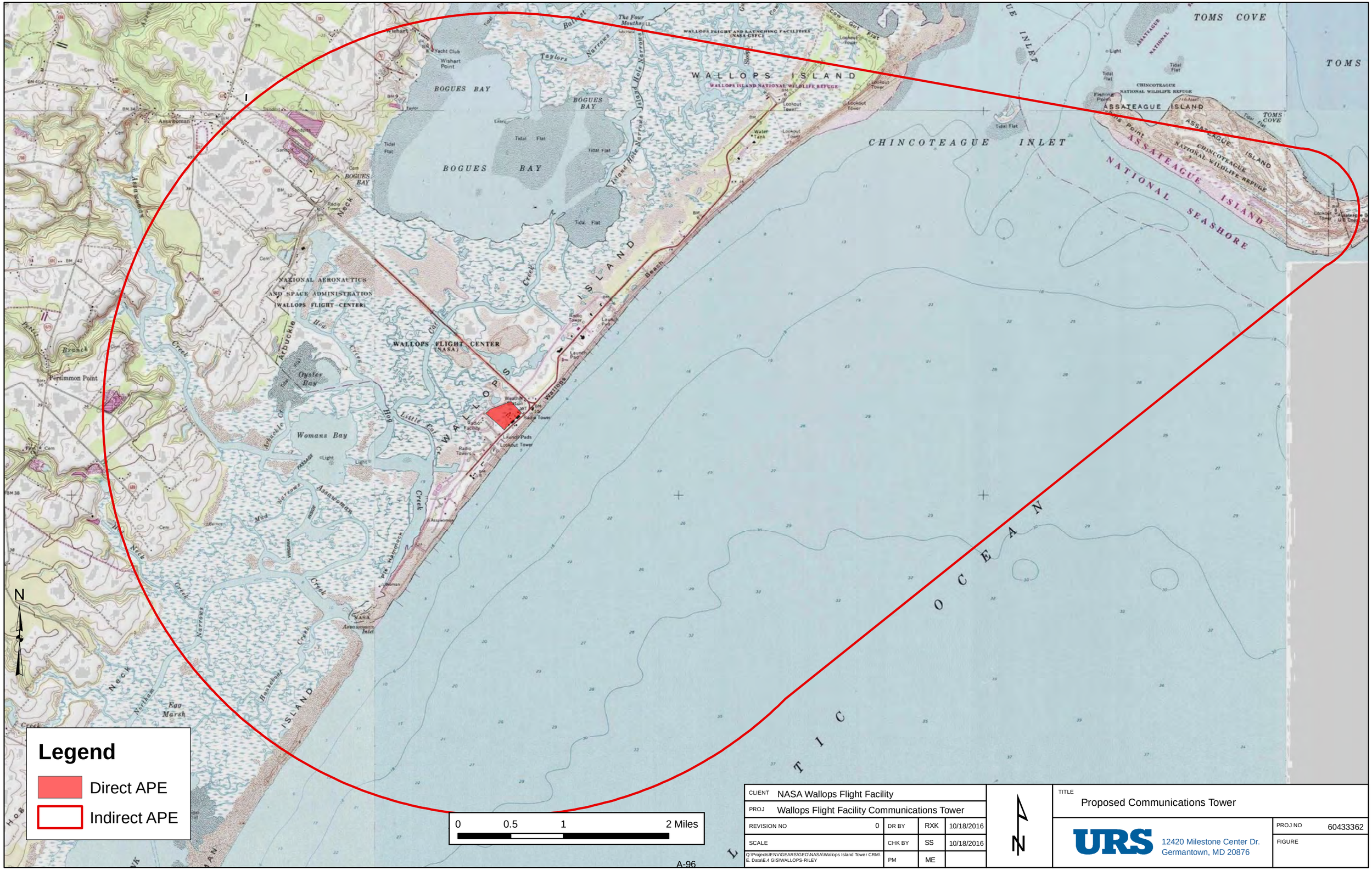
Sincerely,

URS Group, Inc.

Scott Seibel, RPA
Archaeology Program Manager

Lorin V. Farris, MA
Architectural Historian

Attachments



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PROJ	Wallops Flight Facility Communications Tower			
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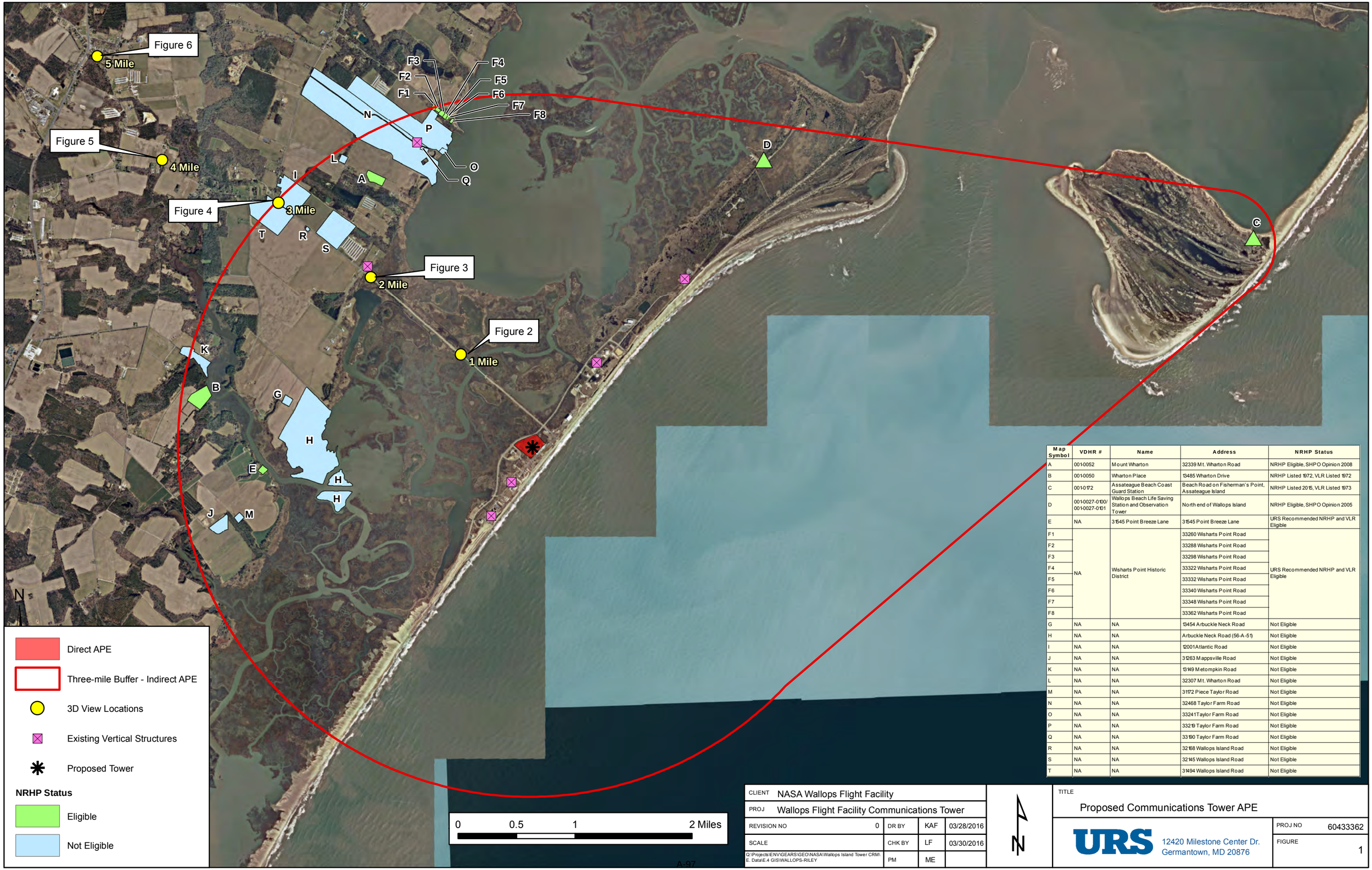
SCALE		CHK BY	SS	10/18/2016
Q:\Projects\ENV\GEARS\GEO\NASA\Wallops Island Tower CRM\E. Data\E.4 GIS\WALLOPS-RILEY		PM	ME	

TITLE
Proposed Communications Tower

URS
12420 Milestone Center Dr.
Germantown, MD 20876

PROJ NO 60433362
FIGURE



Map Symbol	VDHR #	Name	Address	NRHP Status
A	0010052	Mount Wharton	32339 Mt. Wharton Road	NRHP Eligible, SHPO Opinion 2008
B	0010050	Wharton Place	13485 Wharton Drive	NRHP Listed 1972, VLR Listed 1972
C	0010172	Assateague Beach Coast Guard Station	Beach Road on Fisherman's Point, Assateague Island	NRHP Listed 2015, VLR Listed 1973
D	0010027-0100/ 0010027-0101	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		
REVISION NO	0	DR BY	KAF 03/28/2016
SCALE		CHK BY	LF 03/30/2016
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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				
REVISION NO	0	DES BY	LF	02/29/2016	
SCALE	n/a	DR BY	ME	02/29/2016	
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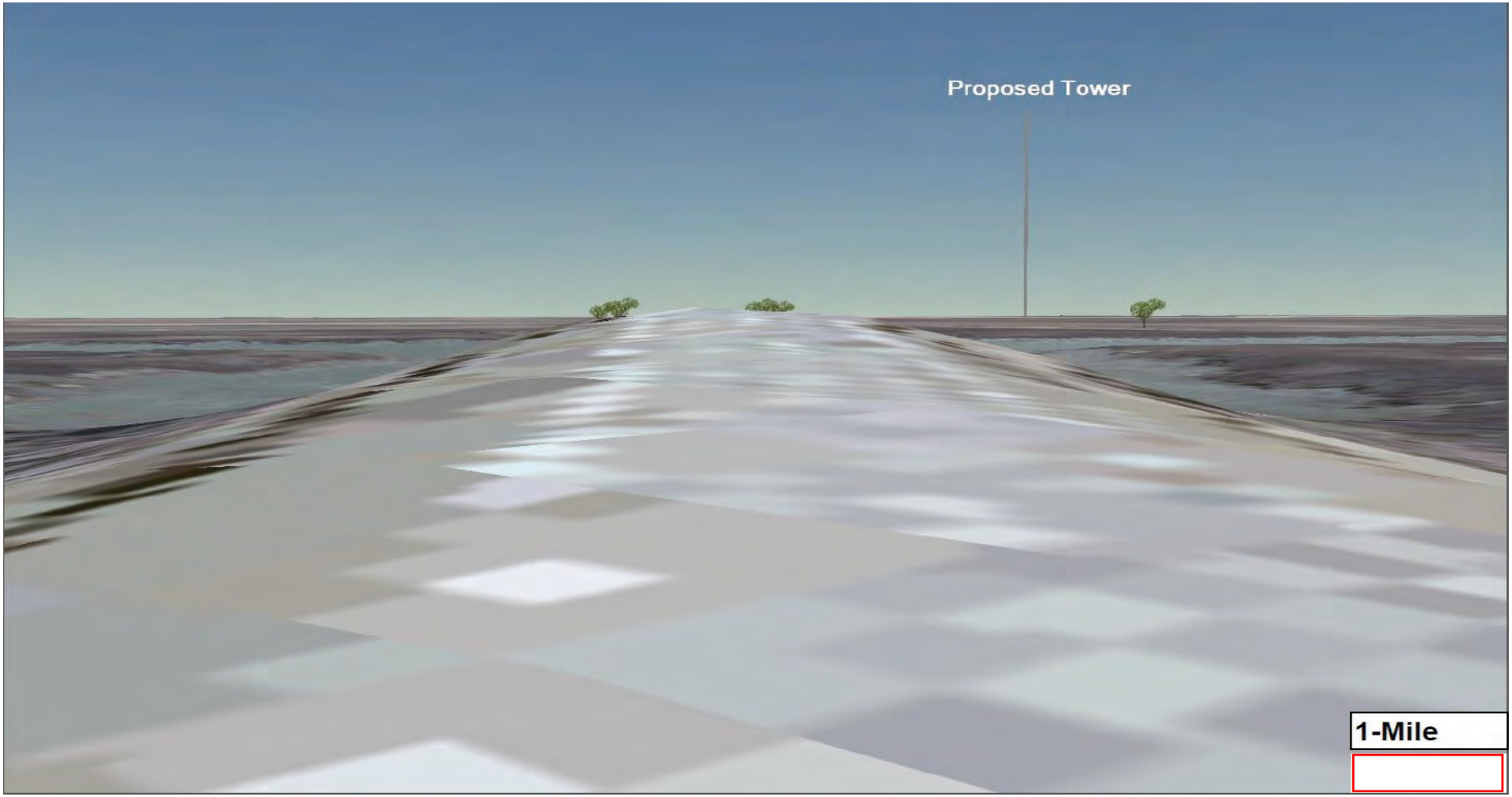
TITLE Proposed Communications Tower - Direct APE

URS 12420 Milestone Center Dr. Germantown, MD 20876

PROJ NO 60433362

FIGURE 2



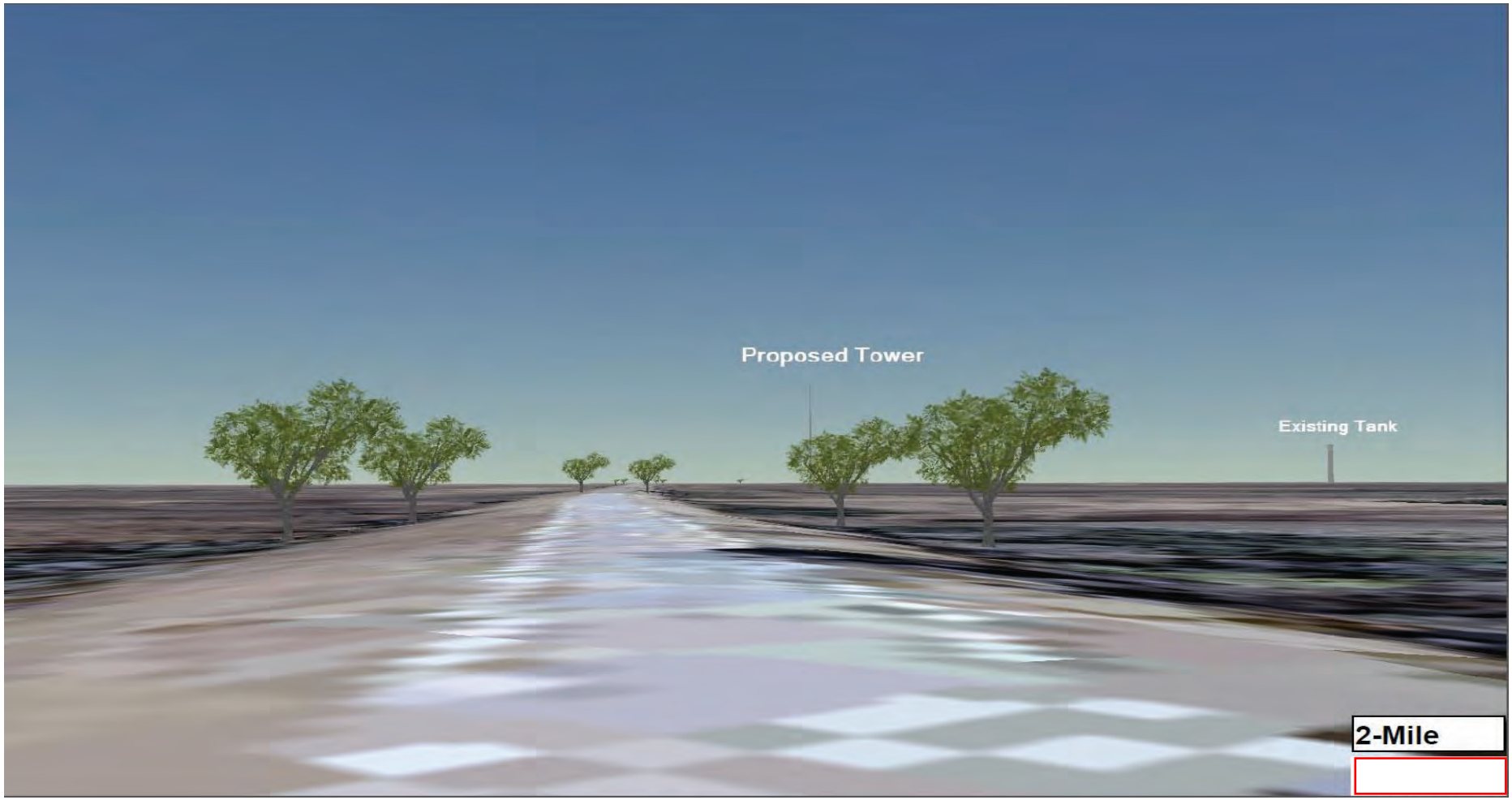
CLIENT NASA Wallops Flight Facility				
PROJ Wallops Flight Facility Communications Tower				
REVISION NO 0	DES BY	LF	02/29/2016	
SCALE n/a	DR BY	ME	02/29/2016	
Q:\Projects\ENV\GEARS\GEO\NASA\Wallops Island Tower CRM\E. Data\E.5 Graphics	CHK BY	SS	02/29/2016	

TITLE Representative Views of Proposed Communications Tower

URS 12420 Milestone Center Dr. Germantown, MD 20876

PROJ NO 60433362

FIGURE 3



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PROJ Wallops Flight Facility Communications Tower				
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SCALE	n/a	DR BY	ME	02/29/2016
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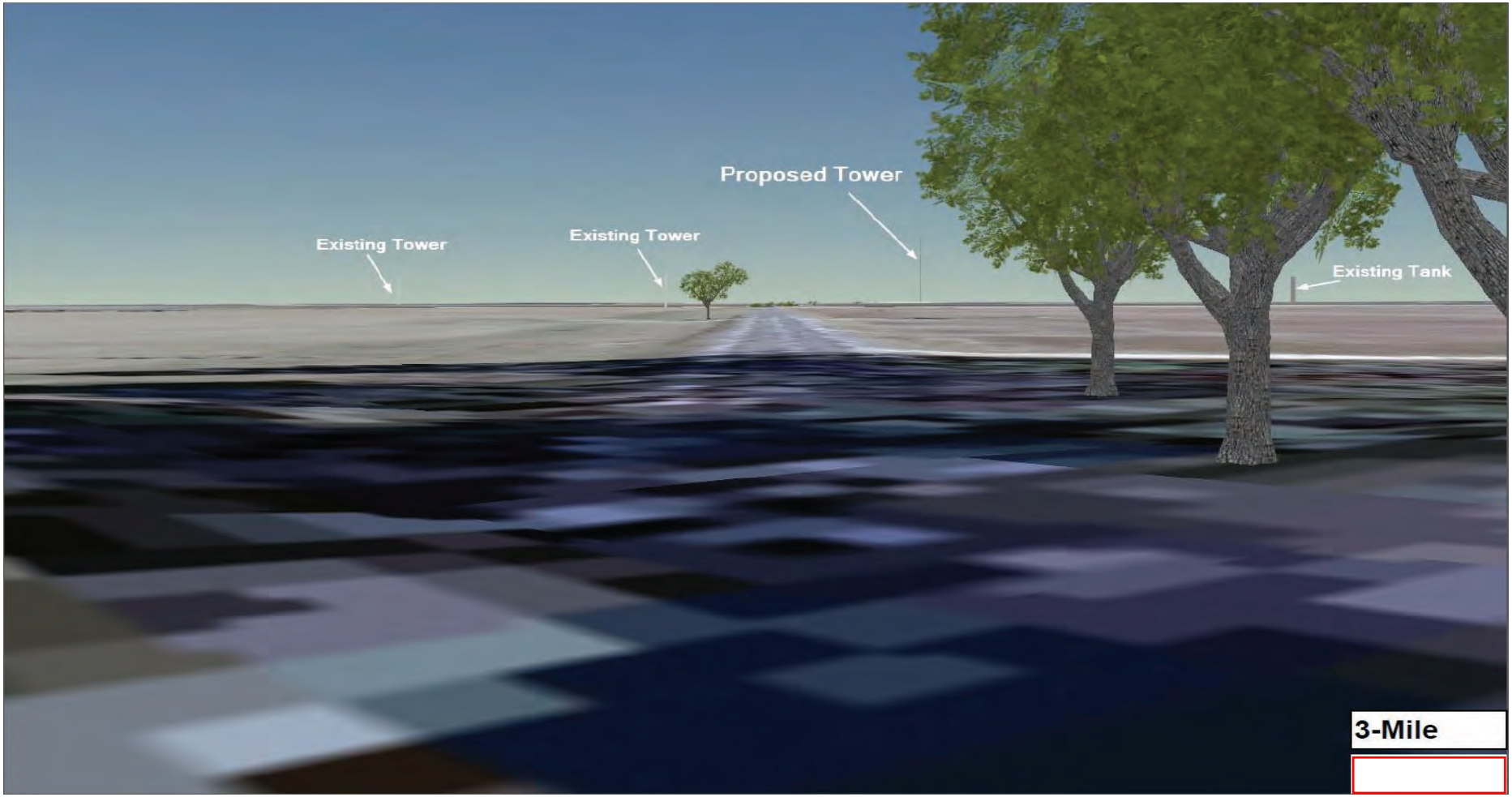
TITLE Representative Views of Proposed Communications Tower

URS 12420 Milestone Center Dr. Germantown, MD 20876

PROJ NO 60433362

FIGURE 4



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PROJ	Wallops Flight Facility Communications Tower			
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SCALE	n/a	DR BY	ME	02/29/2016
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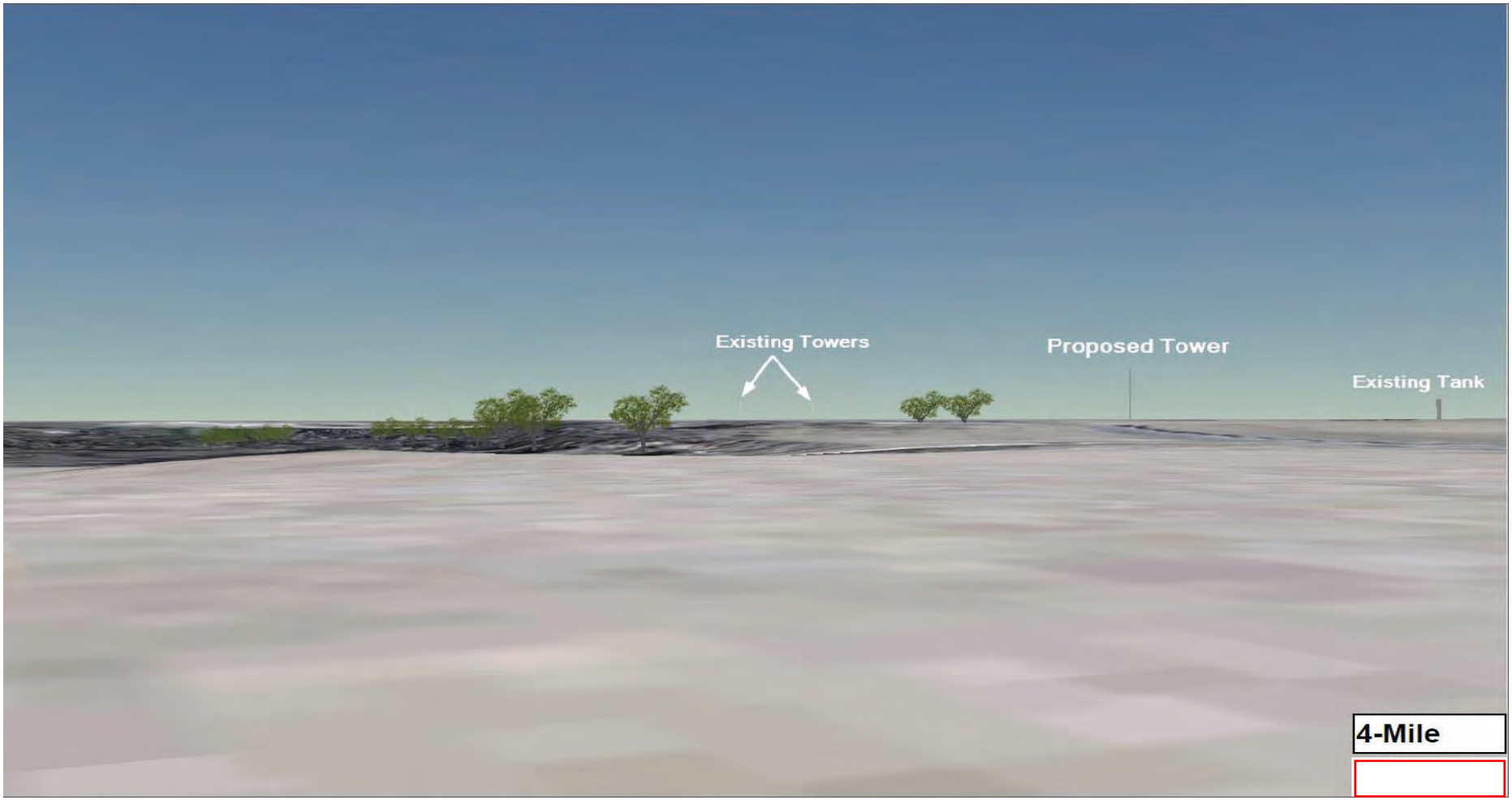
TITLE Representative Views of Proposed Communications Tower

URS 12420 Milestone Center Dr. Germantown, MD 20876

PROJ NO 60433362

FIGURE 5



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PROJ Wallops Flight Facility Communications Tower				
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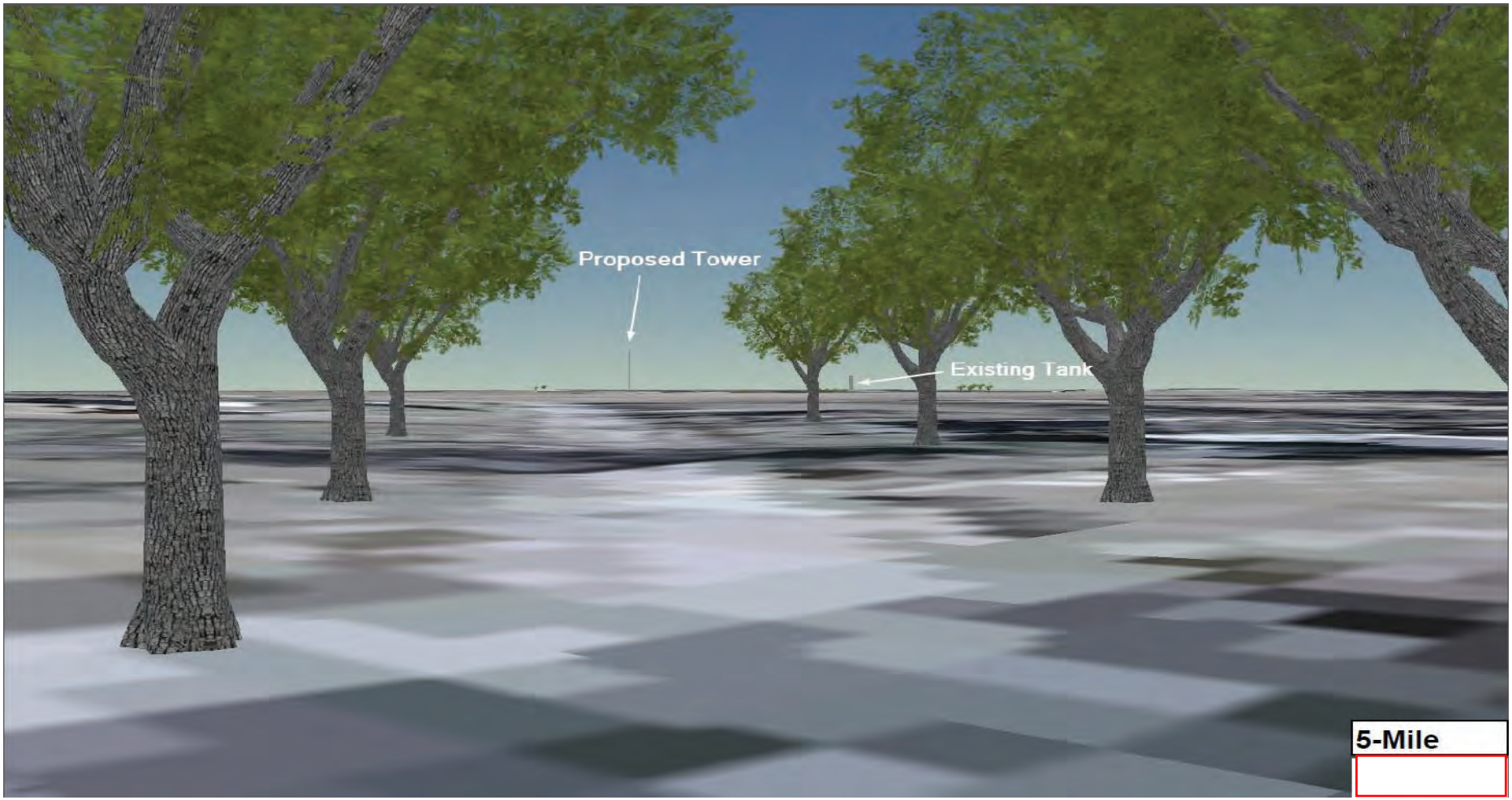
TITLE Representative Views of Proposed Communications Tower

URS 12420 Milestone Center Dr. Germantown, MD 20876

PROJ NO 60433362

FIGURE 6



CLIENT NASA Wallops Flight Facility				
PROJ Wallops Flight Facility Communications Tower				
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SCALE n/a	DR BY	ME	02/29/2016	
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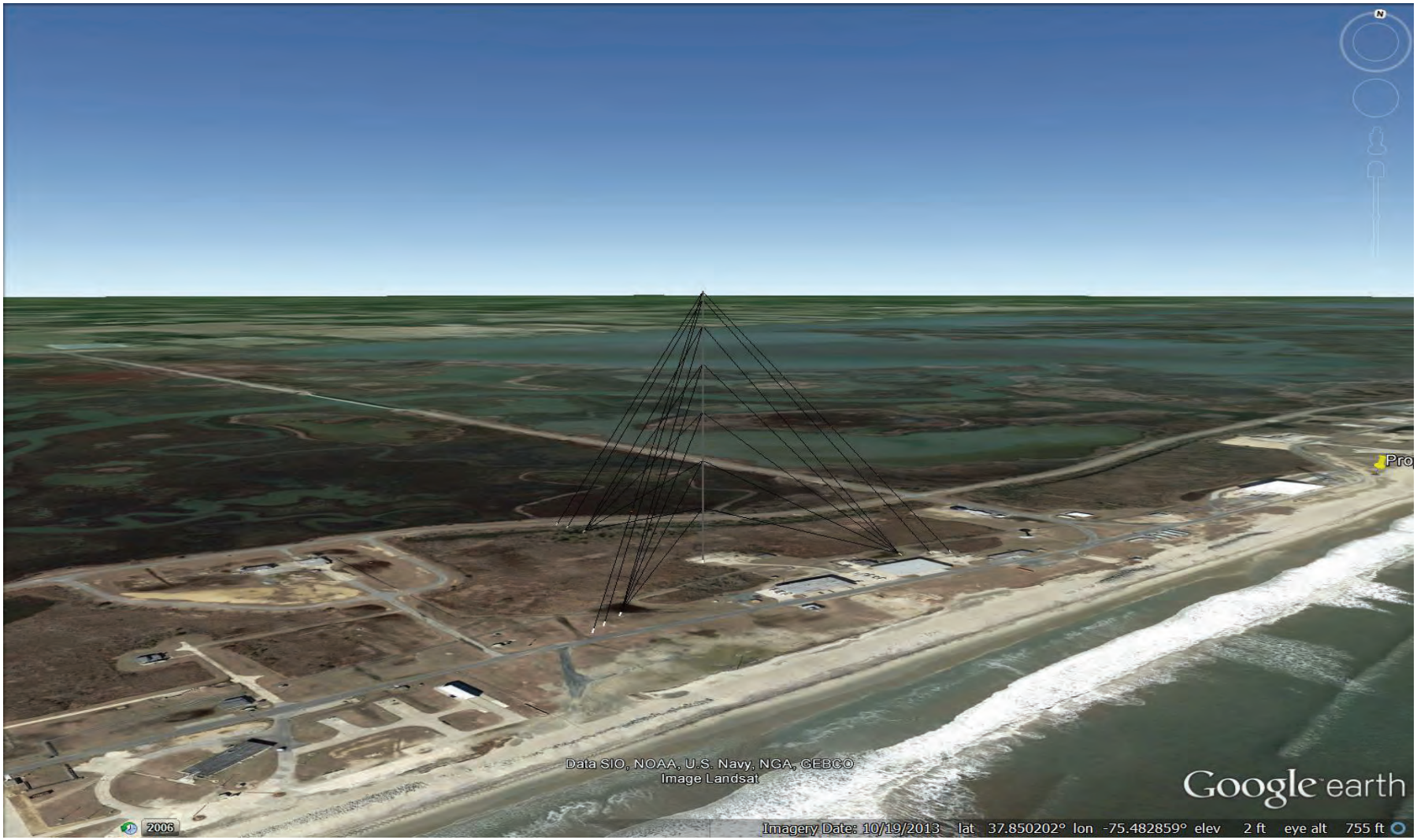
TITLE Representative Views of Proposed Communications Tower

URS 12420 Milestone Center Dr. Germantown, MD 20876

PROJ NO 60433362

FIGURE 7



CLIENT NASA Wallops Flight Facility				
PROJ Wallops Flight Facility Communications Tower				
REVISION NO	0	DES BY	LF	02/29/2016
SCALE	n/a	DR BY	ME	02/29/2016
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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
Q:\Projects\ENV\GEARS\GEO\NASA\Wallops Island Tower CRM \E. Data\E.5 Graphics\Illustrator\Photographs & Graphics		PM	SS	02/26/2016	

Photo 3. 32339 Mt. Wharton Road, Looking Southeast Towards Project Site

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 10
Q:\Projects\ENV\GEARS\GEO\NASA\Wallops Island Tower CRM \E. Data\E.5 Graphics\Illustrator\Photographs & Graphics		PM	SS	02/26/2016	

Photo 1. 13485 Wharton Drive, Looking Northwest

Photo 2. 13485 Wharton Drive, 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 11
Q:\Projects\ENV\GEARS\GEO\NASA\Wallops Island Tower CRM \E. Data\E.5 Graphics\Illustrator\Photographs & Graphics		PM	SS	02/26/2016	

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

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 12
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Photo 1. Assateague Beach Coast Guard Station, Looking Southeast (VDHR)

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

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 13
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Photo 3. Looking Northeast Towards Assateague Beach Coast Guard Station from Project Site

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 14
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Photo 1. Assateague Lighthouse, Looking Northwest (LOC)

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 15
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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			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 16
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Photo 3. Wallops Beach Life Saving Station and Observation Tower, Looking Southwest to Project Site

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 17
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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			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 19
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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			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 23
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Photo 7. 33348 Wisharts Point Road, Looking Southeast

Photo 8. 33362 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 24
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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			TITLE	Non-Eligible Property Photographs and Condition Assessments
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 25
Q:\Projects\ENV\GEARS\GEO\NASA\Wallops Island Tower CRM\E. Data\E.5 Graphics\Illustrator\Photographs & Graphics		PM	SS	02/26/2016	

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			TITLE	Non-Eligible Property Photographs and Condition Assessments
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 26
Q:\Projects\ENV\GEARS\GEO\NASA\Wallops Island Tower CRM \E. Data\E.5 Graphics\Illustrator\Photographs & Graphics		PM	SS	02/26/2016	

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			TITLE	Non-Eligible Property Photographs and Condition Assessments
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 27
Q:\Projects\ENV\GEARS\GEO\NASA\Wallops Island Tower CRM \E. Data\E.5 Graphics\Illustrator\Photographs & Graphics		PM	SS	02/26/2016	

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Federal Consistency Determination

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FEDERAL CONSISTENCY DETERMINATION
U.S. AIR FORCE INSTRUMENTATION TOWER ON WALLOPS ISLAND, VIRGINIA

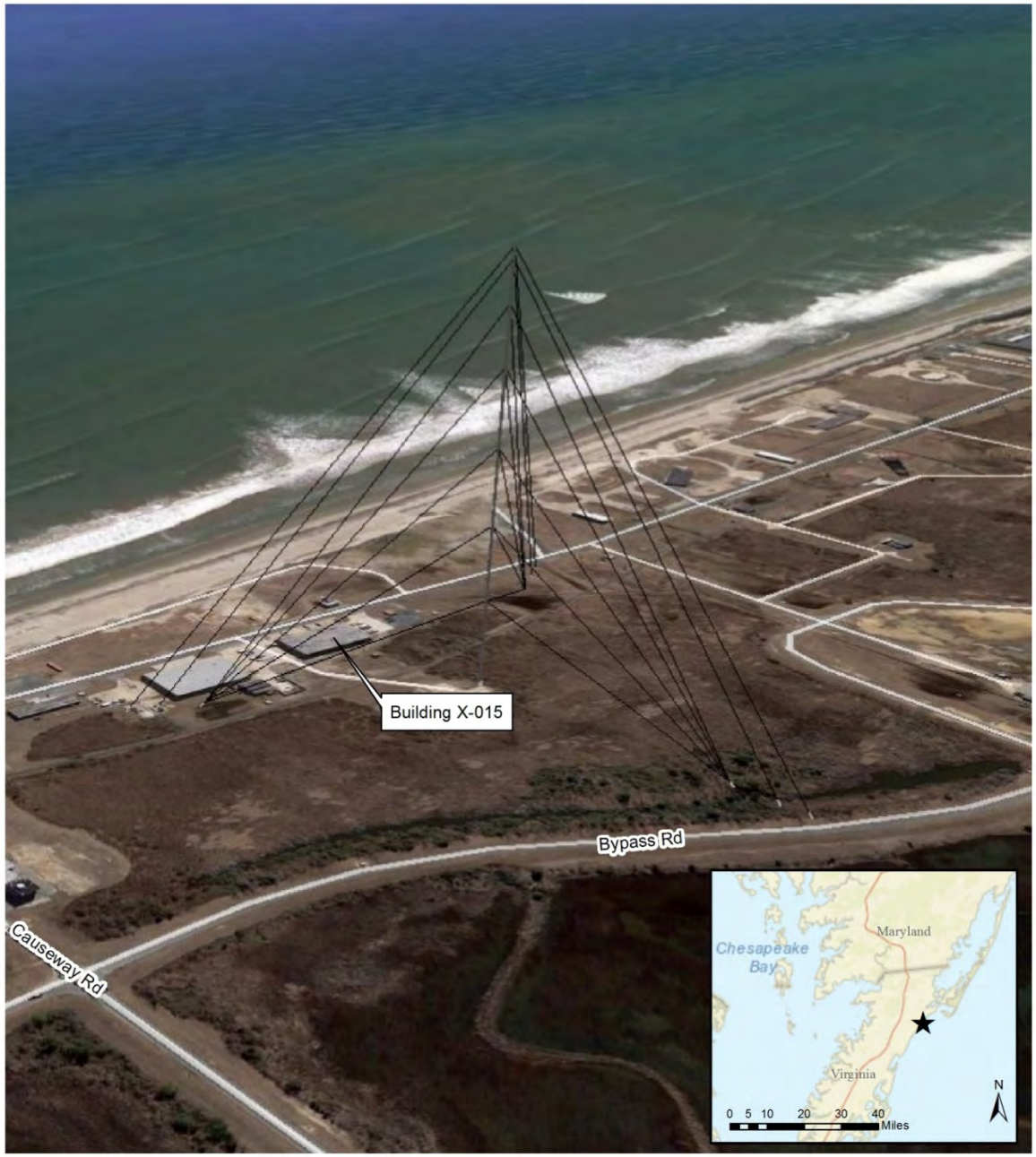
This document provides the Commonwealth of Virginia with the United States Air Force's (USAF) Consistency Determination under the Coastal Zone Management Act (CZMA) section 307(c)(1) and 15 Code of Federal Regulations (CFR) Part 930, subpart C, for the construction and operation of an instrumentation tower on Wallops Island, Accomack County, Virginia. This Consistency Determination serves to document the U.S. Air Force's determination of consistency of the Proposed Action and potential effects with the enforceable policies of the Virginia Coastal Zone Management (CZM) Program.

This document also considers the connected actions of three other Federal agencies. As the federal landowner, the National Aeronautics and Space Administration (NASA) Goddard Space Flight Center's Wallops Flight Facility (WFF) would authorize the construction and operation of the proposed tower on its property. Along with the U.S. Air Force and NASA, the 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. As such, because there are multiple Federal agencies involved in the activity considered herein, USAF has assumed the role of lead agency (15 CFR § 930.40) and prepared this consistency review to not only fulfill its own CZMA obligations but also those of NASA, NAWCAD, and NAVSEA.

PROPOSED ACTION

Under the Proposed Action, the U.S. Air Force would install an approximately 750-foot tall, guyed, multi-use tower on Wallops Island, Virginia. The tower would be a typical three-sided lattice structure, approximately 42 inches wide on each 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, and would extend out a distance of up to 590 feet from the tower base. Guys would be required approximately every 80 feet in 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 could contain up to twelve individual guys depending on final tower height (see Figure 1). The tower would support, at appropriate elevations, a variety of required components including: ultra-high frequency/very high frequency (UHF/VHF) radios, telemetry dishes, global positioning system (GPS) antennas, spectrum-monitoring antennas, a flight termination system, and meteorological instrumentation.

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). Concrete piles would be driven or cast in place to a depth of at least 75 feet. Anchor points for the guy wires would consist either of concrete slabs measuring 14 feet by 14 feet by 5 feet or helical piles, comprised 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, the three intermediate anchor point would be located approximately 530 feet from the tower base, and the three inner anchor points would be approximately 430 feet from the tower base. If necessary, gravel access roads would be installed from a nearby paved road or parking lot to the tower base.



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.

Figure 1: Proposed Action

The USAF recognizes that the implementation of the Proposed Action has the potential to adversely impact avian species breeding, nesting, migrating, or otherwise occurring at and in the vicinity of Wallops Island. Therefore, 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, entitled *Recommended Best Practices for Communication Tower Design, Siting, Construction, Operation, Maintenance, and Decommissioning* (the Guidance; USFWS 2016). The 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. Where applicable and feasible, measures included in the Guidance have been incorporated into the Proposed Action. In addition to implementing an Avian Mitigation and Monitoring Plan, and other recommendations from the Guidance, the proposed tower would incorporate bird diverters placed every 30 feet along the inner- and outer-most guys wires; tower lighting would be minimized to ensure it meets FAA requirements in FAA AC 70/7460-1L, *Obstruction Marking and Lighting with Change 1*, but also remains as bird-friendly as possible; and lighting on support facilities associated with the proposed tower would be down-shielded and motion-activated.

In addition to the tower itself, two small (i.e., approximately 10 feet by 20 feet) buildings would be installed at the base of the tower to house equipment associated with the tower's operation and maintenance. Required utility services include electricity and broadband network communication, both of which would be provided by existing infrastructure adjacent to the project site. A 30-kilowatt propane-fueled generator and associated 500-gallon above-ground fuel tank would be installed adjacent to the electronics enclosure to provide electricity in the event of power outages. To mitigate the potential for flooding during storm events, the structure and all supporting equipment would be elevated to at least 11 feet above mean sea level.

The construction phase of the proposed project would begin approximately one month after environmental approval, and be completed over a period of approximately 18 months. While installing the tower would likely only require approximately three months, other activities (e.g., pile driving and electronics outfitting) would take the majority of the construction phase timeframe. Regular maintenance of the tower would be required, and would include tensioning the guy wires, replacing electronics, and trimming vegetation underneath the guy wires. Occasional top-dressing of the gravel access roads also could be necessary.

It is assumed that the tower would remain at Wallops Island for an approximately 20-year period beginning in 2018. At that point, the need for the tower would be reevaluated. When the tower is no longer needed, the tower and associated equipment would be dismantled, recycled, and/or disposed of in accordance with applicable regulations at that time.

Alternative Sites on Wallops Island

Pursuant to the requirements of the National Environmental Policy Act of 1969 (42 United States Code [U.S.C.] §§4321 et seq.); the Council on Environmental Quality (CEQ) Regulations for Implementing the Procedural Provisions of NEPA (40 CFR §§1500-1508); and the U.S. Air Force Environmental Impact Analysis Process (32 CFR §989) the U.S. Air Force is developing

an Environmental Assessment (EA) as the lead agency for this project. As part of this analysis, two sites on Wallops Island, Virginia, are being considered for the Proposed Action (see Figure 2). The X-015 site is the Preferred Alternative.

CONSISTENCY DETERMINATION

The Virginia CZM Program consists of nine enforceable policies (see Table 1).

Table 1: Virginia CZM Program Enforceable Policies

Enforcement Policy	Administrating Entity or Entities
Fisheries Management	VMRC; VDGIF; VDH (shellfish)
Subaqueous Lands Management	VMRC
Wetlands Management	VMRC (tidal); VDEQ (tidal and non-tidal)
Dunes Management	VMRC
Non-point Source Pollution Control	VDEQ
Point Source Pollution Control	VDEQ
Shoreline Sanitation	VDH
Air Pollution Control	VDEQ
Coastal Lands Management	VDEQ

Key: VDEQ = Virginia Department of Environmental Quality; VDGIF = Virginia Department of Game and Inland Fisheries; VDH = Virginia Department of Health; VMRC = Virginia Marine Resources Commission

The USAF has determined that the construction and operation of its instrumentation tower on Wallops Island, Virginia, may affect the land or water uses or natural resources of Virginia's Coastal Zone and must, therefore, be consistent with the enforceable policies comprising Virginia's Coastal Zone Management Program. USAF's consistency analysis follows:

Fisheries Management

The Proposed Action would not involve construction in or impacts to waterways. Therefore, no impacts to Fisheries Management are anticipated.

Subaqueous Lands Management

The Proposed Action would not involve construction in or impacts to state-owned bottomlands. Therefore, no impacts to Subaqueous Lands Management are anticipated and a permit for such impacts is not required.

Wetlands Management

The Proposed Action would have minor and temporary impacts to wetlands. The construction of guy wire anchors and access paths is expected to result in negligible short-term and negligible long-term impacts which would not exceed more than 1,300 square feet (approximately 0.03 acres) of wetlands. The U.S. Air Force would secure all necessary permits for disturbances to wetlands prior to construction.

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.

Figure 2: Alternative Tower Locations

Dunes Management

The Proposed Action would not involve construction in or impacts to dunes. Therefore, no impacts to Dunes Management are anticipated.

Non-point Source Pollution Control

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 (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 (SWP3). NASA would review 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 SWP3, and oversight from NASA would minimize impacts resulting from construction-related soil erosion and stormwater runoff.

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 project site. NASA would require the USAF's construction contractor to implement site-specific best management practices (BMPs) for vehicle and equipment fueling and maintenance, as well as spill prevention and control measures as specified in the WFF Integrated Contingency Plan (ICP). Adherence to such BMPs would ensure that the potential for inadvertent spills of petroleum products during construction activities would be eliminated or remain minimal.

In accordance with the 2014 NASA WFF *Wallops Island Phragmites Control Plan*, in order to prevent the accidental introduction of *Phragmites australis* 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 and upon exiting the project site.

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.

As a result of these actions, impacts from non-point source pollution are anticipated to be negligible.

Point Source Pollution Control

The project would not involve a new point source discharge to Virginia waters. As such, impacts from point source pollution would not occur.

Shoreline Sanitation

The Proposed Action would not involve installation or use of a septic tank. Therefore, no impacts to Shoreline Sanitation are anticipated.

Air Pollution Control

The Proposed Action would involve temporary, minor impacts to air quality as a result of construction activities. To minimize emissions of criteria pollutants and greenhouse gases 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. A 30-kilowatt propane-fired emergency generator and 500-gallon propane tank would be installed as part of the proposed action. The U.S. Air Force would secure all necessary permits for these air emission sources through the VDEQ prior to construction in order to comply with applicable Virginia and federal regulations. As such, air pollution resulting from the Proposed Action would be minimal, temporary, and transient.

Coastal Lands Management

The Proposed Action would not include land development activities that would impact the Chesapeake Bay or its tributaries. Moreover, although Accomack County has adopted the Chesapeake Bay Preservation Act restrictions for its seaside riparian areas, NASA's Wallops Island is specifically excluded from this overlay area. Therefore, no impacts to coastal lands are anticipated.

ANALYSIS

The Proposed Action would result in no or negligible impacts to seven of nine enforceable policies of the Virginia Coastal Zone Management Program. The two enforceable policies which may be subject to more than negligible impacts from the Proposed Action are Wetlands Management and Non-point Source Pollution Control. However, as described above, USAF would secure necessary permits in advance and ensure that impacts remain minor through the use of BMPs and minimization of disturbed areas.

Based upon the foregoing information, data, and analysis, USAF finds that the construction and operation of its instrumentation tower on Wallops Island, Virginia, would be consistent, to the

maximum extent practicable, with the enforceable policies of the Virginia Coastal Zone Management Program.

CONCLUSION

Pursuant to 15 CFR Section 930.41, the Virginia Coastal Zone Management Program has 60 days from the receipt of this letter in which to concur with or object to this Consistency Determination, or to request an extension under 15 CFR section 930.41(b). Virginia's concurrence will be presumed if its response is not received by the U.S. Air Force on the 60th day from receipt of this determination. The Commonwealth's response should be sent to:

Ronald J. Onderko, P.E.
U.S. Air Force Materiel Center
Wright-Patterson Air Force Base, Ohio

Email: tower.comments@aecom.com

Public Review of the Draft EA

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Notice of Availability (NOA) and Affidavits of Publication

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Eastern Shore Weather

ACCUWEATHER® FIVE-DAY FORECAST FOR ACCOMACK AND NORTHAMPTON COUNTIES

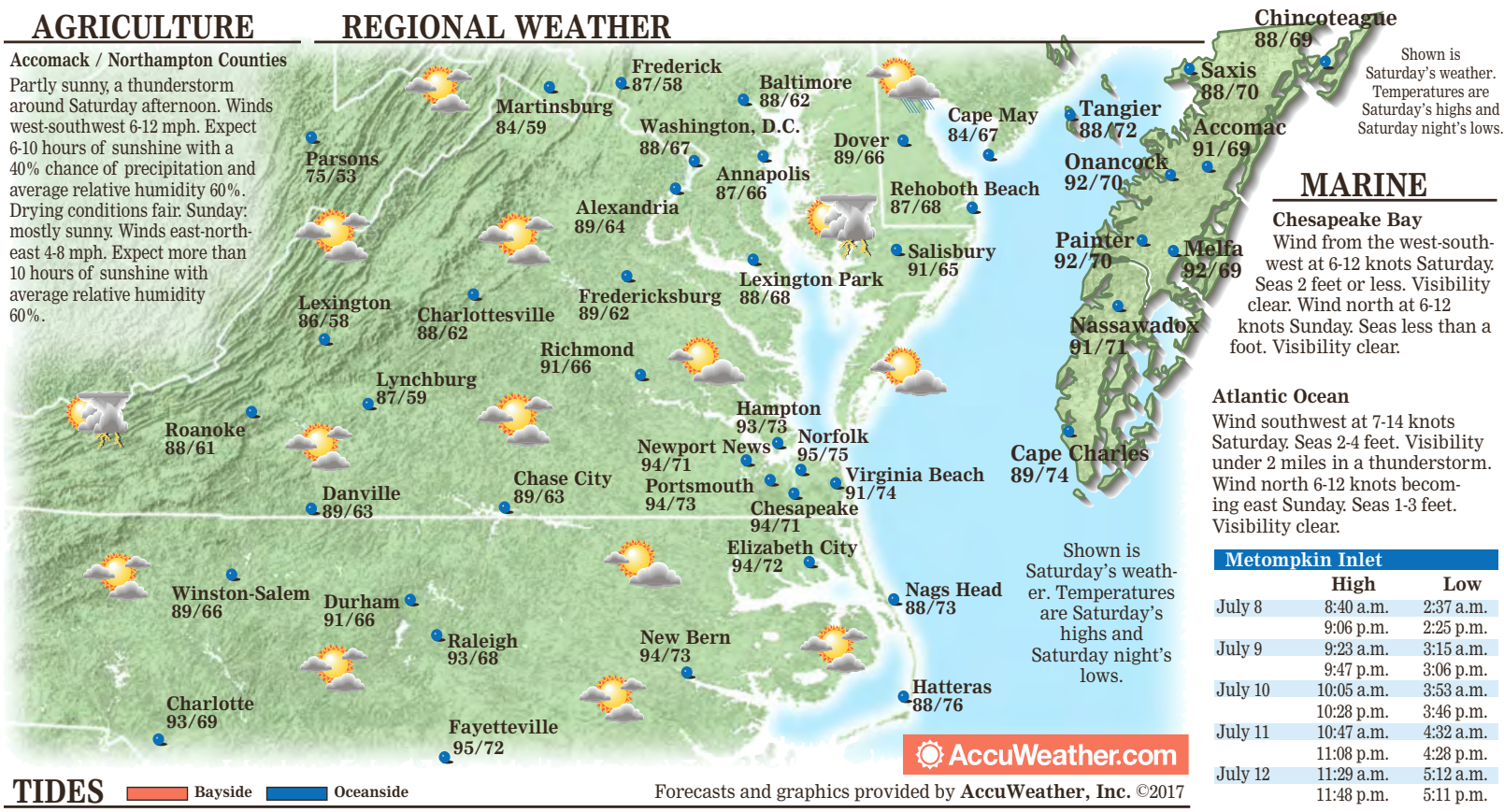
Saturday	Sunday	Monday	Tuesday	Wednesday
A thunderstorm in spots in the afternoon	Mostly sunny	Mostly sunny	Humid with clouds and sun	Mostly cloudy and humid
87-96/65-74	80-89/62-71	83-92/70-79	86-95/72-81	85-94/62-71
Wind: SW at 6-12 mph	Wind: ENE at 4-8 mph	Wind: SSW at 6-12 mph	Wind: S at 6-12 mph	Wind: NNE at 6-12 mph

AGRICULTURE

Accomack / Northampton Counties

Partly sunny, a thunderstorm around Saturday afternoon. Winds west-southwest 6-12 mph. Expect 6-10 hours of sunshine with a 40% chance of precipitation and average relative humidity 60%. Drying conditions fair. Sunday: mostly sunny. Winds east-northeast 4-8 mph. Expect more than 10 hours of sunshine with average relative humidity 60%.

REGIONAL WEATHER



Shown is Saturday's weather. Temperatures are Saturday's highs and Saturday night's lows.

Shown is Saturday's weather. Temperatures are Saturday's highs and Saturday night's lows.

Forecasts and graphics provided by **AccuWeather, Inc.** ©2017

MARINE

Chesapeake Bay

Wind from the west-southwest at 6-12 knots Saturday. Seas 2 feet or less. Visibility clear. Wind north at 6-12 knots Sunday. Seas less than a foot. Visibility clear.

Atlantic Ocean

Wind southwest at 7-14 knots Saturday. Seas 2-4 feet. Visibility under 2 miles in a thunderstorm. Wind north 6-12 knots becoming east Sunday. Seas 1-3 feet. Visibility clear.

SUN AND MOON

	Sunrise	Sunset
Saturday	5:48 a.m.	8:27 p.m.
Sunday	5:49 a.m.	8:27 p.m.
Monday	5:50 a.m.	8:26 p.m.
Tuesday	5:50 a.m.	8:26 p.m.
Wednesday	5:51 a.m.	8:25 p.m.

	Moonrise	Moonset
Saturday	8:02 p.m.	5:26 a.m.
Sunday	8:47 p.m.	6:16 a.m.
Monday	9:28 p.m.	7:10 a.m.
Tuesday	10:07 p.m.	8:06 a.m.
Wednesday	10:43 p.m.	9:04 a.m.

SOLUNAR TABLES

The solunar period schedule allows planning days so you will be fishing in good territory or hunting in good cover during those times. Major periods begin at the times shown and last for 1.5 to 2 hours. The minor periods are shorter.

	Major	Minor	Major	Minor
7/8	11:18 a	5:05 a	11:42 p	5:30 p
7/9	12:06 p	5:54 a	----	6:18 p
7/10	12:32 a	6:44 a	12:56 p	7:08 p
7/11	1:24 a	7:36 a	1:48 p	8:00 p
7/12	2:17 a	8:29 a	2:41 p	8:52 p

Full	Last	New	First
July 8	July 16	July 23	July 30

TIDES

Bayside Oceanside

Machipongo Inlet

	High	Low
July 8	8:44 a.m.	2:49 a.m.
	9:10 p.m.	2:37 p.m.
July 9	9:27 a.m.	3:27 a.m.
	9:51 p.m.	3:18 p.m.
July 10	10:09 a.m.	4:05 a.m.
	10:32 p.m.	3:58 p.m.
July 11	10:51 a.m.	4:44 a.m.
	11:12 p.m.	4:40 p.m.
July 12	11:33 a.m.	5:24 a.m.
	11:52 p.m.	5:23 p.m.

Metompkin Inlet

	High	Low
July 8	8:40 a.m.	2:37 a.m.
	9:06 p.m.	2:25 p.m.
July 9	9:23 a.m.	3:15 a.m.
	9:47 p.m.	3:06 p.m.
July 10	10:05 a.m.	3:53 a.m.
	10:28 p.m.	3:46 p.m.
July 11	10:47 a.m.	4:32 a.m.
	11:08 p.m.	4:28 p.m.
July 12	11:29 a.m.	5:12 a.m.
	11:48 p.m.	5:11 p.m.

Ship Shoal Inlet

	High	Low
July 8	8:45 a.m.	2:22 a.m.
	8:59 p.m.	2:21 p.m.
July 9	9:25 a.m.	3:04 a.m.
	9:36 p.m.	3:03 p.m.
July 10	10:04 a.m.	3:44 a.m.
	10:12 p.m.	3:44 p.m.
July 11	10:42 a.m.	4:22 a.m.
	10:49 p.m.	4:23 p.m.
July 12	11:22 a.m.	4:58 a.m.
	11:29 p.m.	5:01 p.m.

Cape Charles

	High	Low
July 8	9:22 a.m.	3:36 a.m.
	9:38 p.m.	3:26 p.m.
July 9	10:01 a.m.	4:12 a.m.
	10:14 p.m.	4:05 p.m.
July 10	10:38 a.m.	4:47 a.m.
	10:51 p.m.	4:45 p.m.
July 11	11:16 a.m.	5:23 a.m.
	11:28 p.m.	5:25 p.m.
July 12	11:55 a.m.	6:01 a.m.
	---	6:07 p.m.

Pungoteague Creek

	High	Low
July 8	11:48 a.m.	6:06 a.m.
	---	5:56 p.m.
July 9	12:04 a.m.	6:42 a.m.
	12:27 p.m.	6:35 p.m.
July 10	12:40 a.m.	7:17 a.m.
	1:04 p.m.	7:15 p.m.
July 11	1:17 a.m.	7:53 a.m.
	1:42 p.m.	7:55 p.m.
July 12	1:54 a.m.	8:31 a.m.
	2:21 p.m.	8:37 p.m.

Saxis Island

	High	Low
July 8	12:07 a.m.	7:09 a.m.
	12:29 p.m.	6:59 p.m.
July 9	12:45 a.m.	7:45 a.m.
	1:08 p.m.	7:38 p.m.
July 10	1:21 a.m.	8:20 a.m.
	1:45 p.m.	8:18 p.m.
July 11	1:58 a.m.	8:56 a.m.
	2:23 p.m.	8:58 p.m.
July 12	2:35 a.m.	9:34 a.m.
	3:02 p.m.	9:40 p.m.

Quinby Inlet

	High	Low
July 8	8:13 a.m.	2:01 a.m.
	8:27 p.m.	2:00 p.m.
July 9	8:53 a.m.	2:43 a.m.
	9:04 p.m.	2:42 p.m.
July 10	9:32 a.m.	3:23 a.m.
	9:40 p.m.	3:23 p.m.
July 11	10:10 a.m.	4:01 a.m.
	10:17 p.m.	4:02 p.m.
July 12	10:50 a.m.	4:37 a.m.
	10:57 p.m.	4:40 p.m.

Wachapreague Inlet

	High	Low
July 8	8:41 a.m.	2:47 a.m.
	9:17 p.m.	2:41 p.m.
July 9	9:27 a.m.	3:29 a.m.
	10:01 p.m.	3:23 p.m.
July 10	10:13 a.m.	4:09 a.m.
	10:43 p.m.	4:03 p.m.
July 11	10:58 a.m.	4:48 a.m.
	11:24 p.m.	4:43 p.m.
July 12	11:40 a.m.	5:26 a.m.
	---	5:25 p.m.

Wallops Island

	High	Low
July 8	7:43 a.m.	1:49 a.m.
	8:09 p.m.	1:37 p.m.
July 9	8:26 a.m.	2:27 a.m.
	8:50 p.m.	2:18 p.m.
July 10	9:08 a.m.	3:05 a.m.
	9:31 p.m.	2:58 p.m.
July 11	9:50 a.m.	3:44 a.m.
	10:11 p.m.	3:40 p.m.
July 12	10:32 a.m.	4:24 a.m.
	10:51 p.m.	4:23 p.m.

Nassawadox Creek

	High	Low
July 8	10:23 a.m.	4:20 a.m.
	10:45 p.m.	4:15 p.m.
July 9	11:02 a.m.	4:59 a.m.
	11:23 p.m.	4:55 p.m.
July 10	11:41 a.m.	5:37 a.m.
	---	5:35 p.m.
July 11	12:00 a.m.	6:15 a.m.
	12:19 p.m.	6:15 p.m.
July 12	12:38 a.m.	6:52 a.m.
	12:58 p.m.	6:56 p.m.

Onancock Creek

	High	Low
July 8	12:10 a.m.	6:52 a.m.
	12:32 p.m.	6:42 p.m.
July 9	12:48 a.m.	7:28 a.m.
	1:11 p.m.	7:21 p.m.
July 10	1:24 a.m.	8:03 a.m.
	1:48 p.m.	8:01 p.m.
July 11	2:01 a.m.	8:39 a.m.
	2:26 p.m.	8:41 p.m.
July 12	2:38 a.m.	9:17 a.m.
	3:05 p.m.	9:23 p.m.

Occohannock Creek

	High	Low
July 8	10:46 a.m.	5:35 a.m.
	11:14 p.m.	5:17 p.m.
July 9	11:26 a.m.	6:12 a.m.
	11:52 p.m.	5:53 p.m.
July 10	12:07 p.m.	6:47 a.m.
	---	6:29 p.m.
July 11	12:32 a.m.	7:20 a.m.
	12:50 p.m.	7:07 p.m.
July 12	1:12 a.m.	7:53 a.m.
	1:33 p.m.	7:49 p.m.

Hunting Creek

	High	Low
July 8	12:10 a.m.	6:49 a.m.
	12:27 p.m.	6:44 p.m.
July 9	12:49 a.m.	7:28 a.m.
	1:06 p.m.	7:24 p.m.
July 10	1:27 a.m.	8:06 a.m.
	1:45 p.m.	8:04 p.m.
July 11	2:04 a.m.	8:44 a.m.
	2:23 p.m.	8:44 p.m.
July 12	2:42 a.m.	9:21 a.m.
	3:02 p.m.	9:25 p.m.

Gargatha Neck

	High	Low
July 8	9:10 a.m.	3:20 a.m.
	9:36 p.m.	3:08 p.m.
July 9	9:53 a.m.	3:58 a.m.
	10:17 p.m.	3:49 p.m.
July 10	10:35 a.m.	4:36 a.m.
	10:58 p.m.	4:29 p.m.
July 11	11:17 a.m.	5:15 a.m.
	11:38 p.m.	5:11 p.m.
July 12	11:59 a.m.	5:55 a.m.
	---	5:54 p.m.

Chincoteague Channel

	High	Low
July 8	8:18 a.m.	2:33 a.m.
	8:44 p.m.	2:29 p.m.
July 9	9:00 a.m.	3:15 a.m.
	9:24 p.m.	3:09 p.m.
July 10	9:40 a.m.	3:55 a.m.
	10:04 p.m.	3:49 p.m.
July 11	10:21 a.m.	4:34 a.m.
	10:43 p.m.	4:28 p.m.
July 12	11:02 a.m.	5:12 a.m.
	11:24 p.m.	5:10 p.m.

Proposed Construction and Operation of Instrumentation Tower

• Draft Environmental Assessment Available

• Public Comment Period

The U.S. Air Force Materiel Command is pleased to announce the availability of a Draft Environmental Assessment (Draft EA) for the proposed construction and operation of an instrumentation tower at NASA's Wallops Flight Facility. The Draft EA evaluates the environmental effects of building, operating, and maintaining a 750-foot tall, guyed instrumentation tower on Wallops Island for a period of approximately 20 years. The U.S. Air Force is the lead agency preparing the Draft EA. NASA and the U.S. Navy are serving as cooperating agencies.

The document is available for public review at the following locations:

Chincoteague Island Library, Chincoteague, VA
Eastern Shore Public Library, Accomac, VA
Wallops Flight Facility Visitors Center, VA Rt. 175

A limited number of printed copies of the Draft EA are available by contacting:

Shari Fort
Air Force Materiel Center
Tower Project
c/o URS Corp.
12420 Milestone Center Drive, Suite 150 (4th floor - Boose)
Germantown, MD 20876
tower.comments@aecom.com

The Draft EA is also available on the internet in Adobe® portable document format (PDF) at:

https://sites.wff.nasa.gov/code250/Instrumentation_Tower_DEA.html

Comments are requested by August 14, 2017.
Comments submitted by mail should be addressed to:

Shari Fort
Air Force Materiel Center
Tower Project
c/o URS Corp.
12420 Milestone Center Drive, Suite 150 (4th floor)
Germantown, MD 20876

Comments may also be submitted via e-mail to: tower.comments@aecom.com

For additional information, please call 757-824-2958, 8 a.m. to 4:30 p.m., M-F.

MD-0000843326

The Virginia Department for the Aging will be providing coupons to seniors whose income is below **150% of the poverty level.** The coupons can be exchanged for fresh fruits and vegetables at authorized roadside stands. Eligible participants must be age 60 or over and will be able to receive $40 for individuals or $80 a couple in coupons.

The coupons will be issued upon application completion. One form of identification and household income will be requested at the time of visit. If applying for another person you will need their identification and .proof of household income. **The coupons are distributed on a first come, first served basis.**

The program will begin July 11 , 2017. Applications will be taken at the following locations on the following dates:

July 11 Antioch Baptist Church Treherneville, VA 9:00AM - 11:00AM
July 12 Accomack Head Start 9:00AM - 11:00 AM
July 13 Eastern Shore Area Agency on Aging/CAA 9:00AM - 11:00AM

For more information, call the Eastern Shore Area Agency on Aging/Community Action Agency at (757) 442-9652

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Proposed Construction and Operation of Instrumentation Tower
• Draft Environmental Assessment Available
• Public Comment Period

The U.S. Air Force Materiel Command is pleased to announce the availability of a Draft Environmental Assessment (Draft EA) for the proposed construction and operation of an instrumentation tower at NASA's Wallops Flight Facility. The Draft EA evaluates the environmental effects of building, operating, and maintaining a 750-foot tall, guyed instrumentation tower on Wallops Island for a period of approximately 20 years. The U.S. Air Force is the lead agency preparing the Draft EA. NASA and the U.S. Navy are serving as cooperating agencies.

The document is available for public review at the following locations:

Chincoteague Island Library, Chincoteague, VA
Eastern Shore Public Library, Accomac, VA
Wallops Flight Facility Visitors Center, VA Rt. 175

A limited number of printed copies of the Draft EA are available by contacting:

Shari Fort
Air Force Materiel Center
Tower Project
c/o URS Corp.
12420 Milestone Center Drive, Suite 150 (4th floor - Boose)
Germantown, MD 20876
tower.comments@aecom.com

The Draft EA is also available on the internet in Adobe® portable document format (PDF) at:

https://sites.wff.nasa.gov/code250/Instrumentation_Tower_DEA.html

Comments are requested by August 14, 2017.
Comments submitted by mail should be addressed to:

Shari Fort
Air Force Materiel Center
Tower Project
c/o URS Corp.
12420 Milestone Center Drive, Suite 150 (4th floor)
Germantown, MD 20876

Comments may also be submitted via e-mail to: tower.comments@aecom.com
For additional information, please call 757-824-2958, 8 a.m. to 4:30 p.m., M-F.

THE DAILY TIMES
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ATTN: Craig Carver
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Dear Sir:

Here is the Certification of Publication for your ad that ran
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Sincerely

Carrie Ellis, Legals Department
Legals EXT. 4621

CERTIFICATION OF PUBLICATION

We hereby certify that the annexed: 7/08/17 and 7/13/17

Was published 7/08/17 and 7/13/17 in Eastern Shore News and The Chincoteague Beacon.

Carrie Ellis

The Daily Times

AFFIDAVIT

Eastern Shore Post, Inc.
P.O. Box 517
Onley, Va. 23418

We, Eastern Shore Post, Inc., publishers of the Eastern Shore Post, a weekly newspaper published in Onley, State of Virginia, do hereby certify that the enclosed notice has been published.

Published on

July 7, 2017 (ON PAGE 5)

In the said Eastern Shore Post aforementioned.

Attest: Constance Morrison
Constance Morrison, Editor

Dated today 7/7/17

[redacted]

Phone: 757-789-7678
Fax: 757-789-7681

Angela Huether Crutchley
Notary Public
Commonwealth of Virginia
Reg. #7723549
My Commission Exps. 12/31/2021

x Angela H. C
x 7/7/2017

Public Meeting Materials (July 19, 2017)

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Instrumentation Tower on Wallops Island
Draft Environmental Assessment

FACT SHEET

The United States Air Force (USAF) proposes to install and operate a 750-foot instrumentation tower at the NASA Goddard Space Flight Center's Wallops Flight Facility (WFF) to conduct testing in collaboration with other Department of Defense services and government agencies. NASA, the Naval Air Warfare Center – Aircraft Division, and Naval Sea Systems Command (NAVSEA SCSC) are cooperating agencies in this project.

Modeled rendering of the proposed tower.

Why does the USAF need a 750-foot tower?

To support mission demands, the USAF has identified the need to develop a larger research, development, test, and evaluation (RDT&E) footprint in the Virginia Capes Range Complex. These new capabilities would minimize the usage of costly airborne and surface instrumentation systems currently in use. In addition, extending the range of communication coverage would enable aircraft to operate farther offshore, thereby minimizing the risk of crashes or other incidents over land and corresponding risks to human safety and personal property. Through preliminary analysis of 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. Mounting instrumentation at heights between 100 and 200 feet above ground level (AGL) would result in a coverage range between 17 and 23 miles, respectively, for an offshore surface target of about 6 feet in height. In contrast, mounting instrumentation as proposed on the new tower would result in coverage to approximately 41 miles offshore for a similarly-sized target. Thus, in comparison to a 100-foot tall structure, a tower of the height proposed by the USAF would enable an estimated 20 additional nautical miles of coverage when tracking aircraft at typical flight test altitudes (between 10,000 and 20,000 feet AGL).

July 2017

What is the Proposed Action?

The proposed tower would be 750 feet tall and would be a three-sided lattice structure built of galvanized steel, 42 inches wide on each side. Guy wires would be required along the tower's vertical height to provide structural support and would tie into nine anchor points on the ground. The tower would require 12 steel guy wires on each of three sides, installed along radii extending horizontally out from the tower at angles of 120 degrees from each other and anchored in three groups. The three outermost anchor points would be located approximately 590 feet out from the tower base, three intermediate anchor point will be located approximately 530 feet from the tower base, and the three innermost anchor points would be approximately 430 feet from the tower base (all measurements indicate horizontal distances). Anchor points for the guy wires would consist either of concrete slabs measuring 14 by 14 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. A conceptual rendering of the proposed tower as it would appear on the Proposed Action Alternative site is shown on the previous page. 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.

What was the process for selecting project alternatives?

The USAF developed criteria in the early stages of project planning for this Draft Environmental Assessment (Draft EA) 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.

Based on the site selection and alternatives review process, the USAF identified sixteen potential sites at Wallops Flight Facility. One of the sites was located on Mainland and the remainder were located on Wallops Island. The USAF, in coordination with NASA and NAVSEA 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 due to encroachment upon aircraft approaches and rocket launches; interference with radar systems; safety considerations; and susceptibility to storm damage. The two remaining alternative sites are located on mid-Wallops Island and were the subject of further analysis in the Draft 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 Proposed Action Alternative site is located northwest of Building X-015 and the Alternative 1 site is located northwest of Building X-079. The two alternative sites are shown on the next page.

Action Alternatives

Proposed Action Alternative Proposed Tower Footprint

Alternative 1 Proposed Tower Footprint

Proposed Action Alternative Site

Alternative 1 Site

U.S. AIR FORCE

N

0 305 610 1,220 Feet

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.

The National Environmental Policy Act

The National Environmental Policy Act (NEPA) establishes a framework for considering environmental values early in the federal decision-making process. Public involvement is an essential part of the process. Through involving the public and completing detailed environmental analysis, the NEPA process helps the decision-maker arrive at the best possible informed decision.

The USAF is seeking public input as well as any suggestions the public might have for the proposed activities addressed in the Draft EA. The USAF first identified the type and extent of impacts resulting from the proposed then collected data, conducted research, and analyzed potential impacts associated with the proposed action. The environmental analysis examined resources such as water, coastal zone management, avifauna, special-status species, and cultural resources. The degree to which these impacts might potentially affect resources were then presented in the Draft EA currently available for public viewing and comments.

Calendar

- Stakeholder Scoping Letters (February 2016 & March 2017)
- Preparation of Draft EA
- Notice of Availability of Draft EA (July 2017)
- Public Comment Period (July 9 – August 14, 2017)
- Preparation of Final EA
- Notice of Availability of Final EA (October 2017)
- FONSI/FONPA (if warranted) (October 2017)

How can you be involved?

Your involvement in the decision-making process is important to the USAF. There are several ways to submit a comment on the project:

1. Fill out a comment form at public information meeting and give to a representative
2. Website: https://sites.wff.nasa.gov/code250/Instrumentation_Tower_DEA.html
3. Comments can be mailed to the following address:

Scan this QR code to access the project webpage directly.

Ms. Shari Fort
Air Force Materiel Center
Tower Project c/o URS Corp
12420 Milestone Center Drive, Suite 150 (4th floor)
Germantown, MD 20876
E-mail: tower.comments@aecom.com

For additional information, please call 757-824-2958, 8 a.m. to 4:30 p.m., M-F.

To ensure full consideration, please provide your comments no later than August 14, 2017.

Instrumentation Tower on Wallops Island
Draft Environmental Assessment

PURPOSE AND NEED

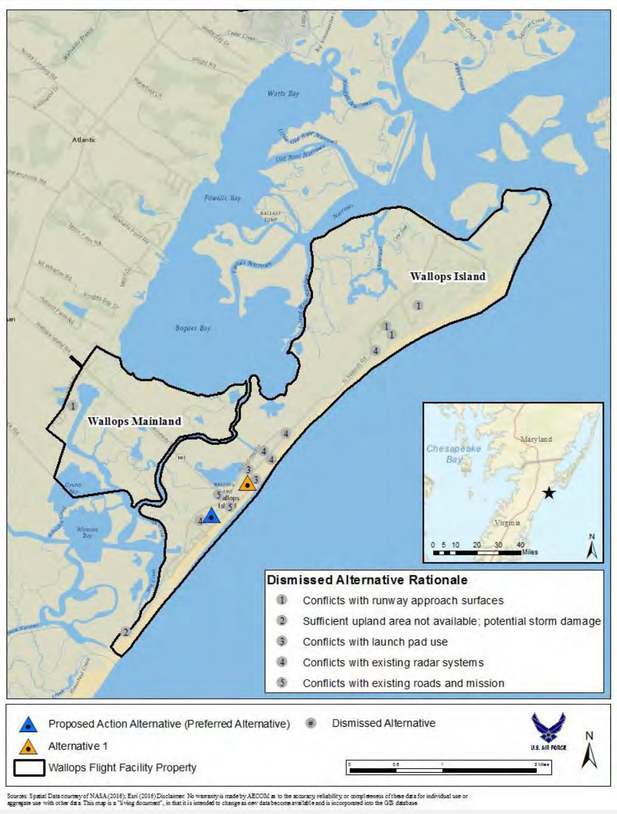
To support mission needs, the USAF has identified the need to develop a larger RDT&E footprint in the Virginia Capes Range Complex. These new capabilities would minimize the usage of costly airborne and surface instrumentation systems currently in use. In addition, extending the range of communication 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. Through preliminary analysis of 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. Mounting instrumentation at heights between 100 and 200 feet AGL would result in a coverage range between 17 and 23 miles, respectively, for an offshore surface target of about 6 feet in height. In contrast, mounting instrumentation as proposed on the new tower would result in coverage to approximately 41 miles offshore for a similarly-sized target. Thus, in comparison to a 100-foot tall structure, a tower of the height proposed by the USAF would enable an estimated 20 additional nautical miles of coverage when tracking aircraft at typical flight test altitudes (between 10,000 and 20,000 feet AGL).

PROPOSED ACTION

The proposed tower would be 750 feet tall and would be a three-sided lattice structure built of galvanized steel, 42 inches wide on each side. Guy wires would be required along the tower's vertical height to provide structural support and would tie into nine anchor points on the ground. The tower would require 12 steel guy wires on each of three sides, installed along radii extending horizontally out from the tower at angles of 120 degrees from each other and anchored in three groups. The three outermost anchor points would be located approximately 590 feet out from the tower base, three intermediate anchor point will be located approximately 530 feet from the tower base, and the three innermost anchor points would be approximately 430 feet from the tower base (all measurements indicate horizontal distances). Anchor points for the guy wires would consist either of concrete slabs measuring 14 by 14 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. A conceptual rendering of the proposed tower as it would appear on the Proposed Action Alternative site is shown on the right. 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.

ALTERNATIVES SELECTION PROCESS



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.

Based on the site selection and alternatives review process, the USAF identified sixteen potential sites at Wallops Flight Facility. One of the sites was located on Mainland and the remainder were located on Wallops Island. The USAF, in coordination with NASA and NAVSEA 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 due to encroachment upon aircraft approaches and rocket launches; interference with radar systems; safety considerations; and susceptibility to storm damage. The two remaining alternative sites are located on mid-Wallops Island and were the subject of further analysis in the Draft 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 Proposed Action Alternative site is located northwest of Building X-015 and the Alternative 1 site is located northwest of Building X-079. These and other Wallops Island sites considered, but rejected, are shown on the left.

Instrumentation Tower on Wallops Island
Draft Environmental Assessment

ENVIRONMENTAL IMPACT ANALYSIS PROCESS

The National Environmental Policy Act guides the environmental impact analysis in the Draft Environmental Assessment (EA).

Your involvement and input are essential to this process.

Calendar

- Stakeholder Scoping Letters (February 2016 & March 2017)
- Preparation of Draft EA
- Notice of Availability of Draft EA (July 2017)
- Public Comment Period (July 9 – August 14, 2017)
- Preparation of Final EA
- Notice of Availability of Final EA (October 2017)
- FONSI/FONPA (if warranted) (October 2017)

Lead Agency

United States Air Force (USAF)

Cooperating Agencies

National Aeronautics and Space Administration (NASA)

Naval Air Warfare Center – Aircraft Division (NAWCAD)

Naval Sea Systems Command (NAVSEA)

Draft Environmental Assessment

The Instrumentation Tower on Wallops Island Draft EA analyzes the potential effects of project alternatives on the following resources:

<u>Physical:</u>
Water
Coastal Zone Management
Hazardous Substances

<u>Biological:</u>
Avifauna
Special-Status Species

<u>Social:</u>
Cultural Resources
Visual Quality and Aesthetics

Cumulative effects are also analyzed, as are the various mitigation and minimization measures proposed for implementation for this project.

The Draft EA is available for review at the following locations:

- Chincoteague Island Library, Chincoteague Island, VA
- Eastern Shore Public Library, Accomac, VA
- Wallops Flight Facility Visitor Center

or online at
https://sites.wff.nasa.gov/code250/Instrumentation_Tower_DEA.html

You may also scan this QR code to access the project webpage directly

Instrumentation Tower on Wallops Island
Draft Environmental Assessment

SUMMARY OF ENVIRONMENTAL IMPACTS BY ALTERNATIVE

Resource Area	No Action	Proposed Action Alternative (Preferred Alternative): X-015 Site	Alternative 1: X-079 Site
Water Resources	No impacts.	Wetlands: negligible short-term and negligible long-term impacts would not exceed more than 1,300 square feet, or approximately 0.03 acre. Floodplains: negligible impacts.	Alternative 1 would disturb a larger area of wetlands relative to the Proposed Action Alternative (i.e., approximately 0.3 acre of temporary and 0.06 acre of permanent wetland impacts); however, short-term and long-term impacts on wetlands would remain negligible. Impacts on floodplains would be similar to the Proposed Action Alternative.
Coastal Zone Management	No impacts.	The Proposed Action Alternative would be consistent to the maximum extent practicable with the enforceable policies of Virginia's Coastal Zone Management (CZM) Program. The USAF has submitted a Federal Consistency Determination to VDEQ for review. Concurrence with this determination by VDEQ is pending.	Similar to the Proposed Action Alternative.
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 Proposed Action Alternative site.	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. Impacts from the use of hazardous substances and generation of hazardous waste during the construction and operation of the proposed tower would be similar to those described for the Proposed Action Alternative.
Avifauna (common bird species)	No impacts.	Low to moderate adverse effects on avifauna based on implementation of the following measures: - collocation of equipment on the proposed tower; - coordination with USFWS to develop an avian mitigation and monitoring plan; - constructing the tower at a previously developed area near similar types of vertical structures; - incorporating bird diverters placed every 30 feet along the inner and outer most guys; - minimizing tower lighting to ensure it meets FAA requirements in FAA AC 70/7460-1L for type G3 towers (i.e., a 700- to 1,050-foot structure with a less than 40-foot appurtenance), but also remains as bird-friendly as possible; and - using down-shielded and motion-activated lighting on support facilities associated with the proposed tower to minimize impacts on wildlife in the vicinity of the proposed tower.	Impacts would be similar to those described for the Proposed Action Alternative.
Special-Status Species	No impacts.	In correspondence dated April 11, 2017, the USFWS concurred with the USAF's determination that the Proposed Action Alternative may affect, but is not likely to adversely affect, red knots, piping plovers, and northern long-eared bats at Wallops Island. The Proposed Action Alternative would have no potential to affect any other special-status terrestrial or marine species.	Impacts would be similar to those described for the Proposed Action Alternative.
Cultural Resources	No impacts.	No adverse effects on historic properties listed or eligible for listing in the National Register of Historic Places (NRHP). Concurrence by the Virginia Department of Historic Resources (VDHR) is pending.	Impacts would be similar to those described for the Proposed Action 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 Proposed Action Alternative.
Cumulative Effects	No impacts.	Would not result in cumulatively significant impacts when considered along with relevant past, present, and reasonably foreseeable future projects at WFF.	Would not result in cumulatively significant impacts when considered along with relevant past, present, and reasonably foreseeable future projects at WFF.

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Table A-1: Summary of Comments on the Draft EA Received during the 30-day Public Review Period

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Table A-1: Summary of Comments Received During the 30-day Draft EA Public Review Period

Comment No.[1]	Agency / Organization	Comment	USAF Response	Final EA text revised based on comment? (Yes/No)
1	Virginia Dept. of Health, Office of Drinking Water	There are no apparent impacts to public drinking water sources due to this project. Potential impacts to public water distribution systems or sanitary sewage collection systems must be verified by the local utility.	Comment noted. Utility locations would be identified prior to construction of the proposed project. The proposed project would not require the creation of new wells or increase withdrawals from existing wells. The proposed project would not create a new source of potable water usage or sewage generation.	**No**
2	Virginia Marine Resources Commission	The Preferred Alternative and Alternative 1 would not fall within the Commission's jurisdiction. No authorization would be required from the Marine Resources Commission.	Comment noted.	**No**
3	Private Citizen (1 signatory)	Important to maintain clean air space for migrating birds. No the tower [sic].	As described in the Final EA (see **Section 2.1.1**), the proposed tower would incorporate a number of mitigation measures to minimize impacts to birds, including migratory birds. The USAF would conduct monitoring of bird collisions and adjust mitigation measures (i.e., adaptive management approach) accordingly based on the species and numbers of birds impacted by the proposed tower.	**No**

Table A-1: Summary of Comments Received During the 30-day Draft EA Public Review Period

Comment No.[1]	Agency / Organization	Comment	USAF Response	Final EA text revised based on comment? (Yes/No)
4	USEPA[2]	(Draft EA p. 2-6) It is assumed that 11 feet AMSL is appropriate for protection of the generator and fuel tank in the event of flooding. It would be helpful in the documentation to state if the plan is following guidelines from FEMA or the source of modeling used to confirm the proposed elevation appropriate for protection. Will there be challenges or risks when needed to fill the fuel tank? Are there guidance/contingency plans in place for this specific action or do the plans need to be altered to address this action (filling raised tanks)? Will the elevated platforms be built to withstand flooding and future climate scenarios? It would be helpful if the documentation discussed any modeling or analysis to evaluate future climate scenarios and weather events. Describe how those scenarios may impact the project and its design. Any assessment done to identify climate trends and sustainable design should be discussed in the Final EA. USEPA recommends considering climate adaptation measures based on how future climate scenarios may impact the project.	The USAF's basis for establishing the 11 feet AMSL level is clarified in the Final EA (see **Section 2.2**). Text describing the USAF procedures for filling and maintaining the elevated tank has been added to the Final EA (see **Section 3.1.3.3**). Text regarding the engineering of the proposed tower platform to resist flooding-induced forces has been added to the Final EA (see **Section 2.2**).	**Yes**
5	USEPA	(Draft EA p. 3-5) Would...floodplain encroachment need to be evaluated and coordinated with the Federal Emergency Management Agency (FEMA)? Please consider, discuss and address in the Final EA.	No comments on the Draft EA were received from FEMA during the public review period. The USAF has prepared a Finding of No Practicable Alternative (FONPA) addressing construction in, and impacts on, the 100-year floodplain prior to building and operating the proposed tower. A copy of the signed FONPA is included in the Final EA.	**No**

Table A-1: Summary of Comments Received During the 30-day Draft EA Public Review Period

Comment No.[1]	Agency / Organization	Comment	USAF Response	Final EA text revised based on comment? (Yes/No)
6	USEPA	(Draft EA p. 2-6) It is assumed that the piling depth of 75 feet is needed to support the height of the tower (750 feet). Have there already been borings to determine that the 75 feet depth can be met? Is there a boring log that can be included in the Final EA?	The proposed piling depth is based on the findings of a site-specific geotechnical study prepared in support of the Proposed Action; this geotechnical study is cited in the EA (see **Section 2.2**). Borings were conducted during the preparation of the geotechnical study; however, the inclusion of the boring logs is not appropriate or necessary for this NEPA document (i.e., the EA). The results of the geotechnical study, which determined the proposed 75-foot depth could be met, would be used during the design and engineering phases of the proposed tower.	**No**
7	USEPA	(Draft EA p. 3-8) What is the size of the concrete slab for the tower? How many pilings will be necessary to support the tower and each of the anchor points? Will the pilings impact submerged aquatic resources? If so, please identify and estimate the impact. In addition, please discuss if the pilings will affect hydrology.	As noted in **Section 3.1.1.3**, the USAF would obtain permits from applicable regulatory agencies prior to construction to address impacts on wetlands and appropriate mitigation requirements, including impacts from the proposed slab and anchor points. Adherence to avoidance, compensation, and/or mitigation measures specified in applicable Federal and/or state permit(s) during and following the proposed project's construction phase would ensure that impacts on wetlands, including submerged aquatic resources, would remain minimal. No impacts to submerged aquatic resources are anticipated. A brief description of the proposed slab supporting tower is included in the Final EA (see **Section 2.2**). The number of pilings required has not been determined at this stage of planning. A description of the minimal effects that the proposed tower, including the proposed slab and pilings, would have on hydrology was added to the Final EA in **Section 3.1.1.3**.	**Yes**
8	USEPA	(Draft EA p. 3-8) Please include the Finding of No Practical Alternative in the Final EA.	The Final FONPA is included in the Final EA.	**No**

Table A-1: Summary of Comments Received During the 30-day Draft EA Public Review Period

Comment No.[1]	Agency / Organization	Comment	USAF Response	Final EA text revised based on comment? (Yes/No)
9	USEPA	(Draft EA p. 2-7, Figure 2-3) Please describe the function of Building X-015... and describe and discuss potential human health impacts, if relevant.	A brief discussion of the current and future use of Building X-015, as well as potential impacts on the facility from the proposed project, is included in the Final EA in **Section 2.1.1.3** and **Table 3-1.**	**Yes**
10	USEPA	(Draft EA p. 3-11) Is it possible that MECs can be uncovered in the area proposed for the tower? ls there a contingency plan in place if MECs are discovered in the area of tower construction? Is there a possible risk to workers? Please cite worker safety plans and contingency plans in the event of discovery of MEC and/or contamination, etc.	Text within the Final EA has been revised to describe the procedures that USAF's contractor would follow in the event that undocumented MECs are encountered during construction of the proposed tower (see **Section 3.1.3.3**).	**Yes**
11	USEPA	(Draft EA p. 3-44) The sensitivity to relocating the telemetry dish to areas of similar infrastructure is appreciated. It is hoped that there is no viewshed impact to the several eligible and recommended eligible NRHP sites on WFF. Although this may have been assumed, stating this in the Final EA (FEA) would be beneficial.	Text within the Final EA has been revised to identify that there would be no viewshed impacts on eligible and/or recommended eligible NRHP properties on WFF from the proposed relocation of the telemetry dish (see **Section 3.3.1.3**).	**Yes**

Table A-1: Summary of Comments Received During the 30-day Draft EA Public Review Period

Comment No.[1]	Agency / Organization	Comment	USAF Response	Final EA text revised based on comment? (Yes/No)
12	USEPA	(Draft EA p. A-63) [C]ould there be a more pronounced visual impact [from the proposed tower on properties evaluated in the Phase II cultural resources survey] once the leaves drop from the trees in the fall and winter? ls this a concern for the residences? Has there been public outreach to the eight residents whose properties are Recommended NRHP and VLR Eligible? Please address in the Final EA.	Due to the density and depth of existing vegetation/ forested areas, there would not be a more pronounced visual effect once the leaves drop from the trees in the fall and winter (Note: the first cultural resources survey was conducted in February 2016, during the leaf-off period). In addition, the referenced eight residences face away from the proposed tower, further minimizing any potential effects. This should not be a concern for the residents. No public outreach was conducted for the residents of the historic properties recommended NRHP and VLR eligible as part of the Phase II Cultural Resources Analysis; however, the public has been provided with three opportunities to provide comments on the Proposed Action during the preparation of the EA (i.e., February 2016 and March 2017 scoping periods, and the 30-day Draft EA public review period conducted July-August 2017). Consultation between the USAF and VDHR (SHPO) with regard to the proposed project is ongoing; concurrence, concerns, and/or other information provided by VDHR as part of the NHPA Section 106 consultation process is addressed accordingly in the Final EA (see **Section 3.3.1**).	**No**

Table A-1: Summary of Comments Received During the 30-day Draft EA Public Review Period

Comment No.[1]	Agency / Organization	Comment	USAF Response	Final EA text revised based on comment? (Yes/No)
13	The Nature Conservancy (TNC)[2]	[TNC] has significant concerns about the adverse impacts on migratory birds and bats that the proposed instrumentation tower, as described in the draft EA, will have. [TNC does] not agree that there is enough evidence to conclude that the project will have "low to moderate adverse effects" on avifauna. Furthermore, we believe that given the unique location of Wallops Island in the Atlantic Flyway and its ecological importance to migratory birds and bats, this is not an appropriate location for the proposed instrumentation tower.	The USAF conducted an extensive site selection process for the proposed tower, which is documented in the EA (see **Section 2**). No sites outside of WFF met the USAF's requirements and thus, did not meet the purpose of or need for the Proposed Action. The USAF would incorporate a number of mitigation measures into the design and construction of the proposed tower to minimize impacts on avian species. Monitoring would be conducted during the tower's operational phase to record the number and species/taxa of birds colliding with the tower. Mitigation measures would then be adjusted as necessary (i.e., adaptive management approach) to minimize impacts on birds to the extent possible.	**No**
14	TNC	[TNC does] not agree with [the conclusion of low to moderate adverse effects on avifauna] based on the study by Paxton and Wilson (2015), which suggests that there are several species in the region with a high risk of collision and medium to high risk of experiencing population level impacts. The study also highlights the lack of information required to carry out a full assessment on expected bird mortality rate caused by the proposed project. We do not believe this assessment translates to a low to moderate risk for the avifauna of the region.	The conclusion of low to moderate adverse effects is based on the review of existing data, studies, and other information. It is not possible to predict with certainty what impacts the proposed tower would have on birds, as no similar towers exist in the vicinity of WFF. As noted in the EA, the design of the tower would incorporate mitigation measures to minimize impacts on birds to the extent possible, and these measures would be adjusted as necessary based on information gathered during the post-construction monitoring of bird collisions.	**No**

Table A-1: Summary of Comments Received During the 30-day Draft EA Public Review Period

Comment No.[1]	Agency / Organization	Comment	USAF Response	Final EA text revised based on comment? (Yes/No)
15	TNC	[TNC is] concerned about several project design characteristics that will increase the chance of adverse impacts to migratory birds and bats: a. the tower's height of750 feet; a significant decrease in mortality is associated with reduced tower height; b. 12 steel guy wires on each of 3 sides; guyed towers cause higher mortality than non-guyed towers; c. required lighting; tall, guyed towers lit with steady-burning lights have the highest fatality rates. Fewer bird fatalities have been documented at towers equipped with only red or white flashing lights as compared to towers with nonflashing, steady-burning lights. d. proximity to the coast; towers taller than 450 feet are generally recommended to be sited away from coastal zones, bird staging areas, colonial nesting sites, and Western Hemisphere Shorebird Reserve Network sites. The EA proposes some mitigating design features, such as flight diverters and blinking lights. We consider these steps to be important and necessary, but they would not ultimately alter the fundamental project characteristics that we are concerned about.	As noted in the Draft EA, the height and location of the proposed tower are based on the USAF's mission requirements (see **Sections 1.3, 1.4, and 2.1**). A shorter tower and/or a tower in a location other than WFF would fail to meet the purpose of and need for the Proposed Action. Lighting would be limited to the minimum amount required by the Federal Aviation Administration (FAA) for a tower of the size and configuration of the proposed USAF tower. The tower would include six L-864 type medium intensity red beacons operating at 20 to 40 flashes per minute (fpm) for nighttime lighting and nine L-856 type high intensity white beacons operating at 40 fpm for day time lighting in accordance with FAA requirements. No steady-burning lights are proposed for the tower's lighting scheme. As noted in Responses to Comments 13 and 14, the USAF would conduct post-construction monitoring of bird collisions at the proposed tower and would adjust mitigation measures as necessary.	**No**
16	TNC	No viable location alternative is proposed to reduce adverse effects. In fact, the proposed location and alternative are both located on Wallops Island, within the Atlantic Flyway, an ecologically important area, and are separated by only 2,300 feet, which means adverse effects will be identical in both cases.	The extensive site selection process undertaken by the USAF to identify a suitable site for the proposed tower is documented in the Draft EA (see **Section 2.1**). No other alternative sites would meet USAF's requirements or satisfy the purpose and need for the Proposed Action. The two sites meeting the USAF's requirements were those on Wallops Island and analyzed in the Draft EA.	**No**

Table A-1: Summary of Comments Received During the 30-day Draft EA Public Review Period

Comment No.[1]	Agency / Organization	Comment	USAF Response	Final EA text revised based on comment? (Yes/No)
17	TNC	The draft EA presents a site-specific assessment of the impacts a single tower would cause at the proposed location. However, the potential population level impacts of such structures could occur over a much broader geographic area and these cumulative impacts must be considered when siting such projects and have not been considered in the draft EA.	The presence of other towers within a 10-mile radius of Wallops Island is identified and considered in the cumulative effects analysis presented in the Draft EA (see **Section 3.4**). The impacts of those towers on birds have not been documented. However, as all of those other towers are less than 500 feet in height and many are less than 200 feet in height, it can be reasonably concluded that the impacts of those towers on birds is less than significant, as non-guyed towers less than 500 feet in height have been found to pose a notably lower collision risk than guyed towers taller than 500 feet (Gehring et al. 2011). The proposed tower, including implementation of identified mitigation measures by the USAF, would not result in significant impacts to birds. Thus, the cumulative effect of the proposed tower on birds, when considered in conjunction with the effects of the existing towers, was concluded to be less than significant. This conclusion is supported by the USFWS' concurrence that the proposed tower would be "not likely to adversely affect" Federal-listed bird species. Please refer to the revised Cumulative Effects Analysis presented in **Section 3.4** of the Final EA.	**Yes**
18	TNC	The draft EA contains a Monitoring and Mitigation plan calling for a minimum of two complete field seasons post-construction, between March 15 and November 15, to document the extent of avian mortality. We consider this plan to be inadequate in that it is short-term and limits the sampling season, which should, instead occur year-round, to also account for winter mortality.	[Final response pending based on further USAF/NASA discussions.]	**TBD**

Table A-1: Summary of Comments Received During the 30-day Draft EA Public Review Period

Comment No.[1]	Agency / Organization	Comment	USAF Response	Final EA text revised based on comment? (Yes/No)
19	TNC	The draft EA does not provide a contingency plan containing specifications on possible measures to adopt in case, after construction, the tower is found to cause serious adverse effects.	The Avifauna and Protected Avian Species Monitoring and Mitigation Plan will incorporate the principles of adaptive management to continually evaluate the effectiveness of monitoring and mitigation methods and revise those mitigation methods as determined necessary, depending upon the monitoring results. The Avifauna and Protected Avian Species Monitoring and Mitigation Plan s presented in **Appendix C** of the Final EA.	**No**
20	National Oceanic and Atmospheric Administration (NOAA) / National Environmental Satellite, Data, and Information Service (NESDIS)	The [proposed] 750-foot tower can potentially generate Radio Frequency Interference (RFI) and Electromagnetic Interference (EMI), which will impact the satellite communications and potentially impact sensitive satellite ground station electronics. The same may be true for the Air Force's [proposed] instrumentation suite.	The proposed tower would not change the established WFF frequency management process. With regard to frequency management, the WFF Test Director and the Wallops Spectrum Manager are responsible for the operational control of the radio frequency (RF) spectrum at WFF. These personnel perform their frequency management duties in close coordination with NASA's tenants and partners, including NOAA and the U.S. Navy. Frequency utilization and management policies and procedures applicable to all range user activities at WFF are detailed in the *Wallops Flight Facility Frequency Utilization Management Handbook* (NASA 2004). Prior to the implementation of the proposed project, the WFF Test Director and the Wallops Spectrum Manager would review the construction and operation of the proposed tower and the equipment that would be installed on it, and coordinate with WFF mission partners, including the U.S. Navy and NOAA, to ensure that the proposed tower's operation would not interfere with existing equipment operating at and in the vicinity of WFF. Please refer to **Section 2.2** of the Final EA where this information has been added.	**Yes**
21	NOAA / NESDIS	[The] draft Environmental Assessment does not address any impact the 750' tower or its extensive steel guy wire infrastructure, may or may not have, on existing Radio Frequency (RF) environment at Wallops. The lack of an RF impact study is a serious omission and needs to be addressed before consideration can be given to accepting this location for tower construction and operation. Any attenuation, reflection or interference of the radiated transmissions by this proposed tower will degrade NOAA's ability to meet mission objectives for providing satellite imagery to generate forecasts and warnings that protect life and property.		**Yes**

Table A-1: Summary of Comments Received During the 30-day Draft EA Public Review Period

Comment No.[1]	Agency / Organization	Comment	USAF Response	Final EA text revised based on comment? (Yes/No)
22	NOAA / NESDIS	NESDIS has serious concerns regarding the Air Force's draft Environmental Assessment on the proposed construction and operation of an instrumentation tower on Wallops Island without adequate consideration of the Wallops Command and Data Acquisition Station (WCDAS) RF Spectrum impacts. The assessment must include consideration for potential RFI and EMI ofNOAA/NESDIS equipment.		**Yes**
23	Private Citizens (6 signatories)	We are concerned with high-powered lighting on the structure. We do not need to be blasted with any more light pollution on Accomack County's Seaside. White Strobes during the day are probably necessary, however, less powerful red lighting should be used at night.	As noted in the Draft EA (see **Section 2.2**), lighting would be limited to the minimum amount required by the Federal Aviation Administration (FAA) for a tower of the size and configuration of the proposed USAF tower. The tower would include six L-864 type medium intensity red beacons operating at 20 to 40 flashes per minute (fpm) for nighttime lighting and nine L-856 type high intensity white beacons operating at 40 fpm for day time lighting in accordance with FAA requirements. While this lighting would be visible from a distance, based on the height of the proposed tower and as intended to warn approaching pilots, it is anticipated that such lighting would not generate an increased or noticeable amount of illumination that would cause annoyance to nearby residents.	**No**

Notes:
1. Comments are listed in the table in the order they were received during the 30-day Draft EA public review period.
2. Comments from this agency or organization were provided in a single letter, but are presented as multiple entries for the purpose of clarity.

Correspondence Received during the 30-day Draft EA Public Review Period

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[redacted]

From: Warren, Arlene (VDH) [redacted]
Sent: Tuesday, July 11, 2017 11:51 AM
To: AMER-US-MD Germantown-Tower Comments
Subject: RE: Notice of Availability on Draft Environmental Assessment: Instrumentation Tower at Wallops

Project Name: Draft Environmental Assessment: Instrumentation Tower at Wallops
Project #: N/A
UPC #: N/A
Location: Accomack Co.

VDH – Office of Drinking Water has reviewed the above project. Below are our comments as they relate to proximity to **public drinking water sources** (groundwater wells, springs and surface water intakes). Potential impacts to public water distribution systems or sanitary sewage collection systems **must be verified by the local utility.**

There are no public groundwater wells within a 1 mile radius of the project site.

There are no surface water intakes located within a 5 mile radius of the project site.

The project is not within the watershed of any public surface water intakes.

There are no apparent impacts to public drinking water sources due to this project.

Best Regards,

Arlene Fields Warren
[redacted]
Office of Drinking Water
Virginia Department of Health
[redacted]
Richmond, VA 23220
[redacted]

The Virginia Department of Health – Office of Drinking Water appreciates the opportunity to provide comments. If you have any questions, please let me know.

From: WFF-Information [mailto:wff-information@mail.nasa.gov]
Sent: Thursday, July 06, 2017 9:52 AM
Subject: Notice of Availability on Draft Environmental Assessment: Instrumentation Tower at Wallops

Sent on behalf of the U.S. Air Force

Notice of Availability on Draft Environmental Assessment for the Proposed Construction and Operation of an Instrumentation Tower on Wallops Island, VA

In accordance with the National Environmental Policy Act of 1969 (NEPA), as amended, the United States Air Force (USAF) is announcing the availability for public review and comment on a draft Environmental Assessment (EA) that

analyzes the potential impacts associated with the proposed construction and operation of a 750-foot-tall instrumentation tower on Wallops Island in Accomack County, Virginia (proposed action). The draft EA includes the draft finding of No Significant Impact (FONSI)/Finding of No Practicable Alternative (FONPA) and draft mitigation and monitoring plan (MMP).

The documents may be downloaded from the following website:
https://sites.wff.nasa.gov/code250/Instrumentation_Tower_DEA.html

Hard copies are also available at the Eastern Shore Public Library, Accomac, Virginia; Chincoteague Island Library, Chincoteague, Virginia; and the NASA WFF Visitors Center, Wallops Island, Virginia.

The public comment period opened July 5, 2017; the USAF respectfully requests comments be submitted by August 14, 2017. Please e-mail responses/inquiries to tower.comments@aecom.com or mail to the following address:

Tower Project
c/o URS Corporation
[redacted]
12420 Milestone Center Drive, Suite 150 (4th Floor)
Germantown, MD 20876

Additionally, NASA Wallops is holding its next quarterly Public Information Session from 5 to 7 p.m., Wednesday, July 19, at the Wallops Visitors Center. The tower project will be among the programs/topics presented during the poster-style information session. The Wallops Visitors Center is located on Virginia Route 175 about six miles from U.S. Route 13 and five miles from Chincoteague.

[redacted]

July 14, 2017

Tower Project
c/o URS Corporation
[redacted]
12420 Milestone Center Drive
Suite 150 (4th Floor)
Germantown, Maryland 20876

Re: USAF Wallops Island, Tower

Dear Mr. Boose:

You have inquired regarding the construction of a 750-foot-tall instrumentation tower on Wallops Island in Accomack County, Virginia.

The Marine Resources Commission requires a permit for any activities that encroach upon or over, or take use of materials from the beds of the bays, ocean, rivers and streams, or creeks which are the property of the Commonwealth.

Based upon my review of the "Draft Environmental Assessment" it appears that the Preferred Alternative and Alternative 1 will not fall within the Commission's jurisdiction, therefore, no authorization would be required from the Marine Resources Commission. If, however any portion of your proposed project encroaches channelward of mean low water a permit may be required.

If I may be of further assistance, please do not hesitate to contact me at [redacted].

Sincerely,

George H. Badger, III
Environmental Engineer

[redacted]

[redacted]

From: Patricia Wolf [redacted]
Sent: Saturday, July 15, 2017 9:15 AM
To: AMER-US-MD Germantown-Tower Comments
Subject: no to the tower

Important to maintain clean air space for migrating birds. No the tower. Patty Wolf

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION III
[redacted]
Philadelphia, Pennsylvania 19103-2029

August 2, 2017

[redacted]
Air Force Materiel Center
Tower Project
c/o URS Corps.
12420 Milestone Center Drive, Suite 150 [redacted]
Germantown, Maryland 20876

Re: Construction and Operation of an Instrumentation Tower at Wallops Island, Virginia, Draft Environmental Assessment

Dear [redacted]

In accordance with the National Environmental Policy Act (NEPA) of 1969, Section 309 of the Clean Air Act and the Council on Environmental Quality (CEQ) regulations implementing NEPA (40 CFR 1500-1508), the U.S. Environmental Protection Agency has reviewed the Draft Environmental Assessment (DEA) for the Construction and Operation of an Instrumentation Tower at Wallops Island in Virginia. The DEA has been prepared by the United States Air Force (USAF), Department of Defense (DoD).

The purpose of the Proposed Action is to enhance current 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 area, allowing for refined communications infrastructure. 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.

Under the Proposed Action, the USAF would build, operate, and maintain a 750-foot tall, guyed tower on approximately 40-acre site on Wallops Island. All structural components of the tower would be piled-supported (to a depth of at least 75 feet). 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. A 30-kilowatt propane-fueled generator and associated 500-gllon above-ground fuel tank would be installed near the prefabricated structures to provide electricity in the event of power outages. In addition, the Proposed Action would include the relocation of an existing NASA telemetry dish to the Mainland or Wallops Island.

Printed on 100% recycled/recyclable paper with 100% post-consumer fiber and process chlorine free.
[redacted]

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. Based on the site selection criteria and alternative review process, the USAF identified two alternatives sites location on mid-Wallops Island for further analysis in the DEA. They are: Proposed Action Alternative (Preferred Alternative) Building X-015 Site and Alternative 1: Building X-079 Site.

As a result of our review of the DEA, EPA developed comments and questions presented in the enclosed Technical Comments document for your consideration. Comments and questions are specific to aquatic resources/floodplains/climate change, human health, hazardous substances, and cultural resources. Thank you for the opportunity to review this project. If you have questions regarding these comments, the staff contact for this project is Karen DelGrosso; she can be reached at [redacted] or [redacted]

Sincerely,

Barbara Rudnick
NEPA Team Leader
Office of Environmental Programs

Enclosure (1)

Technical Comments
Construction and Operation of an Instrumentation Tower at Wallows Island, Virginia

Aquatic Resources/Floodplains/Resiliency

Page 2-6 states, "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)." It is assumed that 11 feet AMSL is appropriate for protection of the generator and fuel tank in the event of flooding. It would be helpful in the documentation to state if the plan is following guidelines from FEMA or the source of modelling used to confirm the proposed elevation appropriate for protection. Will there be challenges or risks when needed to fill the fuel tank? Are there guidance/contingency plans in place for this specific action or do the plans need to be altered to address this action (filling raised tanks)?

Will the elevated platforms be built to withstand flooding and future climate scenarios? It would be helpful if the documentation discussed any modeling or analysis to evaluate future climate scenarios and weather events. Describe how those scenarios may impact the project and its design. Any assessment done to identify climate trends and sustainable design should be discussed in the Final EA. EPA recommends considering climate adaptation measures based on how future climate scenarios may impact the project.

Page 3-5 states, "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)." Would this type of floodplain encroachment need to be evaluated and coordinated with the Federal Emergency Management Agency (FEMA)? Please consider, discuss and address in the Final EA.

Page 2-6 states, "All structural components of the tower would be pile-supported, as necessitated by underlying geologic conditions (i.e., silty materials 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)." It is assumed that the piling depth of 75 feet is needed to support the height of the tower (750 feet). Have there already been borings to determine that the 75 feet depth can be met? Is there a boring log that can be included in the Final EA?

Page 3-8 states, "As currently designed, each of the concrete 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 1,764 square feet." What is the size of the concrete slab for the tower? How many pilings will be necessary to support the tower and each of the anchor points? Will the pilings impact submerged aquatic resources? If so, please identify and estimate the impact. In addition, please discuss if the pilings will affect hydrology.

Page 3-8 states, "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." Please include the Finding of No Practical Alternative in the Final EA.

Human Health

Page 2-7, Figure 2-3 provides a conceptual rendering of the Proposed Tower on the Proposed Action Alternative Site (Preferred Alternative) near Building X-015. Please describe the function of Building X-015. It would be helpful to state if people would be utilizing the building on a daily basis; or if it is a storage building. Is there a risk to human health as a result of the proximity of the tower to the building and the two prefabricated structures that would be installed near the base of the tower to house equipment/fuel? If people occupy this building or any other building nearby (Building X-35, etc.), is there an exposure impact of electromagnetic fields from the tower? Please describe and discuss potential human health impacts, if relevant.

Hazardous Substances

Page 3-11 states, "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 permit/excavation request process has been instituted for any activities that would disturb the soil of the backfill area and immediate surrounding areas."

EPA appreciates that a dig permit/excavation request process would be instituted for activities that would disturb the soil of the backfill area and immediate surrounding areas. Is it possible that MECs can be uncovered in the area proposed for the tower? Is there a contingency plan in place if MECs are discovered in the area of tower construction? In addition, the proposed action would involve digging 75-feet for pilings and since previous excavation was only two feet below ground surface and no soil contaminant testing specific to munitions has reportedly been conducted, is there a possible risk to workers? Please site worker safety plans and contingency plans in the event of discovery of MEC and/or contamination, etc.

Cultural Resources

As noted throughout the DEA and in particular on page 3-44, it states, "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 Mainland or Wallops Island. Its appearance would be consistent with other facilities and equipment that support the missions of WFF and its tenants." The sensitivity to relocating the telemetry dish to areas of similar infrastructure is appreciated. It is hoped that there is no viewshed impact to the several eligible and recommended eligible NRHP sites on WFF. Although this may have been assumed, stating this in the Final EA (FEA) would be beneficial.

As noted in Appendix A (page A-63) within the Wallops Island Tower, Cultural Resources Analysis – Phase II, Management Summary (Draft), June 2017; it states: "Based on the findings from both surveys, the line of sight to the alternative sites is blocked by the overgrowth of vegetation from the eight architectural resources' southwest property lines. Therefore, the undertaking will have No Adverse Effect on the potential NRHP eligible historic district. Additionally, URS does not recommend further inspection of the potential historic district at the intensive level, as the research conducted during this survey was exhaustive and did not yield any undiscovered significant aspects of Virginia's maritime

history for the time period or region." EPA appreciates and respects the evaluation provided. However, could there be a more pronounced visual impact once the leaves drop from the trees in the fall and winter? Is this a concern for the residences? Has there been public outreach to the eight residents whose properties are Recommended NRHP and VLR Eligible? Please address in the Final EA.

The Nature Conservancy
Protecting nature. Preserving life.

The Nature Conservancy in Virginia
Virginia Coast Reserve
[redacted]
Nassawadox, VA 23413

[redacted]
nature.org

August 8, 2017

Tower Project
c/o URS Corporation
[redacted]
12420 Milestone Center Drive, Suite 150 [redacted]
Germantown, MD 20876

RE: Draft Environmental Assessment - Construction and Operation of an Instrumentation Tower at Wallops Island, Virginia

Dear [redacted],

Thank you for this opportunity to provide comments to the U.S. Air Force and NASA Goddard Space Flight Center's Wallops Flight Facility (NASA-WFF) regarding the Draft Environmental Assessment (EA) carried out for the construction and operation of an instrumentation tower at Wallops Island, Virginia.

The Nature Conservancy (the Conservancy) is a non-profit organization with a mission to conserve the lands and waters on which all life depends. For over four decades, the Conservancy has worked with state, federal and local partners on Virginia's Eastern Shore to conserve a 134,000-acre network of protected lands called the Virginia Coast Reserve (VCR). The Conservancy owns and manages all or part of 14 of Virginia's barrier islands including more than 40 miles of Virginia's Atlantic shoreline. The primary reason that the Conservancy has so deeply invested in this area is its location along the Atlantic Flyway, a critically important migration corridor in North America used year-round by heavy concentrations of a wide range of bird species, including waterfowl, shorebirds, raptors and neotropical land birds. In recognition of this uniquely protected stretch of Atlantic Coast wilderness and its significance for birds, VCR has been designated a United Nations International Man and the Biosphere Reserve, a U.S. Department of the Interior National Natural Landmark, a National Science Foundation Long-Term Ecological Research Site, an Audubon Global Important Bird Area, and a Western Hemisphere International Shorebird Reserve Network Site. Of note, at least 25-30% of the federally listed *rufa* subspecies of the red knot are supported by the Virginia barrier islands as well as 15% of the federally threatened Atlantic Coast piping plover. Additionally, the Virginia barrier island system supports over 54% of all breeding waterbirds in the state, 100% of the state breeding population of Wilson's plovers, and 90% of the state breeding population of American Oystercatchers (Paxton and Wilson 2015).

Given our unique standing as a coastal land owner neighboring WFF and our commitment to migratory bird conservation, the Conservancy has significant concerns about the adverse impacts on migratory birds and bats that the proposed instrumentation tower, as described in the draft EA, will have. The Conservancy consulted about this project with other partners that are part of the Virginia Coast Avian Partnership, a group of federal, state, academic and non-governmental organization partners dedicated to monitoring, managing and conserving Virginia's avian resources. After thorough review of the draft EA, we do not agree that there is enough evidence to conclude that the project will have "low to moderate adverse effects" on avifauna. Furthermore, we believe that given the unique location of Wallops Island in the Atlantic Flyway and its ecological importance to migratory birds and bats, this is not an appropriate location for the proposed instrumentation tower. We express our specific concerns below.

(1) The draft EA draws the conclusion that adverse effects to avifauna will be low to moderate. We do not agree with this conclusion based on the study by Paxton and Wilson (2015), which suggests that there are several species in the region with a high risk of collision and medium to high risk of experiencing population level impacts. The study also highlights the lack of information required to carry out a full

assessment on expected bird mortality rate caused by the proposed project. We do not believe this assessment translates to a low to moderate risk for the avifauna of the region.

(2) We are concerned about several project design characteristics that will increase the chance of adverse impacts to migratory birds and bats. Paxton and Wilson (2015) reference a worst-case scenario: "Manville (2001) states that a worst-case scenario would be a 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 of the worst case scenario". The following project design characteristics align with that scenario:

a. the tower's height of 750 feet; a significant decrease in mortality is associated with reduced tower height (Crawford and Engstrom 2001);
b. 12 steel guy wires on each of 3 sides; 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 (towers 1,000 feet or more in height) than on non-guyed, medium-height towers (towers between 380 feet and 479 feet in height) (Gehring et al. 2011);
c. required lighting; 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 nonflashing, 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);
d. proximity to the coast; towers taller than 450 feet are generally recommended to be sited away from coastal zones, bird staging areas, colonial nesting sites, and Western Hemisphere Shorebird Reserve Network sites (FCC 2012);

The EA proposes some mitigating design features, such as flight diverters and blinking lights. We consider these steps to be important and necessary, but they would not ultimately alter the fundamental project characteristics that we are concerned about.

(3) No viable location alternative is proposed to reduce adverse effects. In fact, the proposed location and alternative are both located on Wallops Island, within the Atlantic Flyway, an ecologically important area, and are separated by only 2,300 feet, which means adverse effects will be identical in both cases.

(4) The draft EA presents a site-specific assessment of the impacts a single tower would cause at the proposed location. However, the potential population level impacts of such structures could occur over a much broader geographic area and these cumulative impacts must be considered when siting such projects and have not been considered in the draft EA.

(5) The draft EA contains a Monitoring and Mitigation plan calling for a minimum of two complete field seasons post-construction, between March 15 and November 15, to document the extent of avian mortality. We consider this plan to be inadequate in that it is short-term and limits the sampling season, which should, instead occur year-round, to also account for winter mortality.

(6) The draft EA does not provide a contingency plan containing specifications on possible measures to adopt in case, after construction, the tower is found to cause serious adverse effects.

Again, thank you for providing the Conservancy with the opportunity to submit comments to the draft Environmental Assessment for the construction and operation of an Instrumentation Tower at Wallops Island, Virginia. I can be contacted at [redacted]

Sincerely,

Jill Bieri
Director, Virginia Coast Reserve

UNITED STATES DEPARTMENT OF COMMERCE

National Oceanic and Atmospheric Administration

NATIONAL ENVIRONMENTAL SATELLITE, DATA, and INFORMATION SERVICE

[redacted]

AUG 09 2017

Air Force Materiel Center

Tower Project

C/O URS Corp.

12420 Milestone Center Drive, Suite 150 ([redacted])

Germantown, MD 20876

RE: Comment on Draft Environmental Assessment on Proposed Construction and Operation of Instrumentation Tower on Wallops Island

To whom it may concern:

National Oceanic and Atmospheric Administration's (NOAA), National Environmental Satellite, Data and Information Service (NESDIS) prepared the following comments to the Air Force's Draft Environmental Assessment on Proposed Construction and Operation of Instrumentation Tower on Wallops Island.

The Wallops Command and Data Acquisition Station (WCDAS), adjacent to the National Aeronautics and Space Administration's (NASA) Wallops Flight Facility (WFF), is responsible for control of and data flow from NOAA, NASA, DoD and many other international satellites. WCDAS manages, operates, and maintains the station which executes spacecraft commands and schedules. Additionally WCDAS acquires, maintains, and distributes a continuous flow of meteorological satellite data to the national and international communities.

The 750 foot tower can potentially generate Radio Frequency Interference (RFI) and Electromagnetic Interference (EMI), which will impact the satellite communications and potentially impact sensitive satellite ground station electronics. The same may be true for the Air Force's instrumentation suite.

NOAA satellite systems, as well as the other Federal agency and international satellite systems, are dependent on the RF Spectrum for collecting and disseminating information about the atmosphere, oceans, and hydrologic sciences, which contributes to National Defense, Aviation & Maritime operations, weather prediction, and early warning systems. NOAA's Primary Mission Essential Functions within the Department of Commerce include:

(a) Satellite Imagery - to collect and provide the Nation with critical intelligence data, imagery, and other essential information for predictive environmental and atmospheric modeling systems and space-based distress alert systems by operating NOAA-controlled satellites, communications equipment, and associated systems;

(b) Meteorological Forecasts - provide the Nation with environmental forecasts, warnings, data, and expertise critical to public safety, disaster preparedness, all hazards response and recovery, the national transportation system, safe navigation, and the protection of the Nation's critical infrastructure and natural resources.

(c) Satellite Command and Control – transmission of radio frequencies that may be attenuated, reflected or interfered with by sensors and instrumentation on the Air Force tower.

NOAA notes the draft Environmental Assessment does not address any impact the 750' tower, or its extensive steel guy wire infrastructure, may or may not have, on existing Radio Frequency (RF) environment at Wallops. The lack of an RF impact study is a serious omission and needs to be addressed before consideration can be given to accepting this location for tower construction and operation. Any attenuation, reflection or interference of the radiated transmissions by this proposed tower will degrade NOAA's ability to meet mission objectives for providing satellite imagery to generate forecasts and warnings that protect life and property.

NESDIS has serious concerns regarding the Air Force's draft Environmental Assessment on the proposed construction and operation of an instrumentation tower on Wallops Island without adequate consideration of the WCDAS RF Spectrum impacts. The assessment must include consideration for potential RFI and EMI of NOAA/NESDIS equipment.

Sincerely,

Al Wissman

Chief, Data Management & Continuity Operations Branch
Office of the Assistant Chief Information Officer
National Environmental Satellite, Data & Information Service
National Oceanic and Atmospheric Administration

[redacted]

[redacted]

From: Garnett A. Kellam [redacted]
Sent: Monday, August 14, 2017 3:54 PM
To: AMER-US-MD Germantown-Tower Comments
Cc: Robert Crockett
Subject: FW: 700 FT USAF Tower on Wallops Island

Please see below.

From: Garnett A. Kellam [redacted]
Sent: Monday, August 14, 2017 3:49 PM
To: 'towercomments@aecom.com' <towercomments@aecom.com>
Cc: 'rdcrockett55@yahoo.com' [redacted]
Subject: 700 FT USAF Tower on Wallops Island

Good afternoon,

We are concerned with high powered lighting on the structure. We do not need to be blasted with anymore light pollution on Accomack County's Seaside. White Strobes during the day are probably necessary, however, less powerful red lighting should be used at night.

Sincerely,

Garnett A. Kellam
Jane G. Kellam
Pierce B. Taylor III
Nadean Moore
Ace Sebolt
Rachel C. Kellam

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.

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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		

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

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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)

3

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

4

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)

- 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

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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/ft^3):	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
$VVSF = 1 / (1 + (0.053 * VP * L / 2))$

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

Avifauna and Protected Avian Species Monitoring and Mitigation Plan (*pending*)
U.S. Fish and Wildlife Service Recommended Best Practices for Communication Tower Design, Siting, Construction, Operation, Maintenance, and Decommissioning, August 2016
Table C-1: Birds Recorded in Accomack County that Are Likely to Occur at WFF
Table C-2: Landbird Species Expected to Overlap with the Alternative Sites Evaluated in the EA
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
Assessment of Potential Impacts to Avian Species from a Proposed 750-foot Guyed Tower (Paxton and Wilson 2015)

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Avifauna and Protected Avian Species Monitoring and Mitigation Plan (*pending*)

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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.

REFERENCES

Avery, M., P.F. Springer, and J.F. Cassel. 1976. The effects of a tall tower on nocturnal bird migration – a portable ceilometer study. Auk 93: 281-292.

Ball, L.G., K. Zyskowski, and G. Escalona-Segura. 1995. Recent bird mortality at a Topeka television tower. Kansas Ornithological Society Bulletin 46: 33-36.

Cochran, W.W. and R.R. Graber. 1958. Attraction to nocturnal migrants by lights on a television tower. Wilson Bulletin 70: 378-380.

Erickson W.P., G.D. Johnson, and D.P. Young. 2005. A summary and comparison of bird mortality from anthropogenic causes with emphasis on collisions. USFS Tech. Rep. PSWGTR-191. Pp. 1029-1042.

Evans, W.R., Y. Akashi, N.S. Altman, and A.M. Manville. 2007. Response of night-migrating songbirds in cloud to colored and flashing light. North American Birds 60(4): 476-488.

Federal Aviation Administration. 2015. Obstruction marking and lighting. Advisory Circular AC 70/7460-1L. U.S. Department of Transportation.

Federal Aviation Administration. 2016. FAA Acts to Reduce Bird Fatalities. http://www.faa.gov/news/updates/?newsId=85204

Federal Communications Commission. 2015. Opportunities to reduce bird collisions with communication towers while reducing tower lighting costs. http://wireless.fcc.gov/migratory-birds/Light_Changes_Information_Update_120415.pdf

Gauthreaux, S.A. and C.G. Belser. 1999. The behavioral responses of migrating birds to different lighting systems on tall towers. *In* Transactions of the proceedings of the workshop on avian mortality at communication towers (eds. W.R. Evans and A.M. Manville).

Gauthreaux, S.A. and C.G. Belser. 2006. Effects of artificial night lighting on migrating birds. *In* Ecological Consequences of Artificial Night Lighting (eds. C. Rich and T. Longcore), pp. 67-93. Covelo, California: Island Press.

Gehring, J., P. Kerlinger, and A.M. Manville. 2009. Communication towers, lights, and birds: Successful methods of reducing the frequency of avian collisions. Ecological Applications 19(2): 505–514.

Gehring, J., P. Kerlinger, and A.M. Manville. 2011. The role of tower height and guy wires on avian collisions with communication towers. Journal of Wildlife Management 75(4): 848-855.

Gehring, J. and K. Walter. 2012. Studies of avian collisions with communication towers: a quantification of a bird night flight calls at towers with different structural supports and the use of acoustics as an index of tower fatalities. Progress Report for U.S. Fish and Wildlife Service. MNFI Report Number: 2012-29.

Larkin, R.P. and B.A. Frase. 1988. Circular paths of birds flying near a broadcasting tower in cloud. Journal of Comparative Psychology 102: 90-93.

Longcore, T., C. Rich, P. Mineau, B. MacDonald, D.G. Bert, L.M. Sullivan, E. Mutrie, S.A. Gauthreaux, M.L. Avery, R.L. Crawford, A.M. Manville, E.R. Travis, and D. Drake. 2012a. An estimate of avian mortality at communication towers in the United States and Canada. PLoS One 7(4): 1-17.

Longcore, T., C. Rich, P. Mineau, B. MacDonald, D.G. Bert, L.M. Sullivan, E. Mutrie, S.A. Gauthreaux, M.L. Avery, R.L. Crawford, A.M. Manville, E.R. Travis, and D. Drake. 2012b. Avian mortality at communication towers in the United States and Canada: which species, how many, and where? Biological Conservation 158: 410-419.

Manville, A.M. 2009. Towers, turbines, power lines, and buildings – steps being taken by the U.S. Fish and Wildlife Service to avoid or minimize take of migratory birds at these structures. In Tundra to

tropics: Connecting habitats and people. Proceedings of the 4th International Partners in Flight Conference (eds. T.D. Rich, C. Arizendi, D. Demarest, and C. Thompson). Pp. 1-11.

Manville, A.M. 2013. Recommended Lighting Standards and Lighting Protocols for Structures Requiring Pilot Warning Lighting, and for Security Lighting Purposes. Technical Report, Division of Migratory Bird Management, U.S. Fish and Wildlife Service.

Manville, A.M. 2014. Status of U.S. Fish and Wildlife Service developments with communication towers with a focus on migratory birds: Updates to Service staff involved with tower issues. Webinar Summary Talking Points. Pp. 14.

Norris, D.R. and C.M. Taylor. 2006. Predicting the consequences of carry-over effects for migratory populations. Biology Letters 2006(2): 148-151.

Patterson, J.W. 2012. Evaluation of new obstruction lighting techniques to reduce avian fatalities. Technical Note: DOT/FAA/TC-TN12/9.

Poot, H., B.J. Ens, H. de Vries, M.A.H. Donners, M.R. Wernand, and J.M. Marquenie. 2008. Green light for nocturnally migrating birds. Ecology and Society 13(2): 47.

U.S. Fish and Wildlife Service. 2007. Comments of the U.S. Fish and Wildlife Service Submitted Electronically to the FCC on 47 CFR Parts 1 and 17, WT Docket No. 03-187, FCC 06-164, Notice of Proposed Rulemaking, "Effects of Communication Towers on Migratory Birds." February 2, 2007. 32 pp.

U.S. Fish and Wildlife Service. 2011. Comments of the U.S. Fish and Wildlife Service's Division of Migratory Bird Management Filed Electronically on WT Docket NO. 08-61 and WT Docket No. 03-187, Regarding the Environmental Effects of the Federal Communication Commission's Antenna Structure Registration Program. January 14, 2011. 12 pp.

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).

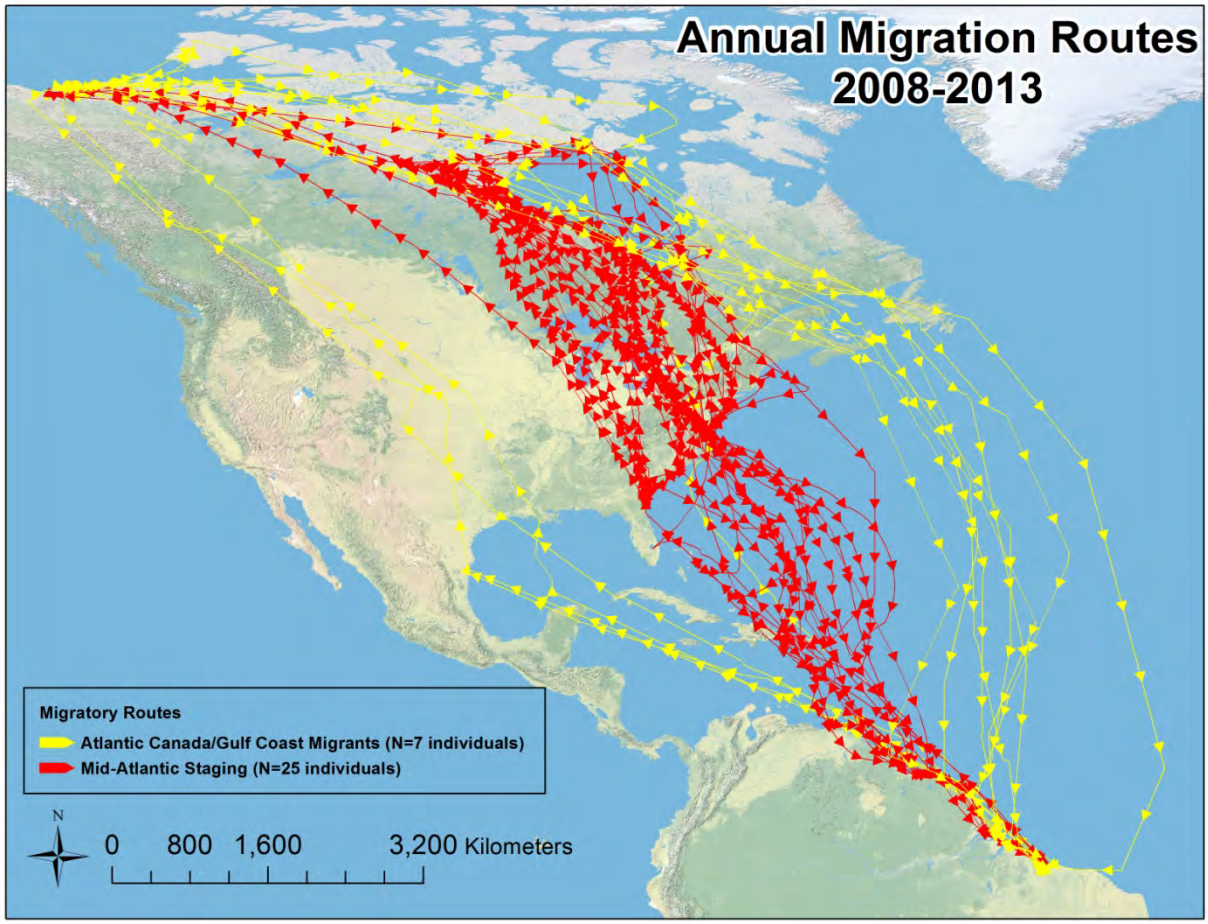

Figure 3. Annual migration routes of whimbrels equipped with satellite tracking units.

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.

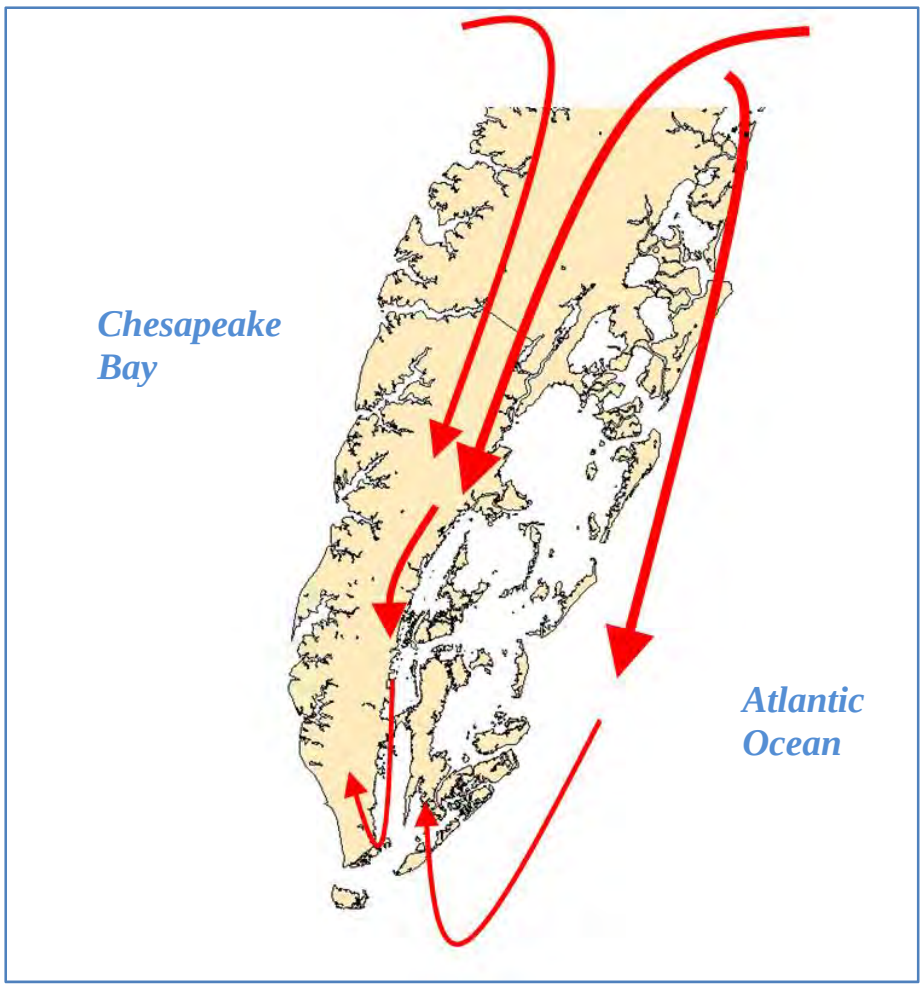

Figure 4. General flight patterns of nocturnal landbird migrants that are funneled southward on the lower Delmarva Peninsula. Birds will discontinue migratory flight as daylight approaches to "fallout" into habitats used for resting and refueling. The Chesapeake Bay and Atlantic Ocean act as a migration 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 threated 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.

Literature Cited

The literature cited section includes all papers reviewed in preparation of this report, not only papers cited.

Able, K. P. 1966. Television tower mortality near Louisville [Kentucky]. Kentucky Warbler 42: 27-28.

Able, K. P. 1968. Connecticut Warblers in the Louisville [Kentucky] area in autumn. Kentucky Warbler 44: 3-4.

Anderson, W. L. 1978. Waterfowl collisions with power lines at a coal-fired power plant. Wildlife Society Bulletin 6(2):77–83.

Avery, Michael L., 1979. REVIEW OF AVIAN MORTALITY DUE TO COLLISIONS WITH MANMADE STRUCTURES. *Bird Control Seminars Proceedings.* Paper 2.

Avery, M., P. F. Springer, and J. F. Cassel. 1977. Weather influences on nocturnal bird mortality at a North Dakota tower. Wilson Bull. 89: 291-299.

Avery, M. L., P. F., Springer, and N. S. Dailey. 1978. Avian mortality at man-made structures: an annotated bibliography. U.S. Fish Wildl. Serv. FWS/OBS-78/58, 108 pp.

Avery, M. L., P. F. Springer, and N. S. Dailey. 1980. Avian mortality at man-made structures: an annotated bibliography (revised). U.S. Fish Wildl. Serv. FWS/OBS-80/54, 152 pp.

Avian Power Line Interaction Committee (APLIC). 1994. Mitigating bird collisions with power lines: the state of the art in 1994. Edison Electric Institute. Washington D.C., USA.

Avian Power Line Interaction Committee (APLIC). 1996 (reprinted 2000). Suggested practices for raptor protection on powerlines: the state of the art in 1996. Edison Electric Institute/Raptor Research Foundation. Washington D.C., USA.

Avian Power Line Interaction Committee (APLIC). 2006. Suggested practices for avian protection on powerlines: the state of the art in 2006. Edison Electric Institute, APLIC, and the California Energy Commision, Washington D.C. and Sacramento, CA.

Avian Power Line Interaction Committee (APLIC). 2012. Reducing avian collisions with powerlines: the state of the art in 2012. Edison Electric Institute and APLIC. Washington D.C.

Avise, J. C., and R. L. Crawford. 1981. A matter of lights and death. Nat. Hist. 90: 6-14.

Ball, L. G., K. Zyskowski, and G. Escalona-Segura. 1995. Recent bird mortality at a Topeka [Kansas] television tower. Kansas Ornithol. Soc. Bull. 46: 33-36.

Baker, Allan, Patricia Gonzalez, R.I.G. Morrison and Brian A. Harrington. 2013. Red Knot (Calidris canutus), The Birds of North America Online (A. Poole, Ed.). Ithaca: Cornell Lab of Ornithology; Retrieved from the Birds of North America Online: http://bna.birds.cornell.edu/bna/species/563doi:10.2173/bna.563

Banks, R. C. 1979. Human-related mortality of birds in the United States. U.S. Fish Wildl. Serv. Spec. Sci. Rep.--Wildl. 215, 16 pp.

Barbour, R. W. 1961. An unusual bird mortality at Lexington [Kentucky]. Kentucky Warbler 37: 55.

Barkley, R., C. Elk, and J. Palmquist. 1977. Recent TV tower kills at Goodland, Kansas. Kansas Ornithol. Soc. Bull. 28: 10-12.

Barr, Jack F., Christine Eberl and Judith W. Mcintyre. 2000. Red-throated Loon (Gavia stellata), The Birds of North America Online (A. Poole, Ed.). Ithaca: Cornell Lab of Ornithology; Retrieved from the Birds of North America Online: http://bna.birds.cornell.edu/bna/species/513doi:10.2173/bna.513

Bartolo, B. 1976. Bird kill at [Ohio] TV tower. Redstart 43: 109.

Beadell, J., R. Greenberg, S. Droege, and J. A. Royle. 2003. Distribution, abundance, and habitat affinities of the coastal plain swamp sparrow. Wilson Bulletin 115: 38-44.

Beaularier, D. L. 1981. Mitigating bird collisions with transmission lines. Bonneville Power Admin., U.S. Department of Energy, Portland, Oregon, USA.

Bevanger, K. 1998. Biological and conservation aspects of bird mortality caused by electricity power lines: a review. *Biological Conservation*, *86*(1), 67-76.

Bevanger, K. 1994. Bird interactions with utility structures: collision and electrocution, causes and mitigating measures. Ibis 136: 412-425.

Bierly, M. L. 1968. Television tower casualties at Birmingham [Alabama] in 1967. Alabama Birdlife 16: 34-35.

Bierly, M. L. 1969. 1968 Birmingham [Alabama] tower casualties. Alabama Birdlife 17: 46-49.

Bierly, M. L. 1972. Spring 1969 tower casualties in Birmingham [Alabama]. Alabama Birdlife 20(1-2): 3.

Bjorge, R. R. 1987. Bird kill at an oil industry flare stack in northwest Alberta. Canadian Field-Nat. 101: 346-350.

Blokpoel, H., and P. R. M. Hatch. 1976. Snow geese, disturbed by aircraft, crash into powerlines. Canadian Field Naturalist 90:195.

Boettcher, R., Penn, T., Cross, R. R., Terwilliger, K. T., & Beck, R. A. (2007). An overview of the status and distribution of piping plovers in Virginia. *Waterbirds*, *30*(sp1), 138-151.

Bohlen, H. D. 1985. Age and sex composition of a TV-tower kill near Springfield [Illinois]. Illinois Birds Birding 1: 61-62.

Brown, W. M., R. C. Drewien, and D. L.Walker. 1984. Crane flight behavior and mortality associated with power lines in the San Luis Valley, Colorado. Forest, Wildlife and Range Experiment Station, University of Idaho, Moscow, Idaho, USA.

Brown, W. M., R. C. Drewien, and E. G. Bizeau. 1987. Mortality of cranes and waterfowl from power line collisions in the San Luis Valley, Colorado. Pages 128–136 *in* J. C. Lewis, editor. Proceedings of the 1985 Crane Workshop. Platte River Whooping Crane Habitat Maintenance Trust, Grand Island, Nebraska, USA.

Brown, W. M., and R. C. Drewien. 1995. Evaluation of two power line markers to reduce crane and waterfowl collision mortality. Wildlife Society Bulletin 23:217–227.

Buchanan, J. B. 2011. Collisions and in-flight calamities involving shorebirds in western Washington. *Washington Birds*, *11*, 22-27.

Buehler, David A. 2000. Bald Eagle (Haliaeetus leucocephalus), The Birds of North America Online (A. Poole, Ed.). Ithaca: Cornell Lab of Ornithology; Retrieved from the Birds of North America Online: http://bna.birds.cornell.edu/bna/species/506doi:10.2173/bna.506

Bundick, J. A. 2015. Personal communication on data for monthly IFR events and hourly fog frequency at Wallops Flight Facility Airport, from 1997 to 2012.

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.

Burger, J. and Gochfeld, M., 1991. Human activity influence and diurnal and nocturnal foraging of sanderlings (Calidris alba). *Condor*, pp.259-265.

Burger, J., Niles, L. J., Porter, R. R., Dey, A. D., Koch, S., & Gordon, C. 2012. Using a shore bird (red knot) fitted with geolocators to evaluate a conceptual risk model focusing on offshore wind. *Renewable Energy*, *43*, 370-377.

Caldwell, L. D., and N. L. Cuthbert. 1963. Bird mortality at television towers near Cadillac, Michigan. Jack-Pine Warbler 41: 80-89.

Caldwell, L. D., and G. J. Wallace. 1966. Collections of migrating birds at Michigan television towers. Jack-Pine Warbler 44: 117-123.

Carter, J. H., III, and J. F. Parnell. 1976. TV tower kills in eastern North Carolina. Chat 40: 1-9.

Carter, J. H., III, and J. F. Parnell. 1978. TV tower kills in eastern North Carolina: 1973 through 1977. Chat 42: 67-70.

CCB, Center for Conservation Biology. 2015. Mapping portal. http://www.ccbbirds.org/maps/ accessed December 2015

Cohen, J. B., Karpanty, S. M., Fraser, J. D., Watts, B. D., & Truitt, B. R. (2009). Residence probability and population size of Red Knots during spring stopover in the mid-Atlantic region of the United States. *Journal of Wildlife Management*, *73*(6), 939-945.

Confer, J. L., P. Hartman, and A. Roth. 2011. Golden-winged Warbler (Vermivora Chysoptera), The Birds of North America Online (A. Poole, Ed.). Ithaca: Cornell Lab Of Ornithology; Retrieved from the Birds of North America Online: http://bna.birds.cornell.edu/bna/species/020.

Cooley, C. D. 1977. Television tower casualties at Huntsville [Alabama]: fall, 1976. Alabama Birdlife 25(3-4): 14-15.

Cooper, B. A & R.J. Ritchie. 1995. The altitude of bird migration in east-central Alaska: a radar and visual study. J. Field Ornith. 66: 590–608.

Cooper, B. A., C. B. Johnson, and R. J. Ritchie. 1995a. Bird migration near existing and proposed wind turbine sites in the eastern Lake Ontario region. Report to Niagara Mohawk Power Corporation, Syracuse, NY. 71 p.

Cooper, B. A., C. B. Johnson, and E. F. Neuhauser. 1995b. The impact of wind turbines on birds in upstate New York. Windpower '95 Proceedings. American Wind Energy Association,Washington, DC.

Corbat, Carol A. and Peter W. Bergstrom. 2000. Wilson's Plover (Charadrius wilsonia), The Birds of North America Online (A. Poole, Ed.). Ithaca: Cornell Lab of Ornithology; Retrieved from the Birds of North America Online: http://bna.birds.cornell.edu/bna/species/516doi:10.2173/bna.516

Crawford, R. L. 1974. Bird casualties at a Leon County, Florida, TV tower: October 1966-September 1973. Bull. Tall Timbers Res. Sta. 18, 27 pp.

Crawford, R. L. 1976a. Willow and Alder flycatcher records at a north Florida TV tower. Florida Field Nat. 4: 1-4.

Crawford, R. L. 1976b. Some old records of TV tower kills from southwest Georgia. Oriole 41: 45-51.

Crawford, R. L. 1980. Wind direction and the species composition of autumn TV tower kills in northwest Florida. Auk 97: 892-895.

Crawford, R. L. 1981a. Bird kills at a lighted man-made structure: often on nights close to a full moon. Am. Birds. 35: 913-914.

Crawford, R. L. 1981b. Bird casualties at a Leon County, Florida, TV tower: a 25-year migration study. Bull. Tall Timbers Res. Sta. 22, 30 pp.

Crawford, R. L. 1981c. Weather, migration, and autumn bird kills at a north Florida TV tower. Wilson Bull. 93: 189-195.

Crawford, R. L. 1989. Another consideration of Yellow-billed Cuckoo casualties at a Tennessee TV tower. Migrant 60: 72-73.

Crawford, R. L., and W. W. Baker. 1981. Bats killed at a north Florida television tower: a 25-year record. J. Mammal. 62: 651-652.

Crawford, R. L., and R. Engstrom. 2001. CHARACTERISTICS OF AVIAN MORTALITY AT A NORTH FLORIDATELEVISION TOWER: A 29-YEAR STUDY. Journal of Field Ornithology, 72(3):380-388.

Davis, W. M. 1987. Avian mortality during spring migration at a north Mississippi television tower. Mississippi Kite 16: 5-7.

Desholm, M. 2003. How much do small-scale changes in flight direction increase overall migration distance? Journal of Avian Biology 34:155-158.

Desholm, M. 2006. Wind farm related mortality among avian migrants: A remote sensing study and model analysis. PhD dissertation, University of Copenhagen, Copenhagen.

Desholm, M. and J. Kahlert. 2005. Avian collision risk at an offshore wind farm. Biological Letters. The Royal Society, London.

Dinsmore, J. J., R. B. Renken, and J. P. Schaufenbuel. 1983. TV tower kill in central Iowa. Iowa Bird Life 53: 91-93.

Dinsmore, S., E. Munson, J. J. Dinsmore, and G. M. Nelson. 1987. Two television tower kills in Iowa. Iowa Bird Life 57: 5-8.

Dugan, P.J., 1981. The importance of nocturnal foraging in shorebirds: a consequence of increased invertebrate prey activity. In *Feeding and Survival Strategies of Estuarine Organisms* (pp. 251-260). Springer US.

Drewitt, A. L. and R. H. W. Langston. 2006. Assessing the impacts of wind farms on birds. Ibis 148:29-42.

Dunn, E. H. 1993. Bird mortality from striking residential windows in winter. J. Field Ornithol. 64: 302-309.

eBird. 2012. eBird: An online database of bird distribution and abundance [web application]. eBird, Cornell Lab of Ornithology, Ithaca, New York. Available: http://www.ebird.org. (Accessed: December 2015).

Eddleman, W. R., R. E. Flores and M. Legare. 1994. Black Rail (Laterallus jamaicensis), The Birds of North America Online (A. Poole, Ed.). Ithaca: Cornell Lab of Ornithology; Retrieved from the Birds of North America Online: http://bna.birds.cornell.edu/bna/species/123doi:10.2173/bna.123

Elder, W. H. 1982. Television can be hazardous for [Missouri] warblers! Bluebird (St. Louis) 49(4): 9.

Ellis, C. D. 1997. Back to the tower: tower-killed birds at a Putnam County, West Virginia, television transmission tower. Redstart 64: 111-113.

Elmore, J. B., Jr., and B. Palmer-Ball Jr. 1991. Mortality of migrant birds at two central Kentucky TV towers. Kentucky Warbler 67: 67-71.

Erickson, W. P., G. D. Johnson, M. D. Strickland, D. P. Young, Jr., K. J. Sternka, and R. E. . Good. 2001. Avian collisions with wind turbines: A summary of existing studies and comparisons to other sources of avian collision mortality in the United States. National Wind Coordinating Committee, Washington, D.C..

Erickson, W. P., Johnson, G. D., & Young Jr, D. P. 2005. A summary and comparison of bird mortality from anthropogenic causes with an emphasis on collisions. *USDA Forest Service General Technical Report PSW-GTR-191*, 1029-1042.

Evans, W. R., and A. M. Manville, II (eds.). 2000. Avian mortality at communication towers. Transcripts of Proceedings of the Workshop on Avian Mortality at Communication Towers, August 11, 1999, Cornell University, Ithaca, NY. Published on the internet at <http://migratorybirds.fws.gov/issues/towers/agenda.html

Exo, K., O. Huppop, and S. Garthe. 2003. Birds and offshore wind farms: a hot topic in marine ecology. Wader Study Group Bulletin 100:50-53.

Faanes, C. A. 1987. Bird behavior and mortality in relation to power lines in prairie habitats. U. S. Fish and Wildlife Technical Report 7. Washington D.C., USA.

Federal Communications Commission (FCC). 2009. Antenna Structure Registration. http://wireless.fcc.gov/uls/index.htm?job=transaction&page=weekly . Accessed November 2015

Feehan, J. 1963. Destruction of birdlife in Minnesota--Sept[ember] 1963. II. Birds killed at the Ostrander television tower. Flicker 35: 111-112.

Fox, A. D., M. Desholm, J. Kahlert, T. K. Christensen, and I. B. K. Petersen. 2006. Information needs to support environmental impact assessment of the effects of European marine offshore wind farms on birds. Ibis 148:129-144.

Gauthreaux Jr, S.A. and Belser, C.G., 2006. Effects of artificial night lighting on migrating birds. Ecological consequences of artificial night lighting (C. Rich and T. Longcore, Editors). Island Press, Washington, DC, USA, pp.67-93.

Geo-Marine, Inc. 2009. Ocean/Wind power ecological baseline studies. Interim report to New Jersey Department of Environmental Protection Division of Science, Research, and Technology. Plano, TX.

Gehring, J., P. Kerlinger, and A.M. Manville II. 2009. Communication towers, lights, and bird: successful methods of reducing the frequency of avian collisions. Ecological Applications 19:505-514.

Gehring J, Kerlinger P, Manville AM. 2011. The role of tower height and guy wires on avian collisions with communication towers. *J. Wildl. Manag.* 75:848–55.

Gochfeld, Michael and Joanna Burger. 1994. Black Skimmer (Rynchops niger), The Birds of North America Online (A. Poole, Ed.). Ithaca: Cornell Lab of Ornithology; Retrieved from the Birds of North America Online: http://bna.birds.cornell.edu/bna/species/108doi:10.2173/bna.108

Goodpasture, K. A. 1984. Television tower casualties, Nashville, Tennessee 1976-1983. Migrant 55: 53-57.

Goodpasture, K. A. 1986. Nashville, Tennessee, television tower casualties, 1984. Migrant 57: 70-72.

Goodpasture, K. A. 1987. 1985 tower casualties at WSMV, Nashville, Tennessee. Migrant 58: 85-86.

Graber, R., and J. Graber. 1980. Comparison of [Illinois] bird kill and census. Illinois Audubon Bull. 192: 20-23.

Graber, R. R., and W. W. Cochran. 1960. Evaluation of an aural record of nocturnal migration. Wilson Bull. 72: 253-273.

Gratto-Trevor, Cheri L. 2000. Marbled Godwit (Limosa fedoa), The Birds of North America Online (A. Poole, Ed.). Ithaca: Cornell Lab of Ornithology; Retrieved from the Birds of North America Online: http://bna.birds.cornell.edu/bna/species/492doi:10.2173/bna.492

Green, J. C. 1963. Destruction of birdlife in Minnesota--Sept[ember] 1963. III. Notes on kills at Duluth on September 18/19. Flicker 35: 112-113.

Greenberg, R., P. P. Marra, and M. J. Wooler. 2007. Stable-isotope (c, n, h) analysises help locate the winter range of the coastal plain swamp sparrow (Melospiza georgiana migrescens). Auk 124:1137-1148.

Hamel, P. B. 1987. An improbable number of Yellow-billed Cuckoo casualties at a Tennessee TV tower. Migrant 58: 86-89.

Hamel, P. B. 1989. Reply to Crawford. Migrant 60: 74.

Hatch, J. J. and S. Brault. 2007. Collision mortalities at Horseshoe Shoal of bird species of special concern. Report No. 5.3.2-1. Cape Wind Associates. Boston, MA.

Hebert, E., E. Reese, and L. Mark. 1995 (October). Avian collision and electrocution: an annotated bibliography. California Energy Commission.

Herron, J. 1997. Television transmission tower kills in Lewis County, West Virginia. Redstart 64: 114-117.

Hicklin, Peter and Cheri L. Gratto-Trevor. 2010. Semipalmated Sandpiper (Calidris pusilla), The Birds of North America Online (A. Poole, Ed.). Ithaca: Cornell Lab of Ornithology; Retrieved from the Birds of North America Online: http://bna.birds.cornell.edu/bna/species/006doi:10.2173/bna.6

HMANA Hawkcount.org, 2015. Hawkwatch data. http://hawkcount.org/index.php accessed December 2015

Hobson, K. A., S. L. V. Wilgenburg, J. Faaborg, J. D Toms, C. Renfigo, A. L. Sosa, Y. Aubry, and R. B. Aguilar. 2014. Connecting breeding and wintering grounds of Neotropical migrants using stable hydrogen isotopes: a call for isotopic atlas of migratory connectivity. Journal of Field Ornithology 85: 237-257

Houston, C. Stuart, Cameron R. Jackson and Daniel E. Bowen, Jr. 2011. Upland Sandpiper (Bartramia longicauda), The Birds of North America Online (A. Poole, Ed.). Ithaca: Cornell Lab of Ornithology; Retrieved from the Birds of North America Online: http://bna.birds.cornell.edu/bna/species/580doi:10.2173/bna.580

Hoving, E. J., and S. G. Sealy. 1987. Species and age composition of a sample of birds killed in fall 1979 at a Manitoba TV tower. Prairie Nat. 19: 129-133.

Huckabee, J. W. 1993. Proceedings: avian interactions with utility structures, international workshop, September 13–16, 1992, Miami, Florida. Electric Power Research Institute, Project 3041, EPRI TR-103268.

Huppop, O., J. Dierschke, K. Exo, E. Fredrich, and R. Hill. 2006. Bird migration studies and potential collision risk with offshore wind turbines. Ibis 148:90-109.

Janss, G. F. 2000. Avian mortality from power lines: a morphologic approach of a species-specific mortality. Biological Conservation, 95(3), 353-359.

Janss, G. F. E., and M. Ferre. 2000. Common crane and great bustard collision with power lines: collision rate and risk exposure. Wildlife Society Bulletin 28:675–680.

Janssen, R. B. 1963. Destruction of birdlife in Minnesota--Sept[ember] 1963. I. Birds killed at the Lewisville television tower. Flicker 35: 110-111.

Jehl, Jr., Joseph R., Joanna Klima and Ross E. Harris. 2001. Short-billed Dowitcher (Limnodromus griseus), The Birds of North America Online (A. Poole, Ed.). Ithaca: Cornell Lab of Ornithology; Retrieved from the Birds of North America Online: http://bna.birds.cornell.edu/bna/species/564doi:10.2173/bna.564

Johnston, D. W. 1976. Races of Palm Warblers killed at a Florida TV tower. Florida Field Nat. 4: 22-24.

Johnson, G.D., W.P. Erickson, M.D. Strickland, M.F. Shepherd, D.A. Shepherd, and S.A. Sarappo. 2002. Collision mortality of local and migrant birds at the large-scale wind power development on Buffalo Ridge, Minnesota. Wildlife Society Bulletin 30:879-887.

Jones, J. and Francis, C. M. 2003. The effects of light characteristics on avian mortality at lighthouses. J. Avian Biol. 34: 328–333.

Kaiser, M. J., M. Galanidi, A. J. Elliot, D. A. Showler, R. W. G. Caldow, and W. J. Sutherland. 2006. Disturbance displacement of Common Scoters in relation to wind farms. Ibis 148:110-128.

Kale, H. W., II. 1975. Extension of winter range of *Telmatodytes palustris waynei* to Georgia and Florida. Auk 92: 806-807.

Kemper, C. 1996. A study of bird mortality at a west central Wisconsin TV tower from 1957-1995. Passenger Pigeon 58: 219-235.

Kerlinger, P. 2000. Avian mortality at communication towers: a review of recent literature, research and methodology. Report to United States Fish and Wildlife Service Office of Migratory Bird Management. http://training.fws.gov/Pubs9/avian_mortality00.pdf . Accessed November 2015.

King, S., I. M. D. Maclean, T. Norman, and A. Prior. 2009. Developing guidance on ornithological cumulative impact assessment for offshore wind farm developers. Collaborative Offshore Wind Research Into the Environment, London.

Klem, D., Jr. 1989. Bird-window collisions. Wilson Bull. 101: 606-620.

Klem, D., Jr. 1990. Collisions between birds and windows: mortality and prevention. J. Field Ornithol. 61: 120-128.

Klem, D., Jr. 1991. Glass and bird kills: an overview and suggested planning and design methods of preventing a fatal hazard. Pp. 99-104 in L. W. Adams and D. L. Leedy (Eds.), Wildlife conservation in metropolitan environments. Natl. Inst. Urban Wildl. Symp. Ser. 2.

Koneke, M. A. 1992. Yellow Rail and Sharp-tailed Sparrow in Oswego County [New York]. Kingbird 42: 14.

Koops, F.B.J. 1987. Collision victims of high-tension lines in the Netherlands and effects of marking. KEMA Report 01282-mob 86–3048.

Kruse, K. 1996. A study of the effects of transmission towers on migrating birds. M.S. thesis, University of Wisconsin, Green Bay.

Lambert, J.D., D.I. King, J.P. Buonaccorsi and L.S. Prout. 2008. Decline of a New Hampshire Bicknell's Thrush Population, 1993-2003. Northeastern Naturalist 15: 607-618.

Lanctot, R. B. and C. D. Laredo. 1994. Buff-breasted Sandpiper (Calidris subruficollis), The Birds of North America Online (A. Poole, Ed.). Ithaca: Cornell Lab of Ornithology; Retrieved from the Birds of North America Online: http://bna.birds.cornell.edu/bna/species/091doi:10.2173/bna.91

Langston, R. H. W. and J. D. Pullan. 2002. Windfarms and birds: An analysis of the effects of windfarms on birds, and guidance on environmental assessment criteria and site selection issues. 22nd meeting Standing Committee "Convention on the conservation of European wildlife and natural habitats". Strasbourg.

Larkin, R. P. 1988a. Why are migrating birds killed at tall structures? Illinois Audubon Bull. 226: 20-21.

Larkin, R. P. 1988b. Why are migrating birds killed at tall structures? Illinois Nat. Hist. Surv. Rep. 277: 1-2.

Larkin, R. P., and B. A. Frase. 1988. Circular paths of birds flying near a broadcasting tower in cloud. J. Comp. Psychol. 102: 90-93.

Larsen, J. K. and M. Guillemette. 2007. Effects of wind turbines on flight behaviour of wintering common eiders: implications for habitat use and collision risk. Journal of Applied Ecology 44:516-522.

Laskey, A. R. 1961. [Tennessee] TV tower casualties. Inland Bird Banding News 33: 1.

Lee, J.M. 1978. Effects of transmission lines on birds in flight: studies of Bonneville Power Administration Lines. Pages 93–116 *in* M. L. Avery, editor. Impacts of transmission lines on birds in flight. U.S. Fish and Wildlife Service, Washington D.C., USA.

Leenhouts, W. P. 1987. Osprey killed by lightning at Merritt Island National Wildlife Refuge, Florida. Florida Field Nat. 15: 22-23.

Longcore T, Rich C, Gauthreaux S. 2008. Height, guy wires, and steady-burning lights increase hazard of communication towers to nocturnal migrants: a review and meta-analysis. Auk 125: 485–492.

Longcore T, Rich C, Mineau P, MacDonald B, Bert DG, et al. (2012) An Estimate of Avian Mortality at Communication Towers in the United States and Canada. PLoS ONE 7(4): e34025. doi:10.1371/journal.pone.0034025

Longcore T,Rich C, Mineau P, MacDonald B, BertDG,et al. 2012. An estimate of mortality at communication towers in the United States and Canada. *PLOS ONE* 7:e34025

Longcore, T., C. Rich, P. Mineau, B. MacDonald, D. G. Bert, et. al. 2013. Avian mortality at communication towers in the United States and Canada: which species, how many, and where? Biological Conservation 158:410-419.

Lowther, Peter, Alan F. Poole, J. P. Gibbs, S. Melvin and F. A. Reid. 2009. American Bittern (Botaurus lentiginosus), The Birds of North America Online (A. Poole, Ed.). Ithaca: Cornell Lab of Ornithology; Retrieved from the Birds of North America Online: http://bna.birds.cornell.edu/bna/species/018doi:10.2173/bna.18

Maehr, D. S., and J. Q. Smith. 1988. Bird casualties at a central Florida power plant: 1982-1986. Florida Field Nat. 16: 57-64.

Malcolm, J. M. 1982. Bird collisions with a power transmission line and their relation to botulism at a Montana wetland. Wildlife Society Bulletin, 10(4) 297-304.

Manville, A. 2000. The ABCs of avoiding bird collisions at communication towers: the next steps. Proceedings of the Avian Interactions Workshop, Charleston, S.C. Electric Power Research Institute, CA.

Manville, A.M., 2001, May. Communication Towers, Wind Generators, and Research: Avian Conservation Concerns. In *Proceedings of National Avian-Wind Power Planning Meeting IV (ed. PNAWPPM-IV)* (pp. 152-159).

Manville, A.M., II. 2005. Bird strikes and electrocutions at power lines, communication towers, and wind turbines: state of the art and state of the science – next steps toward mitigation. Pages 1051–1064 *in* C. J. Ralph and T. D. Rich, Editors. Bird Conservation Implementation in the Americas: Proceedings Third International Partners in Flight Conference 2002. U.S.D.A. Forest Service Technical Report, PSW-GTR-191. Albany, California, USA.

Manville, A.M., II. 2009. Towers, turbines, power lines, and buildings – steps being taken by the U.S. Fish and Wildlife Service to avoid or minimize take of migratory birds at these structures. *In* C.J. Ralph and T.D. Rich (editors). Proceedings 4th International Partners in Flight Conference, February 2008, McAllen, TX.

Martin, G. R., & Shaw, J. M. 2010. Bird collisions with power lines: failing to see the way ahead?. Biological Conservation, *143*(11), 2695-2702.

Marsden, J. E., T. C. Williams, V. Krauthamer, and H. Krauthamer. 1980. Effects of nuclear power plant lights on migrants. J. Field Ornithol. 51: 315-318.

Masden, E. A., D. T. Haydon, A. D. Fox, R. W. Furness, R. Bullman, and M. Desholm. 2009. Barriers to movement: impacts of wind farms on migrating birds. ICES Journal of Marine Science 66:746-753.

Mayfield, H.F. 1992. Kirtland's warbler. No. 19 in A. Poole, P. Stettenheim, and F. Gill, eds., The birds of North America. The Academy of Natural Sciences, Philadelphia, Pennsylvania, and the American Ornithologists' Union; Washington, DC.

McCrary, M. D., R. L. McKernan, R. W. Schreiber, W. D. Wagner, and T. C. Sciarrotta. 1986. Avian mortality at a solar energy power plant. J. Field Ornithol. 135-141.

McNEIL, R.A. and Rompre, G., 1995. Day and night feeding territoriality in Willets Catoptrophorus semipalmatus and Whimbrel Numenius phaeopus during the non-breeding season in the tropics. Ibis, *137*(2), pp.169-176.

Molina, K. C., J. F. Parnell and R. M. Erwin. 2014. Gull-billed Tern (Gelochelidon nilotica), The Birds of North America Online (A. Poole, Ed.). Ithaca: Cornell Lab of Ornithology; Retrieved from the Birds of North America Online: http://bna.birds.cornell.edu/bna/species/140doi:10.2173/bna.140

Mollhoff, W. 1979. [Nebraska] Tower kills. Nebraska Bird Rev. 47: 58.

Mollhoff, W. J. 1983. [Nebraska] Tower kills. Nebraska Bird Rev. 51: 92.

Morkill, A. E. 1990. Effectiveness of markers in reducing sandhill crane collisions with power lines. Thesis, University of Wyoming, Laramie, Wyoming. USA.

Morkill, A. E., and S. H. Anderson. 1991. Effectiveness of marking power lines to reduce sandhill crane collisions. Wildlife Society Bulletin 19:442–449.

Morrison, R.I.G., B.J. McCaffery, R.E. Gill, S.K. Skagen, S.L. Jones, G.W. Page, C.L. Gratto-Trevor and B.A. Andres. 2006. Population estimates of North American shorebirds, 2006. Wader Study Group Bulletin 111: 66-84.

Moskoff, William. 2011. Solitary Sandpiper (Tringa solitaria), The Birds of North America Online (A. Poole, Ed.). Ithaca: Cornell Lab of Ornithology; Retrieved from the Birds of North America Online: http://bna.birds.cornell.edu/bna/species/156doi:10.2173/bna.156

Mosman, D. 1975. Bird casualties at Alleman, Iowa, TV tower. Iowa Bird Life 45: 88-90.

Muller, Martin J. and Robert W. Storer. 1999. Pied-billed Grebe (Podilymbus podiceps), The Birds of North America Online (A. Poole, Ed.). Ithaca: Cornell Lab of Ornithology; Retrieved from the Birds of North America Online: http://bna.birds.cornell.edu/bna/species/410doi:10.2173/bna.410

Myers, J.P., 1983. Conservation of migrating shorebirds: staging areas, geographic bottlenecks, and regional movements. American Birds, *37*(1), pp.23-25.

Nicholson, C. P. 1984. September 1984 tower kill in Knox County, Tennessee. Migrant 55: 86.

Niles, L. J., H. P. Sitters, A. D. Dey, P. W. Atkinson, A. J. Baker, K. A. Bennett, R. Carmona, K. E. Clark, N. A. Clark, C. Espoz, P. M. Gonzalez, B. A. Harrington, D. E. Hernandez, K. S. Kalasz, R. G. Lathrop, R. N. Matus, C. D. T. Minton, R. I. G. Morrison, M. K. Peck, W. Pitts, R. A. Robinson, and I. L. Serrano. 2008. Status of the red knot (Calidris canutus rufa) in the western hemisphere. Studies in Avian Biology 36:1–185.

Nol, E. and Robert C. Humphrey. American Oystercatcher Working Group 2012. American Oystercatcher (Haematopus palliatus), The Birds of North America Online (A. Poole, Ed.). Ithaca: Cornell Lab of Ornithology; Retrieved from the Birds of North America Online: http://bna.birds.cornell.edu/bna/species/082doi:10.2173/bna.82

Norman, J. L. 1975. Birds killed at a TV tower near Coweta, Oklahoma. Bull. Oklahoma Ornithol. Soc. 8: 25-27.

Norman, J. L. 1982. The Coweta [Oklahoma] TV tower kill. Bull. Oklahoma Ornithol. Soc. 15: 19-22.

Norman, J. L. 1987. Synopsis of birds killed at the Coweta, Oklahoma, TV tower, 1974-1984. Bull. Oklahoma Ornithol. Soc. 20: 17-22.

Ogden, L. P. 1996. Collision course: the hazards of lighted structures and windows to migrating birds. World Wildlife Fund Canada and the Fatal Lights Awareness Program. 46 pp.

Osborn, R. G., C. D. Dieter, K. F. Higgins, and R. E. Usgaard. 1998. Bird flight characteristics near wind turbines in Minnesota. American Midland Naturalist 139:29-39.

Ouellet, H. 1993. Bicknell's Thrush: taxonomic position and distribution. Wilson Bulletin 105: 545-572.

Palmer-Ball, B., Jr., and L. Rauth. 1990. Tower mortality in Henderson County [Kentucky]. Kentucky Warbler 66: 97-98.

Parmalee, P. W., and M. D. Thompson. 1963. A second kill of birds at a television tower in central Illinois. Illinois Audubon Bull. 128: 13-15.

Parsons, Katharine C. and Terry L. Master. 2000. Snowy Egret (Egretta thula), The Birds of North America Online (A. Poole, Ed.). Ithaca: Cornell Lab of Ornithology; Retrieved from the Birds of North America Online: http://bna.birds.cornell.edu/bna/species/489doi:10.2173/bna.489

Payne, Laura X. and Elin P. Pierce. 2002. Purple Sandpiper (Calidris maritima), The Birds of North America Online (A. Poole, Ed.). Ithaca: Cornell Lab of Ornithology; Retrieved from the Birds of North America Online: http://bna.birds.cornell.edu/bna/species/706doi:10.2173/bna.706

Paxton, B. J. 2007. Potential impact of common reed expansion on threatened highmarsh bird communities on the seaside: breeding bird surveys of selected high-marsh patches. Center for Conservation Biology Technical Report Series, CCBTR-07-03. College of William and Mary, Williamsburg, VA. 19pp.

Percival, S. M. 2001. Assessment of the effects of offshore wind farms on birds. Department of Trade and Industry, London.

Pfand, A. 1996 (November/December). Fatal light. The Storm-Petrel 17(6), Kalmiopsis Audubon Society, Port Orford, Oregon. <http://www.harborside.com/cc/audubon/petrl6-6.htm#alice>. Accessed 8 June 1998.

PNAWPPM-IV. 2001. Proceedings of the National Avian-Wind Power Planning Meeting IV, Carmel, CA, May 16-17, 2000. Prepared for the Avian Subcommittee of the National Wind Coordinating Committee, by RESOLVE, Inc., Washington, D.C., Susan Savitt Schwartz, ed., 179 p.

Poole, Alan F., Peter Lowther, J. P. Gibbs, F. A. Reid and S. M. Melvin. 2009. Least Bittern (Ixobrychus exilis), The Birds of North America Online (A. Poole, Ed.). Ithaca: Cornell Lab of Ornithology; Retrieved from the Birds of North America Online: http://bna.birds.cornell.edu/bna/species/017doi:10.2173/bna.17

Rayner, J.M.V., 1988. Form and function in avian flight. In: Johnston, R.F. (Ed.), Current Ornithology, Vol. 5. Plenum, New York, pp. 1-66.

Remy, R. J., Jr. 1974. Birmingham [Alabama] tower casualties--fall, 1974. Alabama Birdlife 22(3-4): 9-10.

Remy, R. J., Jr. 1975. Birmingham [Alabama] television tower casualties, 1975. Alabama Birdlife 23(3-4): 18-19.

Rioux, S., Savard, J. P. L., & Gerick, A. A. 2013. Avian mortalities due to transmission line collisions: a review of current estimates and field methods with an emphasis on applications to the Canadian electric network. *Avian Conservation and Ecology*, *8*(2), 7.

Roberts, R. E., and C. V. Tamborski. 1993. Blackpoll Warbler mortality during fall migration at a tower in southeastern Florida. Florida Field Nat. 21: 118-120.

Rusz, P. J., Prince, H. H., Rusz, R. D., & Dawson, G. A. 1986. Bird collisions with transmission lines near a power plant cooling pond. *Wildlife Society Bulletin*, 441-444.

Savereno, A. J., L.A. Savereno, R. Boettcher, and S. M. Haig. 1996. Avian behavior and mortality at power lines in coastal South Carolina. Wildlife Society Bulletin 24:636–648.

Science Applications International Corporation (SAIC). 2000. *Avian collision at transmission lines associated with the Hells Canyon complex*. Technical Report Appendix E.3.2-20. Science Applications International Corporation, Boise, Idaho, USA.

Scott, R. E., L. J. Roberts, and C. J. Cadbury. 1972. Bird deaths from power lines at Dungeness. British Birds 65:273–286.

Sealy, S. 1986. Fall migration of Northern Orioles: an analysis of tower-killed individuals. N. Am. Bird Bander 12: 43-45.

Shire, G. G., Brown, K., & Winegrad, G. 2000. Communication towers: a deadly hazard to birds. Report compiled by the American Bird Conservancy.

Skeel, Margaret A. and Elizabeth P. Mallory. 1996. Whimbrel (Numenius phaeopus), The Birds of North America Online (A. Poole, Ed.). Ithaca: Cornell Lab of Ornithology; Retrieved from the Birds of North America Online: http://bna.birds.cornell.edu/bna/species/219doi:10.2173/bna.219

Smith, F.M., B.D. Watts, and A.E. Duerr. 2011. Using Satellite and Radio Telemetry to Examine Stop-over and Migration Ecology of the Whimbrel: 2009-2011 Report. Center for Conservation Biology Technical Report Series, CCBTR-11-05.College of William and Mary & Virginia Commonwealth University, Williamsburg, VA.21 pp.

Smithsonian Migratory Bird Center. 1997. When it comes to pesticides, birds are sitting ducks, Fact Sheet 8. Smithsonian Migratory Bird Center, Washington, D.C.

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

Stantial. M.L. 2014. FLIGHT BEHAVIOR OF BREEDING PIPING PLOVERS: IMPLICATIONS FOR RISK OF COLLISION WITH WIND TURBINES. Thesis. State University of New York College of Environmental Science and Forestry Syracuse, New York

Stantial, Michelle L., and Jonathan B. Cohen. 2015. Estimating flight height and flight speed of breeding Piping Plovers. Journal of Field Ornithology 86(4):369-377.

Stedman, Stephen J. 2000. Horned Grebe (Podiceps auritus), The Birds of North America Online (A. Poole, Ed.). Ithaca: Cornell Lab of Ornithology; Retrieved from the Birds of North America Online: http://bna.birds.cornell.edu/bna/species/505doi:10.2173/bna.505

Stehn, Thomas V. and Wassenich, Tom, "Whooping Crane Collisions with Power Lines: an Issue Paper" (2008). North American Crane Workshop Proceedings. Paper 203.

Stevenson, H. M., and W. W. Baker. 1970. Records of new avian subspecies in Florida. Florida Nat. 41: 69-70.

Stoddard, H. L., Sr. 1961. Bird casualties at a Leon County, Florida, TV tower: 1955-1961. Bull. Tall Timbers Res. Sta. 1, 94 pp.

Stoddard, H. L., Sr., and R. A. Norris. 1967. Bird casualties at a Leon County, Florida, TV tower: an eleven-year study. Bull. Tall Timbers Res. Sta. 8, 104 pp.

Strnad, F. 1962. Birds killed at the KROC-TV tower, Ostrander, Minnesota. Flicker 34: 7-9.

Strnad, F. V. 1975. More bird kills at KROC-TV tower, Ostrander, Minnesota. Loon 47: 16-21.

Sundar, K. S. G., and B. C. Choudhury. 2005. Mortality of sarus cranes (*Grus antigone*) due to electricity wires in Uttar Pradesh, India. Environmental Conservation 32 (3): 260–269.

Sutton, G. M. 1980. Subspecies of Savannah Sparrow found in Oklahoma. Bull. Oklahoma Ornithol. Soc. 13: 6-8.

Sykes P. W. Jr. 1986. Autumn land-bird migration on the Barrier Islands of northeastern North Carolina. Occ Papers of the N. C. Biol. Surv.

Taylor, W. K. 1981. No longer a bird killer. Florida Nat. 9: 4-5, 10.

Taylor, W. K., and B. H. Anderson. 1974. Nocturnal migrants killed at a central Florida TV tower, autumn 1972. Florida Field Nat. 2: 40-43.

Taylor, W. K., and M. A. Kershner. 1986. Migrant birds killed at the Vehicle Assembly Building (VAB), John F. Kennedy Space Center. J. Field Ornithol. 57: 142-154.

Telfer, T. C., J. L. Sincock, G. V. Byrd, and J. R. Reed. 1987. Attraction of Hawaiian seabirds to lights: conservation efforts and effect of moon phase. Wildl. Soc. Bull. 15: 406-413.

Temme, M., and W. B. Jackson. 1981. Cooling towers as obstacles in bird migrations. Proc. Bird Control Seminar 8: 111-118.

Terrill, S. B., and R. L. Crawford. 1988. Additional evidence of nocturnal migration by Yellow-rumped Warblers in winter. Condor 90: 261-263.

Tetra Tech. 2010. Wallops Flight Facility Alternative Energy Demonstration Project Wind Energy Avian Study Report. Prepared for National Aeronautic and Space Administration Goddard Space Flight Center Wallops Flight Facility Wallops Island, Virginia

Thompson, Bruce C., Jerome A. Jackson, Joanna Burger, Laura A. Hill, Eileen M. Kirsch and Jonathan L. Atwood. 1997. Least Tern (Sternula antillarum), The Birds of North America Online (A. Poole, Ed.). Ithaca: Cornell Lab of Ornithology; Retrieved from the Birds of North America Online: http://bna.birds.cornell.edu/bna/species/290doi:10.2173/bna.290

Thompson, L. S. 1978. Mitigation through engineering and habitat modification. Pages 51–92 *in* M. L. Avery, editor. Impacts of transmission lines on birds in flight. U.S. Fish and Wildlife Service, Washington D.C., USA.

Tibbitts, T. Lee and William Moskoff. 2014. Lesser Yellowlegs (Tringa flavipes), The Birds of North America Online (A. Poole, Ed.). Ithaca: Cornell Lab of Ornithology; Retrieved from the Birds of North America Online: http://bna.birds.cornell.edu/bna/species/427doi:10.2173/bna.427

Townsend, J.M.and C.C. Rimmer. 2006. Known natal and wintering sites of a Bicknell's Thrush. Journal of Field Ornithology 77: 452-454.

Trapp, J. L. 1998. Bird kills at towers and other man-made structures: an annotated partial bibliography (1960-1998). U. S. Fish and Wildlife Service web report: http://www.fws.gov/migratorybirds/currentbirdissues/hazards/towers/tower.html accessed November 2015.

Turner, L., and M. Davis. 1980. Birds killed at television towers in Knox County [Tennessee]. Migrant 51: 27-29.

USFWS. 2008. Birds of Conservation Concern 2008. U.S. Fish and Wildlife Service, Division Of Migratory Bird Management. Arlington, VA. 93 pp.

USFWS. 2013. Rufa Red Knot Ecology and Abundance SUPPLEMENT TO Endangered and Threatened Wildlife and Plants; Proposed Threatened Status for the Rufa Red Knot (Calidris canutus rufa). Docket No. FWS–R5–ES–2013–0097; RIN 1018–AY17. http://www.fws.gov/northeast/redknot/pdf/20130923_REKN_PL_Supplement02_Ecology%20Abundance_Final.pdf. Accessed November 2015

USFWS. 2013. U.S. Fish and Wildlife Service Proposes to Protect the Rufa Red Knot as Threatened Under Endangered Species Act. http://www.fws.gov/northeast/redknot/pdf/QAs_RedKnotpL_FINAL_092713.pdf. Accessed February 2016

USFWS. 2014. U.S. Fish and Wildlife Service Protects the Rufa Red Knot as Threatened Under Endangered Species Act. http://www.fws.gov/northeast/redknot/pdf/DRAFT_QAs_red_knot_finallisting_120814_FINAL.pdf. Accessed February 2016.

Vaughn, C. R. 1977. First Virginia specimen of the Magnificent Frigatebird. Raven 48: 78.

Velie, E. D. 1963. Report of a survey of bird casualties at television towers, ceilometers, and other obstructions. Flicker 35: 79-84.

Verheijen, F. J. 1980. The moon: a neglected factor in studies on collisions of nocturnal migrant birds with tall lighted structures and with aircraft. Vogelwarte 30: 305-320.

Verheijen, F. J. 1981a. Bird kills at lighted man-made structures: not on nights close to a full moon. Am. Birds 35: 251-254.

Verheijen, F. J. 1981b. Bird kills at tall lighted structures in the USA in the period 1935-1973 and kills at a Dutch lighthouse in the period 1924-1928 show similar lunar periodicity. Ardea 69: 199-203.

Walker, Brad M., Nathan R. Senner, Chris S. Elphick and Joanna Klima. 2011. Hudsonian Godwit (Limosa haemastica), The Birds of North America Online (A. Poole, Ed.). Ithaca: Cornell Lab of Ornithology; Retrieved from the Birds of North America Online: http://bna.birds.cornell.edu/bna/species/629doi:10.2173/bna.629

Walkinshaw, L. H. 1956. Sandhill cranes killed by flying in to a power line. Wilson Bulletin 68: 325–326.

Ward, J., and S. Anderson. 1992. Sandhill crane collisions with power lines in south central Nebraska. Pages 189–196 *in* Don Wood, editor. Proceedings of the 1988 North American Crane Workshop. Florida Game Freshwater Fish Commission, Nongame Wildlife Program Technical Report 12. Tallahassee, Florida, USA.

Ward, J., R. Romme, and S. Anderson. 1986. Evaluation of the Platte and North Platte Rivers as sites to study power line modification to reduce crane collisions. Wyoming Cooperative Fish and Wildlife Research Unit, University of Wyoming, Laramie, Prepared for J. C. Lewis, USFWS Endangered Species Office, Albuquerque, New Mexico, USA.

Watts, B. D. 2013. Waterbirds of the Chesapeake: A monitoring plan. Version 1.0. Virginia Department of Game and Inland Fisheries, Richmond, VA. 95 p.

Watts, B. D. 2010. Wind and waterbirds: Establishing sustainable mortality limits within the Atlantic Flyway. Center for Conservation Biology Technical Report Series, CCBTR-10-05. College of William and Mary/Virginia Commonwealth University, Williamsburg, VA. 43 pp.

Watts, B. D. 2006. Synthesizing information resources for the Virginia Important Bird Area Program: Phase I Delmarva Peninsula and tidewater. Center for Conservation Biology Technical Report Series, CCBTR-06-05. College of William and Mary, Williamsburg, VA. 70 pp.

Watts, B. D. and B. J. Paxton. 2014. Status and distribution of colonial waterbirds in coastal Virginia: 2013 breeding season. Raven 85:12-25.

Watts, B. D. and S. E. Mabey. 1994. Migratory landbirds of the lower Delmarva: habitat selection and geographic distribution. Final Report submitted to the National Oceanic and Atmospheric Administration's Office of Ocean and Coastal Resource Management, NOAA Grant Nos. NA37OZ0360-01, NA27OZ0312-01, NA17OZ0359-01.

Watts, B. D. and E. K. Mojica. 2015. Virginia Peregrine Falcon monitoring and management program: Year 2015 report. Center for Conservation Biology Technical Report Series, CCBTR-15-06. College of William and Mary & Virginia Commonwealth University, Williamsburg, VA. 18 pp.

Watts, B.D. and Truitt, B.R., 2015. Spring migration of red knots along the Virginia barrier islands. The Journal of Wildlife Management, *79*(2), pp.288-295.

Weise, C. M. 1971. Relative abundance of small landbirds in southeastern Wisconsin. Passenger Pigeon 33:173–188.

Weir, R. C. 1976. Annotated bibliography of bird kills at man-made obstacles: a review of the state of the art and solutions. Canadian Wildl. Serv., Ontario Region, Ottawa. 85 pp.

White, Clayton M., Nancy J. Clum, Tom J. Cade and W. Grainger Hunt. 2002. Peregrine Falcon (Falco peregrinus), The Birds of North America Online (A. Poole, Ed.). Ithaca: Cornell Lab of Ornithology; Retrieved from the Birds of North America Online: http://bna.birds.cornell.edu/bna/species/660doi:10.2173/bna.660

Wiggins, D. A., D. W. Holt and S. M. Leasure. 2006. Short-eared Owl (Asio flammeus), The Birds of North America Online (A. Poole, Ed.). Ithaca: Cornell Lab of Ornithology; Retrieved from the Birds of North America Online: http://bna.birds.cornell.edu/bna/species/062doi:10.2173/bna.62

Wilke, A. 2015. Personal communication on results of 2015 Virginia winter American oystercatcher count.

Willard, D. E., J. T. Harris and M. J. Jaeger. 1977. The impact of a proposed 500 kV transmission route on waterfowl and other birds. A Report for the Public Utility Commissioner of the State of Oregon, Salem, Oregon, USA.

Willis, R. 2000. FCC permitting, NEPA, endangered species, refuge issues: the role of the Fish and Wildlife Service. Transcripts of Proceedings of the Workshop on Avian Mortality at Communication Towers, August 11, 1999, Cornell University, Ithaca, NY.

Wilson, M. D. and B. D. Watts. 1999. Response of brown-headed nuthatches to thinning of pine plantations. Wilson Bulletin 111: 56-60.

Wilson, M. D., B. D. Watts, and D. F. Brinker. 2007. Status review of marsh lands and breeding marsh birds. Waterbirds, Vol. 30, Special Publication. Pp. 122-137.

Wilson, M. D., F. M. Smith, and B. D. Watts. 2015. Re-survey and Population Status Update of the Black Rail in Virginia. Center for Conservation Biology Technical Report Series, CCBTR-15-004. College of William and Mary and Virginia Commonwealth University. Williamsburg, VA. 15pp.

Winning, G, Murray M. 1997. Flight behavior and collision mortality of waterbirds flying across electricity transmission lines adjacent to the shortland wetlands, Newcastle, NSW. Wetlands (Australia) 17(1) 29-40.

Wylie, B. 1977. Bird kill at Chestnut Ridge [West Virginia]. Redstart 44: 65.

Wylie, W. L. 1966. [West Virginia] Migration mishap. Redstart 33: 102-103.

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

Wetlands Delineation and U.S. Army Corps of Engineers Preliminary Jurisdictional Determination

Figure 2 from Environmental Baseline Survey (EBS) for the Proposed Action Alternative (Preferred Alternative) Site (**Note:** Figure 2 will be included following finalization of the EBS.)

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Wetlands Delineation and U.S. Army Corps of Engineers Preliminary Jurisdictional Determination

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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

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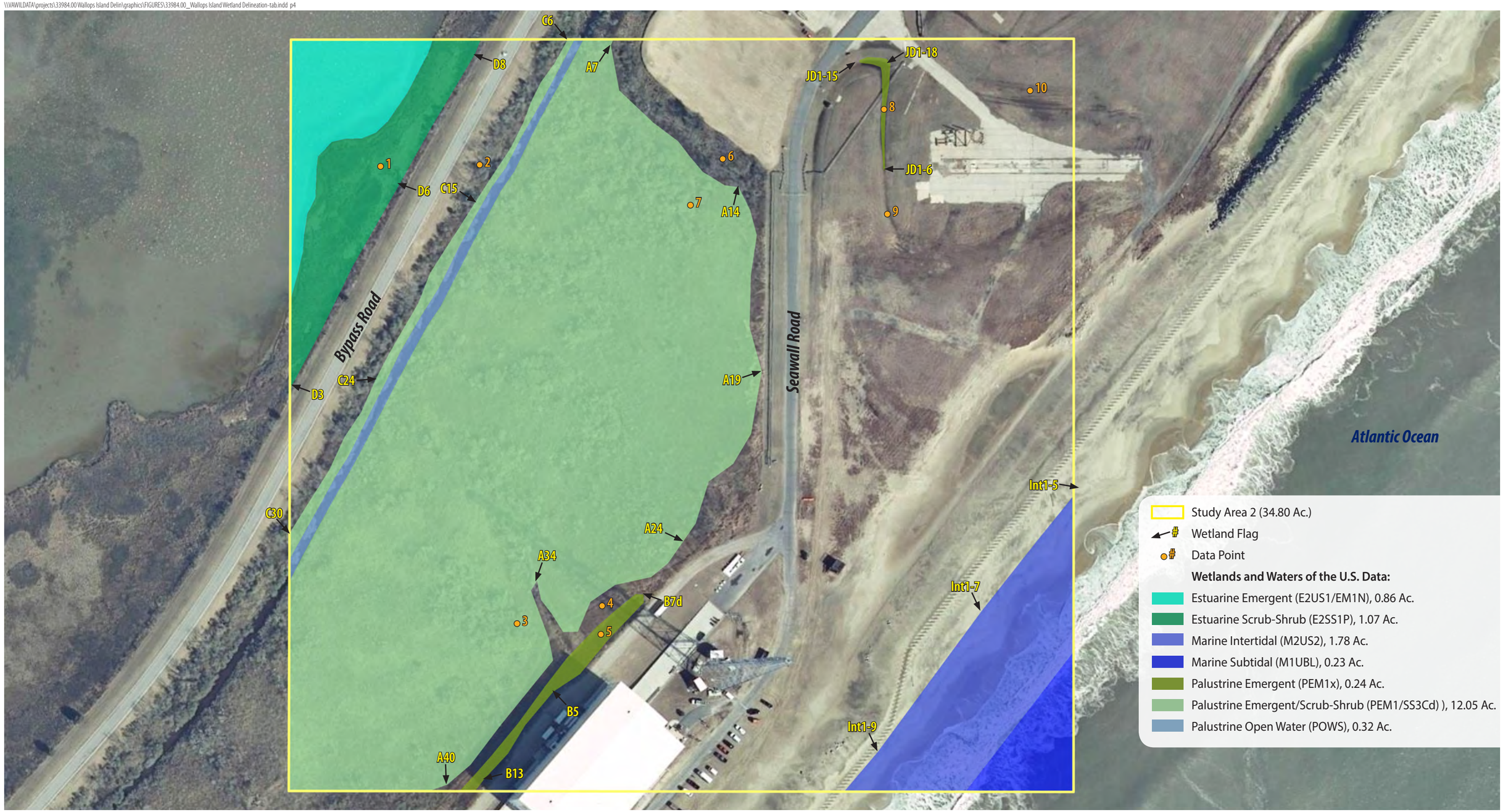
NASA WALLOPS ISLAND TOWER SITES

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

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)

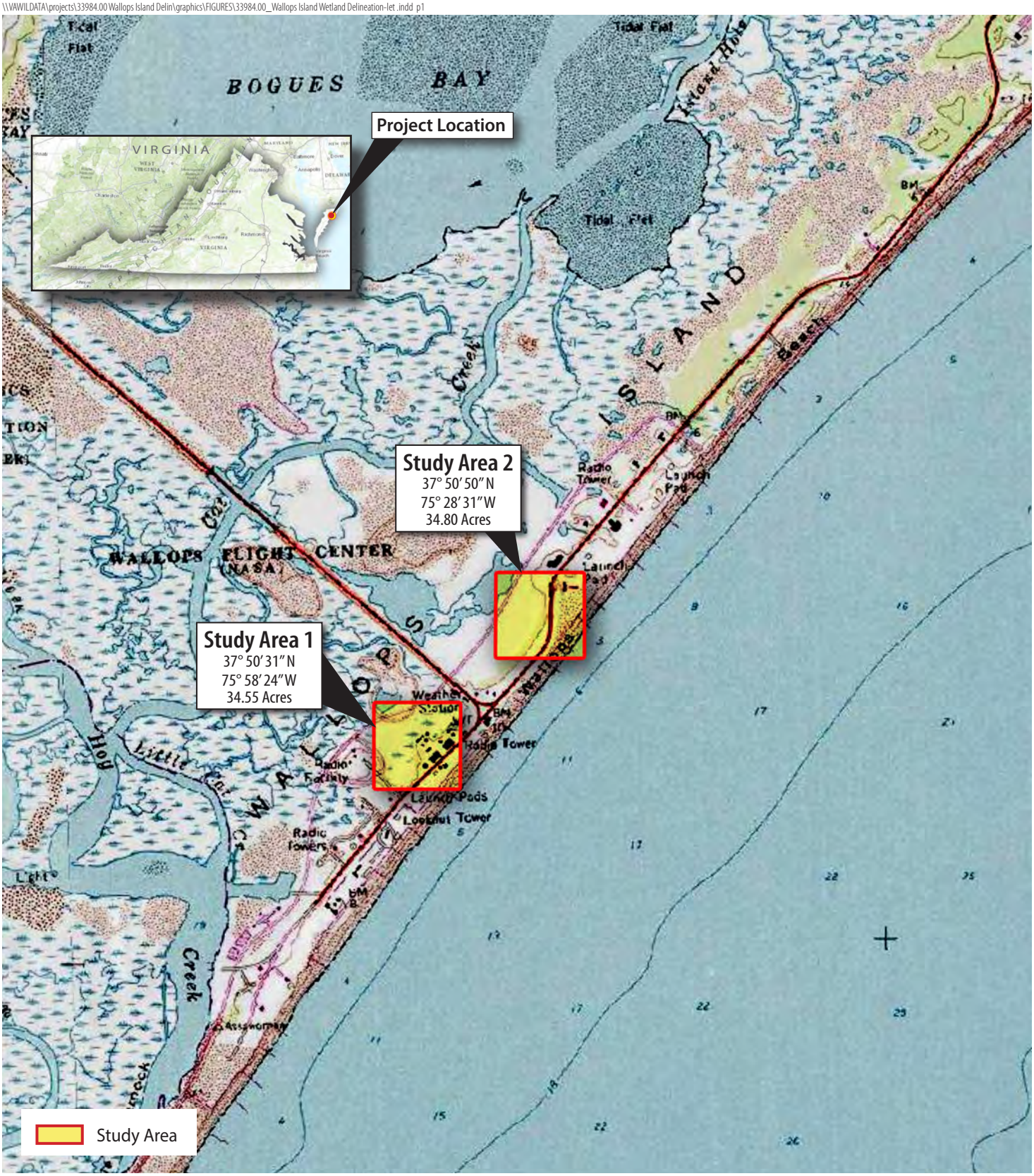
Reference Cited:

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



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NASA WALLOPS ISLAND TOWER SITES

WATERS OF THE U.S. DELINEATION
ACCOMACK COUNTY, VIRGINIA

FIGURE 1
Project Location Map

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NASA WALLOPS ISLAND TOWER SITES

WATERS OF THE U.S. DELINEATION
ACCOMACK COUNTY, VIRGINIA

FIGURE 2
NRCS Soil Map

0 200 400
SCALE IN FEET

NASA WALLOPS ISLAND TOWER SITES

WATERS OF THE U.S. DELINEATION
ACCOMACK COUNTY, VIRGINIA

FIGURE 3
National Wetland Inventory Map

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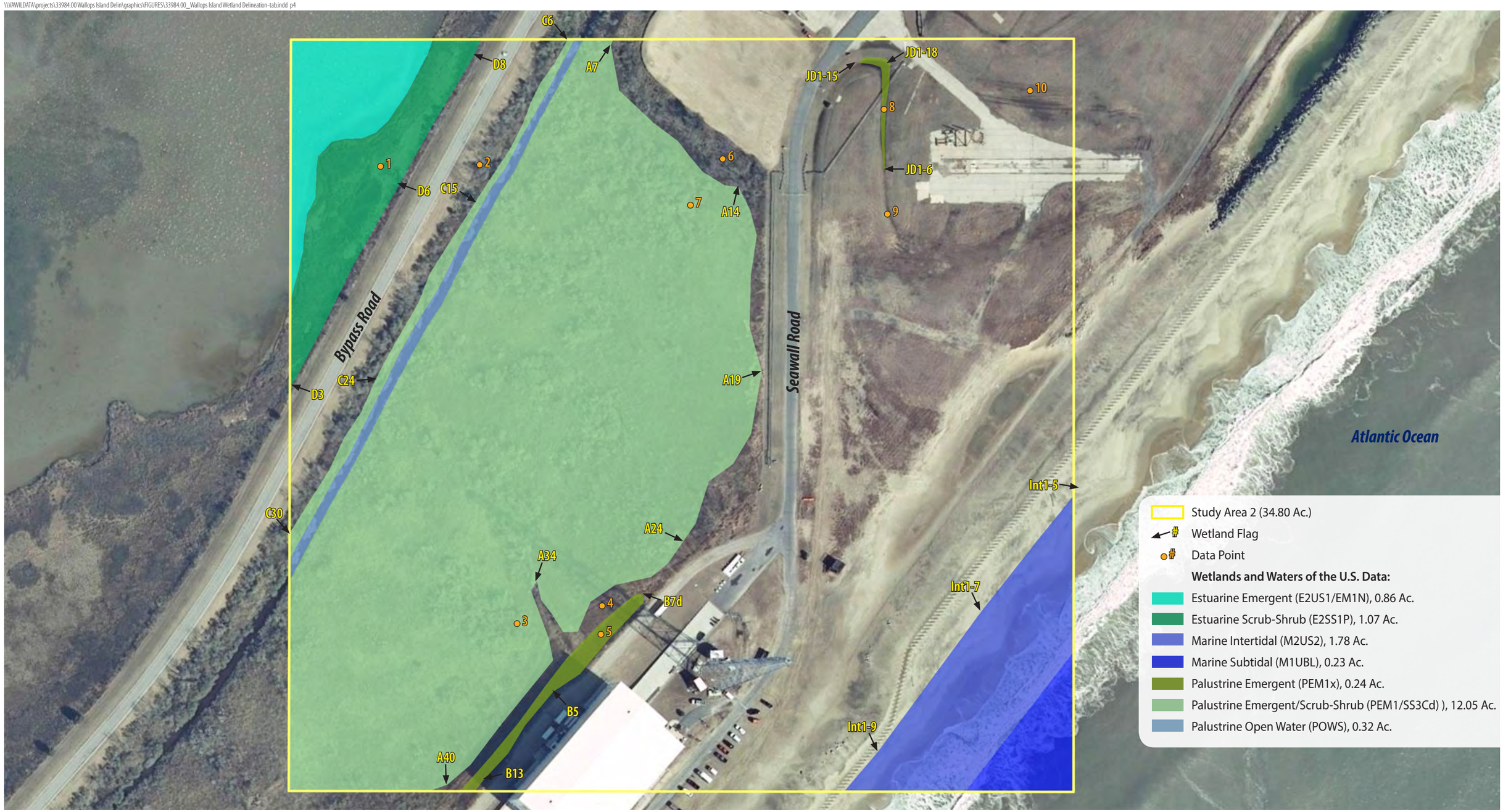
NASA WALLOPS ISLAND TOWER SITES

WATERS OF THE U.S. DELINEATION
ACCOMACK COUNTY, VIRGINIA

FIGURE 4
Study Area 1 Waters of the U.S. Delineation Map



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

Attachment 2

2015 USACE Data Sheets

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: **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**
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 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)
X	High Water Table (A2)		Marl Deposits (B15)
X	Saturation (A3)	X	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
0-5	**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.

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.			
2.			
3.			
4.			
5.			
6.			
7.			
		= Total Cover	

Herb Stratum (Plot size: **10' radius**)			
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**)			
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.

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**
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 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	Matrix		Redox Features					
(in)	Color (moist)	%	Color (moist)	%	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

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)
- ____ 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
0-3	**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)
- ____ 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: **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**)			
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.			
	100	= 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	**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.

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	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 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)		Surface Soil Cracks (B6)
X	High Water Table (A2)		Marl Deposits (B15)		Sparsely Vegetated Concave Surface (B8)
X	Saturation (A3)		Hydrogen Sulfide Odor (C1)		Drainage Patterns (B10)
	Water Marks (B1)	X	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):	
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
0-16	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)		2 cm Muck (A10)
	Histic Epipedon (A2)		Polyvalue Below Surface (S8)		Piedmont Floodplain Soils (F19)
	Black Histic (A3)		Thin Dark Surface (S9)		Anomalous Bright Loamy Soils (F20)
	Hydrogen Sulfide (A4)		Loamy Gleyed Matrix (F2)		Red Parent Material (F21)
	Stratified Layers (A5)	X	Depleted Matrix (F3)		Very Shallow Dark Surface (TF12)
	Organic Bodies (A6)		Redox Dark Surface (F6)		Other (Explain in Remarks)
	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]:

[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**
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 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	Matrix		Redox Features					
(in)	Color (moist)	%	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)
- ____ 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.			
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. **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**)			
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

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**	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 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)		Surface Soil Cracks (B6)
X	High Water Table (A2)		Marl Deposits (B15)		Sparsely Vegetated Concave Surface (B8)
X	Saturation (A3)		Hydrogen Sulfide Odor (C1)		Drainage Patterns (B10)
	Water Marks (B1)	X	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):
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
0-16	**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)		2 cm Muck (A10)
	Histic Epipedon (A2)		Polyvalue Below Surface (S8)		Piedmont Floodplain Soils (F19)
	Black Histic (A3)		Thin Dark Surface (S9)		Anomalous Bright Loamy Soils (F20)
	Hydrogen Sulfide (A4)		Loamy Gleyed Matrix (F2)		Red Parent Material (F21)
	Stratified Layers (A5)	X	Depleted Matrix (F3)		Very Shallow Dark Surface (TF12)
	Organic Bodies (A6)		Redox Dark Surface (F6)		Other (Explain in Remarks)
	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]:

[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**	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 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)	____ Aquatic Fauna (B13)	____ Surface Soil Cracks (B6)
____ High Water Table (A2)	____ Marl Deposits (B15)	____ Sparsely Vegetated Concave Surface (B8)
____ Saturation (A3)	____ 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): ____
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 3/2**	**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)	____ Dark Surface (S7)	____ 2 cm Muck (A10)
____ Histic Epipedon (A2)	____ Polyvalue Below Surface (S8)	____ Piedmont Floodplain Soils (F19)
____ Black Histic (A3)	____ Thin Dark Surface (S9)	____ Anomalous Bright Loamy Soils (F20)
____ Hydrogen Sulfide (A4)	____ Loamy Gleyed Matrix (F2)	____ Red Parent Material (F21)
____ Stratified Layers (A5)	____ Depleted Matrix (F3)	____ Very Shallow Dark Surface (TF12)
____ Organic Bodies (A6)	____ Redox Dark Surface (F6)	____ Other (Explain in Remarks)
____ 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]:

[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	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 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)		Aquatic Fauna (B13)		Surface Soil Cracks (B6)
X	High Water Table (A2)		Marl Deposits (B15)		Sparsely Vegetated Concave Surface (B8)
X	Saturation (A3)		Hydrogen Sulfide Odor (C1)		Drainage Patterns (B10)
	Water Marks (B1)	X	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):	
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
0-16	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)		2 cm Muck (A10)
	Histic Epipedon (A2)		Polyvalue Below Surface (S8)		Piedmont Floodplain Soils (F19)
	Black Histic (A3)		Thin Dark Surface (S9)		Anomalous Bright Loamy Soils (F20)
	Hydrogen Sulfide (A4)		Loamy Gleyed Matrix (F2)		Red Parent Material (F21)
	Stratified Layers (A5)	X	Depleted Matrix (F3)		Very Shallow Dark Surface (TF12)
	Organic Bodies (A6)		Redox Dark Surface (F6)		Other (Explain in Remarks)
	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]:

[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)
- ____ 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 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)
- ____ 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. **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**)			
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	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 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)		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):	
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
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)		Dark Surface (S7)		2 cm Muck (A10)
	Histic Epipedon (A2)		Polyvalue Below Surface (S8)		Piedmont Floodplain Soils (F19)
	Black Histic (A3)		Thin Dark Surface (S9)		Anomalous Bright Loamy Soils (F20)
	Hydrogen Sulfide (A4)		Loamy Gleyed Matrix (F2)		Red Parent Material (F21)
	Stratified Layers (A5)		Depleted Matrix (F3)		Very Shallow Dark Surface (TF12)
	Organic Bodies (A6)		Redox Dark Surface (F6)		Other (Explain in Remarks)
	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)		
X	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]:

[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	Matrix		Redox Features					
(in)	Color (moist)	%	Color (moist)	%	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**	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 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	Matrix		Redox Features					
(in)	Color (moist)	%	Color (moist)	%	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**)			
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**	**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**)			
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.

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	Matrix		Redox Features					
(in)	Color (moist)	%	Color (moist)	%	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**	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 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)		Aquatic Fauna (B13)		Surface Soil Cracks (B6)
X	High Water Table (A2)		Marl Deposits (B15)		Sparsely Vegetated Concave Surface (B8)
X	Saturation (A3)		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):	
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
0-16	**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)		Dark Surface (S7)		2 cm Muck (A10)
	Histic Epipedon (A2)		Polyvalue Below Surface (S8)		Piedmont Floodplain Soils (F19)
	Black Histic (A3)		Thin Dark Surface (S9)		Anomalous Bright Loamy Soils (F20)
	Hydrogen Sulfide (A4)		Loamy Gleyed Matrix (F2)		Red Parent Material (F21)
	Stratified Layers (A5)		Depleted Matrix (F3)		Very Shallow Dark Surface (TF12)
	Organic Bodies (A6)	X	Redox Dark Surface (F6)		Other (Explain in Remarks)
	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]:

[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.**

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	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 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	Matrix		Redox Features					
(in)	Color (moist)	%	Color (moist)	%	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.**

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**	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-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	Matrix		Redox Features					
(in)	Color (moist)	%	Color (moist)	%	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**
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-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.

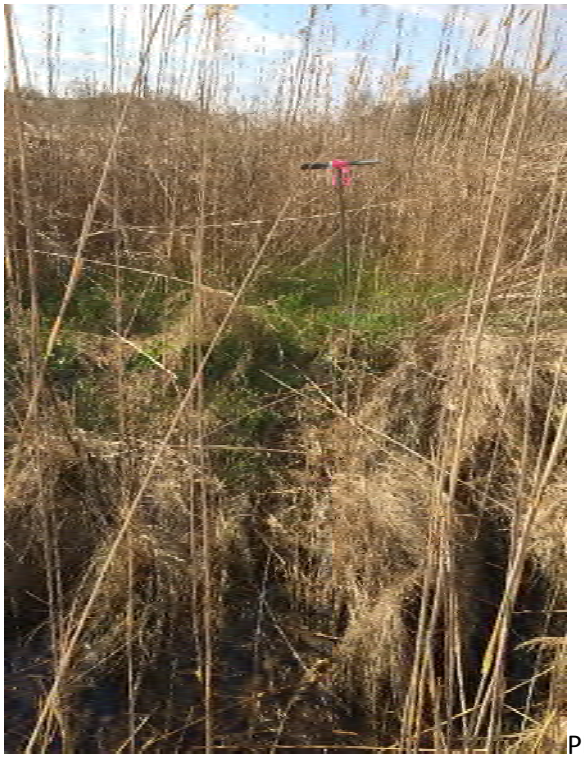
Photograph 11: View of intertidal zone along Atlantic Ocean in Study Area 1.

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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Figure 2 from Environmental Baseline Survey (EBS) for the Alternative 1 (Preferred Alternative) Site (*to be included following finalization of the EBS*)

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