Best Management Practices (BMP) and Mitigation Measures

U.S. Department of Commerce

National Telecommunications and Information Administration

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Introduction

This guide provides examples of best management practices (BMPs) and mitigation measures to help grant recipients (grantees) avoid or minimize potential impacts during the construction, deployment, and operation of NTIA funded broadband projects. NTIA may ***require*** recipients to implement mitigation or follow BMPs as a condition of its National Environmental Policy Act (NEPA) review. The application of BMPs may also be ***recommended*** as practicable or feasible during construction, deployment, and operation of the Proposed Action. BMPs or mitigation required as a condition of an NTIA Decision Document, including a Categorical Exclusion (CE) memo, a Finding of No Significant Impact (FONSI) or Record of Environmental Consideration (REC) are enforceable in accordance with grants administration regulations contained in 2 CFR Part 200, and can include measures ranging from corrective action plans up to and including termination of the award.

Approach

NTIA drew from several different resources to develop this guide. The FirstNet Authority, an independent authority within NTIA, prepared five regional programmatic environmental impact statements (PEISs) to analyze the potential impacts of the deployment and operation of the FirstNet communications network on the natural and human environment. NTIA reviewed FirstNet's Nationwide PEISs and publicly available PEISs from the U.S. Department of Agriculture, the National Flood Insurance Program, and Department of Energy for potential application to a variety of broadband deployment project types and technologies.

The BMP's included in this guide also build upon the substantial record of environmental analyses that NTIA required for the Broadband Technology Opportunities Program (BTOP), which funded the deployment of broadband internet infrastructure, public computer centers, and the sustainable adoption of broadband service to rural and underserved areas under the American Recovery and Reinvestment Act.

Types of Projects and Proposed Actions

A wide range of technologies may be used by grantees to implement and deploy their broadband projects funded by NTIA grant programs. The project types that are relevant to NTIA's grant program's mission objectives are listed in Table 1 below.

Table 1: Types of wired, wireless, satellite technology, and deployable technology projects that grantees may consider:

Project Type	Description
Wired Projects	
New Build – Buried Fiber Optic Plant	Plowing or trenching cable and/or cable conduit within public or (where necessary) private road, utility, or other rights-of-way (ROWs) or easements, along with new points of presence (POPs)a, huts, or other facilities.

Use of Existing Conduit New Buried Fiber Optic Plant	Installation of new fiber optic cable in existing, buried conduit. Ground disturbance would usually be limited to existing conduit entry and exit points.
New Build – Aerial Fiber Optic Plant	Installation of new poles with new cables in previously disturbed or new ROWs or easements or installing replacement poles in an existing ROW. Deployment may include new access roads, POPs, huts, or other facilities to house plant equipment.
Collocation on Existing Aerial Fiber Optic Plant	Installation of new fiber optic cable on existing poles. This may require structural hardening or reinforcement, and/or pole replacement.
Use of Existing Buried or Aerial Fiber Optic Plant or Existing Submarine Cable	Activation of existing unused (dark) fiber. Deployment may require the installation of new equipment, usually in existing equipment huts.
New Build – Submarine Fiber Optic Plant	Installation of sealed cables in limited near-shore or inland bodies of water, along with new onshore landings and facilities to accept cable, which are typically buried close to shore
Installation of Optical Transmission or Centralized Transmission Equipment	Installation of equipment as part of the core network deployment. This equipment is usually installed in small boxes or huts in the ROW of the utility corridor and may involve construction of access roads.
Wireless Projects	
New Wireless Communication Towers	Installation of new towers, antennas, and/or microwave dishes to support wireless infrastructure, along with generators, equipment sheds, fencing, lighting, electrical feeds, concrete foundations and pads, and/or access roads.
Collocation on Existing Wireless Tower, Structure, or Building	Mounting or installation of equipment such as antennas or microwave dishes on existing towers, along with power units in some cases. Existing towers, structures, or buildings may require structural hardening or increased physical security measures.
Deployable Technologies	
Cell on Wheels (COW)	A cellular base station on a trailer with an expandable antenna mast, designed to be part of a cellular network and augment existing capacity. COWs typically include a small

	generator and microwave or satellite link.
Cell on Light Truck (COLT)	A cellular base station on a light truck platform with an expandable antenna mast, designed to be part of a cellular network and augment existing capacity. COLTs typically contain a small generator and microwave or satellite link.
System on Wheels (SOW)	A full base station and controller on a large towable trailer or truck, with a large antenna mast, suitable to address larger localized coverage or capacity shortages in the event of large incidents. A SOW can support an island system with no need for satellite/microwave link back, and typically includes a generator.
Deployable Aerial Communications Architecture (DACA)	Aerial vehicles such as drones, piloted aircraft, weather balloons, and blimps deployed at varying altitudes, capable of providing wide-area coverage, although with relatively low capacity/throughput. DACA would be generally used for addressing wide-scale loss of coverage after a major catastrophic event.
Satellite Technologies	
Satellite-Enabled Devices and Equipment	Installation of permanent equipment on existing structures or the use of portable devices that use satellite technology, such as satellite phones or video cameras.

How to Use this Guide

This guide identifies typical BMPs and mitigation measures for broadband project types by resource area and provides project specific recommendations where appropriate. The lists included here are not exhaustive; consultation with resource agencies, permit requirements, or environmental reviews specific to a grant-funded proposed action may identify additional site-specific BMPs and mitigation measures necessary for compliance with NEPA and other applicable laws, regulations, statutes, and executive orders. Where the guide references specific guidelines or regulations, grantees should confirm that the cited version remains current and seek assistance from the NTIA Federal Program Officer or Environmental Program Officer if necessary.

This guide is organized into four sections. The first section covers general recommendations of best management practices that are applicable to all project types. All grantees should review Section 1 to identify best management practices that could be applied to their project across thirteen different Resource Areas. The remaining sections focus on best management practices specific to project type.

After reviewing Section 1, grantees should review any additional sections relevant to their project type. Section 2 includes best management practices specific to wired projects, Section 3 includes best management practices specific to wireless projects, and Section 4 include best management practices specific to deployable technologies.

Applicable to All Project Types

1.1 Resource Area: Roads, Right-of-Ways, Utilities, and Emergency Services

This section describes BMPs and mitigation measures to address potential impacts to existing roads, rights-of-way, and utilities. Grantees and/or their project partners would require, as practicable or feasible, the following BMPs and mitigation measures to reduce potential impacts:

Typical BMPs and Mitigation Measures
• Follow all applicable federal, state, and local requirements for construction on or near public roads. • Follow all applicable federal, state, and local laws concerning traffic speed and safety during the transport of equipment. • Follow all applicable federal, state, or local requirements regarding utilities (water, sewer, power, and electricity) and construction within a utility ROW as to not exceed any acceptable limits. • Follow all applicable state and local one-call laws and procedures for buildouts. • Schedule deployment activities outside of peak traffic hours and avoid roads with heavy traffic volumes during peak travel hours, when scheduling the transport of heavy equipment or construction materials. • Design staging areas to minimize unnecessary equipment and material mobilizations. • Repave and restore disturbed roads and public road rights-of-way (ROWs), in accordance with federal, state, and local laws, as quickly as possible to minimize traffic impediments that hinder access to local public safety and emergency facilities and to allow traffic capacity and safety conditions to return to their pre-construction condition. • Design new deployment activities within ROWs, to the extent possible, and outside of roadways and thoroughfares to minimize potential impacts on traffic flow or safety. • Coordinate closely with public safety officials, emergency and medical facilities, and existing telecommunications providers so that each is aware of the deployment activities and schedule. • Schedule new construction outside of seasons known to cause more accidents (e.g., hurricane or winter storm seasons or times of the year when wildfires are more likely to occur) so that potential service disruptions are less likely to coincide with times of increased demand. • Confirm or otherwise install detection systems so that if a disruption to utility services or telecommunications systems occurs, it is identified and can be repaired quickly. • Implement a backup telecommunications system, as needed and feasible, which allows first responders to communicate during deployment activities.

- Complete deployment activities as quickly and safely as possible to avoid any possible disruptions to utility services.
- Complete deployment activities that could interrupt power during non-peak times to minimize disruption of service.

1.2 Resource Area: Soils

Implementation of the Proposed Action and alternatives could include potential construction related impacts to soil resources resulting from ground disturbance activities. Grantees and/or its partners would require, as practicable or feasible, the following BMPs and mitigation measures, to further reduce potential impacts:

Typical BMPs and Mitigation Measures

- Follow all applicable federal, state, and local requirements for soil erosion and sedimentation control and permitting to avoid or minimize erosion and sedimentation and restore disturbed soil.
- Minimize soil disturbance to the extent practicable, especially in wetlands and designated natural resource areas.
- Avoid construction in areas with steep (greater than 20 percent) or unstable slopes with soils known to be particularly susceptible to soil erosion and construct facilities in alternate locations, if practical.
- Develop a soil erosion and sedimentation control plan for disturbed areas and implement BMPs and mitigation measures including the use of silt fences, fiber rolls, gravel bag berms, erosion control blankets, retention ponds, straw and sandbag barriers, and other controls as needed to reduce soil erosion, stormwater runoff, and sedimentation.
- Schedule construction activities to avoid the movement of heavy equipment across land surfaces immediately following heavy rainfall or cover exposed areas with tarps or similar materials to prevent exposure.
- Minimize the area of bare soil at any one time as much as possible by constructing in stages.
- Revegetate disturbed areas as progressively and quickly as practicable to achieve stabilization.
- For areas requiring plowing, remove and store topsoil with a woven weed barrier or similar material for post-construction site restoration.
- Segregate topsoil or surface soil from subsurface layers to avoid compaction, and avoid areas identified as having soils vulnerable to compaction by selecting alternate locations to construct facilities, if practical.
- All vehicles should stay on existing roads or previously disturbed areas to the maximum

extent practicable. Use timber mats or similar infrastructure to distribute vehicle and heavy equipment weight.

- Use deep tillage procedures where practical to loosen compacted soils.
- Restore soil surface to original or improved contours.
- Identify and maintain topsoil and implement temporary topsoil storage areas. Replace topsoil as soon as possible following construction.

1.3 Resource Area: Geology

Environmental concerns regarding geology can be viewed as two distinct types, those that would potentially result in impacts to the project, such as seismic hazards, landslides, and volcanic activity, and those that would potentially be impacts from the project, such as land subsidence, mineral and fossil fuel resources, paleontological resources, and impacts to resources such as surface geology, bedrock, topography, physiography, and geomorphology.

For those areas with the potential to encounter geologic hazards, grantees and/or its partners would require, as practicable or feasible, the BMPs and mitigation measures listed below, to further reduce potential impacts:

Typical BMPs and Mitigation Measures

- Follow all applicable federal, state, and local requirements for construction codes, seismic criteria, and geotechnical designs.
- Follow all applicable federal, state, and local requirements for mineral, fossil fuel, and paleontological resources.
- Locate construction/deployment activities outside of seismically active areas, high-risk seismic hazard zones, active faults, and away from low coastal areas. Avoid construction in locations with karst topography or that have shown recent subsidence, or steep or unstable slopes that are susceptible to erosion.
- Avoid, to the extent practicable, deployment in areas that undergo significant geomorphological changes, such as within streams and rivers.
- Design and deploy resilient infrastructure to withstand earthquakes typical to the region.
- Consider alternate methods to trenching for placement of fiber optic cable and transmission lines in sensitive areas.
- Avoid rock ripping to preserve bedrock resources, topography, and physiography.
- Minimize the area/volume of disturbed terrain during construction.
- Avoid areas with significant fossil resources. If areas with significant fossil resources cannot be avoided, closely monitor construction activities and develop a Paleontological Monitoring and Mitigation Plan outlining areas with high likelihood for encountering significant fossil resources and plans for avoidance. If paleontological resources are

encountered on a project site, suspend all work until a certified paleontologist has been brought on-site to oversee project activities and ensure that fossil resources are handled properly, in accordance with applicable laws and regulations.

- Limit construction to areas that are not actively mined or undergoing mineral or other material or petroleum extraction activities, or coordinate deployment with mining and extraction activities (both existing and planned) in active areas.
- Restore topographic features and grades to pre-construction/deployment conditions.

1.4 Resource Area: Water Resources

Implementation of the Proposed Action and alternatives could include potential deployment-and operation-related impacts to water resources resulting from ground disturbance activities, such as an increase in erosion or sedimentation near construction and staging areas. Grantees and/or its partners would require, as practicable or feasible, the following BMPs and mitigation measures, to further reduce potential impacts:

Typical BMPs and Mitigation Measures

- Follow all applicable federal, state, and local requirements for soil erosion and sedimentation control and permitting to avoid or minimize introduction of eroded materials into waterbodies.
- Establish and clearly mark all waterbody buffers in the field with signs or highly visible flagging until construction-related ground disturbing activities are complete.
- Minimize in-stream work to the extent practicable. Route the stream crossing to minimize the number of waterbody crossings where waterbodies meander or have multiple channels. Construct all stream crossings (roads and trenching) as close as perpendicular to the axis of the waterbody channel as engineering and routing conditions permit.
- Use standard upland construction techniques when crossing waterbodies when they are dry or frozen and not flowing or as required by permit or law, if it is not likely for flow to resume during construction and prior to post-construction stabilization. If in-stream construction (trenching or roads) must be conducted during times that streams have flow, maintain adequate waterbody flow rates to protect aquatic life and prevent the interruption of existing downstream users.
- Do not permit underwater blasting and pile driving activities in any waterbody.
- Avoid actions that could potentially impact a sole source aquifer. If the project has the potential to impact a sole source aquifer, the project must be reviewed by the Environmental Protection Agency.
- Develop management plans for wetlands, vegetation management and restoration, water quality protection, and erosion and sediment control.
- Where construction is required, maintain natural drainage patterns to the extent practicable by installing culverts in sufficient number and size to prevent ponding,

diversion, or concentrated runoff. Properly space and size culverts in accordance with federal, state, or local regulations.

- Develop a Storm Water Pollution Prevention Plan (SWPPP), including engineered or site designed methods to control stormwater. For large-scale construction activities, implement stormwater reduction methods, such as minimizing impervious surfaces and using porous materials, directing runoff to stormwater drains, and collecting and reusing stormwater in retention ponds, wetlands, filtration structures, or rain gardens.
- Develop a Spill Prevention, Control, and Countermeasure (SPCC) Plan to prevent, contain, and report accidental spills.
- Minimize ground disturbance in or near waterbodies during construction, by minimizing the total area of bare soil, restoring native vegetation, and using silt fences and erosion control blankets.
- Stabilize approaches to streams and stream crossings with clean rock or steel plates during construction to minimize erosion and sedimentation. Avoid construction activities during rainy or snowmelt seasons when runoff is highest and avoid construction in areas with steep or unstable slopes with soils known to be particularly susceptible to soil erosion.
- Use existing access roads whenever possible and use wide-tracked or low-ground pressure construction equipment operating from the ROW, timber mats, or prefabricated equipment mats.
- Monitor site restoration following ground disturbance activities and implement contingency measures if site restoration should fail and soil erosion occurs.
- Park vehicles at least 50 feet from any stream or wetland unless authorized by a permit or on an existing roadway. Inspect and maintain tanks and equipment containing oil, fuel, or chemicals for drips or leaks to prevent spills to the ground or directly into waterbodies.

1.5 Resource Area: Wetlands and Floodplains

Implementation of the Proposed Action and alternatives could include potential deployment- and

operation-related impacts to wetlands resulting from ground disturbance activities. Grantees and/or its partners would require, as practicable or feasible, the following BMPs and mitigation measures, to further reduce potential impacts:

Typical BMPs and Mitigation Measures

- Follow all applicable federal, state, and local requirements and BMPs related to potential wetland impacts and permitting to avoid or minimize potential wetland impacts, compensate for unavoidable impacts to wetlands, and restore impacted wetlands.
- Follow all BMPs and mitigation measures related to minimizing soil erosion, sedimentation, and soil compaction presented in Section 1.2, Soils.
- Conduct a detailed baseline study of the wetland to be impacted, if impacts to a specific wetland are unavoidable, to aid in restoration of pre-impact condition, including, as appropriate or required by law, a survey of wetland contours, soil texture and profile; plant species, structure, and cover; and hydrology.
- Avoid construction activities within wetlands to the greatest extent practicable. When construction within wetlands is unavoidable, maintain natural drainage patterns to the extent practicable by installing culverts in sufficient number and size to prevent ponding, diversion, or concentrated runoff, and time the use of heavy equipment to avoid periods of heavy moisture. Avoid diversion of surface water and groundwater sources, which could affect nearby wetlands.
- Avoid above and belowground wetland crossings. When crossing a wetland is unavoidable, take advantage of already disturbed areas such as easements, roads, roadway shoulders, bridges, or old railroad beds.
- Create and maintain buffer zones around wetlands to protect their functions and values.
- Preserve existing tree canopies and natural areas in and around wetlands as much as possible. When cutting wetland vegetation is unavoidable, complete the work by hand (chain or hand saw) instead of using large equipment.
- Span wetlands by locating telecommunication poles on either side of the wetland, instead of disturbing the interior.
- Avoid temporarily storing or stockpiling materials in wetland areas or in areas that could alter wetland hydrology (causing damming and flooding) or impede or divert water (causing drying). When unavoidable, place temporary fill on geotextile fabric.
- Where practicable, do not use heavy equipment within wetlands, even temporarily, and do not travel through wetlands. Use wide-tracked, or low-ground pressure construction equipment and/or conventional equipment operating from the ROW, timber mats, or prefabricated equipment mats.
- Do not store hazardous materials, chemicals, fuels, and lubricating oils in wetlands. Do not maintain, store, wash, or repair equipment in or near (within 100 feet of) wetland areas to avoid spills or contamination.
- Clearly mark the boundaries of wetland areas to be avoided during construction using flagging and maintain markers until reclamation is complete. Train equipment operators on the activities to avoid within or near wetlands.
- Install and maintain sediment barriers at saturated wetlands or wetlands with standing water across the entire construction ROW upslope of the wetland boundary and where saturated wetlands or wetlands with standing water are adjacent to the construction

ROW as necessary to prevent sediment flow into the wetland.

- Use gravel for road surfaces where possible to avoid an increase in permeable surfaces and use proper drainage structures to minimize sedimentation and erosion to adjacent wetlands.
- Prohibit use of herbicides or pesticides within 100 feet of any wetland (unless allowed or required by the appropriate land management, tribal, or federal, state, or local agency).
- Consult local wetland restoration guidance, including communicating with local agencies and other wetland and restoration scientists. Use suggested up-to-date published restoration manuals to ensure that appropriate wetland restoration measures are followed and to increase restoration success.
- In areas where wetlands would be restored, stockpile wetland topsoil and sod mats removed during installation using standard reclamation protocol. Re-use the topsoil and sod mats in the post-construction wetland restoration.
- Revegetate bare areas as progressively and quickly as possible (preferably within the same growing season) to stabilize soils, reduce sedimentation, and avoid the spread of invasive species. Install erosion protection and leave in place until the area is revegetated and the soil is stabilized.
- Ensure any development proposed in a floodway or floodplain meets or exceeds state or local regulations.
- Place materials storage and staging areas outside of waterways and floodplains.
- Avoid construction of roads and other impervious surfaces in floodplain areas to the extent practicable, and where necessary in floodplains, construct roads and other impervious surfaces level with existing grades to not change or restrict water flow.

1.6 Resource Area: Biological Resources

The potential for impacts to biological resources, including terrestrial vegetation, wildlife, fisheries and aquatic habitats, and threatened or endangered species, could occur through activities such as land clearing, excavation activities, construction, or operation of ground-based and aerial vehicles. Potential impacts to threatened and endangered species are expected to be less than significant with the incorporation of BMPs and mitigation measures.

1.6.1 Terrestrial Vegetation

Subgrantee and/or its partners would require, as practicable or feasible, the following BMPs and mitigation measures, to further reduce potential impacts to terrestrial vegetation:

Typical BMPs and Mitigation Measures
• Follow all applicable federal, state, and local requirements for vegetation removal, disturbance, and restoration. Obtain all appropriate permits and comply with permit

conditions to minimize or avoid impacts to vegetation.

- Avoid construction/deployment in areas with high quality habitat or sensitive vegetation (i.e., woodlots and wetlands), unique habitat (i.e., shorelines and streambanks), or designated natural resources.
- Minimize land clearing and vegetation disturbance, specifically to native vegetation, by using existing roads, previously disturbed areas, and unvegetated areas, and consolidate construction activities and staging areas as much as possible (collocation and use of existing ROWs) to reduce vegetation loss. Minimize construction of all roads, fences, and other ancillary facilities to reduce overall vegetation loss.
- Control the spread of invasive plants and animals by inspecting and cleaning equipment and vehicles before moving from one deployment site to another. Identify all areas within the proposed construction footprint that contain noxious or invasive plants and use pre-construction treatments such as mowing or herbicide applications (not within 100 feet of any wetland) in consultation with appropriate agencies and stakeholders prior to ground disturbance activities. Store soil containing noxious or invasive plants awaiting proper disposal, in a location away from clean topsoil and subsoil.
- Restore disturbed areas as progressively and quickly as possible to pre-construction use and vegetation cover using native and certified seed mixes and seed dispersal, management, and maintenance processes. Close and revegetate any temporary and unnecessary roads after completion of the project.
- Conduct post-construction monitoring inspections after the first growing season to determine success of revegetation, unless otherwise required by a permit.

1.6.2 Wildlife

Subgrantee and/or its partners would require, as practicable or feasible, the following BMPs and mitigation measures, to further reduce potential impacts to wildlife:

Typical BMPs and Mitigation Measures
• Engage in early consultation with appropriate agencies and stakeholders as necessary, including but not limited to USFWS, National Marine Fisheries Service (NMFS), and other relevant federal or state wildlife and natural resources agencies. • Follow guidelines outlined by the Avian Power Line Interaction Committee and USFWS (APLIC, 2012) for any aboveground lines or cables (e.g., use of diverters). • Implement seasonal and spatial buffer zones around sensitive areas for deployment and maintenance activities, where possible, as recommended by USFWS and state wildlife and natural resources agencies. • Implement the National Bald Eagle Management Guidelines (USFWS, 2007); • Assess locations of roost sites for bats and timing of critical life stages (e.g., maternity

and weaning periods) and hibernation for deployment and associated activities (these times vary greatly depending on region, species, and habitat).

- Avoid construction/deployment in areas with sensitive vegetation, unique habitat, or designated natural resources.
- Avoid Important Bird Areas (IBAs) and other known important bird habitats to the maximum extent practicable.
- Turn off all unnecessary lighting at night. If nighttime lighting is required use motion sensor security lights that are activated as needed. Minimize or avoid the use of sodium vapor lights at site facilities to reduce attraction of migratory birds.
- Install nest exclusion devices on existing or new structures to discourage nest construction and use.
- Where mowing is required for site maintenance, ensure a minimum mower height of 18 inches to reduce potential mortality to tortoises and snakes.
- Limit construction equipment and vehicles to approved roads or ROWs but avoid roads and rights-of-way that provide access to critical wildlife habitat, and near known migration routes (especially terrestrial and semi-aquatic wildlife routes), stopover sites, and large blocks of habitat.
- Consolidate facilities as much as possible (collocation and use of existing ROWs) to reduce potential habitat loss. Minimize construction of all roads, fences, and other ancillary facilities to reduce habitat fragmentation.
- Develop “good housekeeping” procedures to ensure that sites would be kept clean of debris, garbage, and fugitive trash or waste during operation, including micro trash.
- Develop monitoring programs, adaptive management strategies and outline the plans that are reviewed and approved periodically.
- Avoid development in areas that contain high densities of breeding or wintering birds, in high wildlife use areas, migratory staging areas, woodlots, riparian corridors, Audubon Important Bird Areas, Nature Preserves, State and National Parks, State Forests, Fish and Wildlife Areas, and other publicly owned properties.
- Instruct all construction employees to avoid harassment and disturbance of wildlife, especially during reproductive (e.g., courtship, lambing/calving, pupping and molting [haulout period], spring/fall migrations) seasons. Do not permit pets on site to avoid harassment and disturbance of wildlife and prohibit hunting or fishing or any other action that would result in the disturbance of wildlife.
- Minimize herbicide and pesticide use during maintenance activities to the extent possible and prohibit use of herbicides or pesticides within 100 feet of any wetland (unless allowed or required by the appropriate land management, tribal, or federal, state, or local agency).
- Report observations of potential wildlife interactions, including wildlife mortality, to the appropriate agency immediately.

1.6.3 Fisheries and Aquatic Habitats

Subgrantee and/or its partners would require, as practicable or feasible, the following BMPs and mitigation measures, to further reduce potential impacts to fisheries and aquatic habitats:

Typical BMPs and Mitigation Measures
• Follow all applicable federal and state requirements for construction activities near/in fish and fish habitat. Engage in early consultation with appropriate agencies and stakeholders, including but not limited to USFWS, NMFS, and other relevant federal or state wildlife and natural resources agencies. • Establish buffers around sensitive areas (e.g., nesting sites, wetlands, haulouts) and avoid construction during sensitive seasons for fish, such as migration, spawning, egg development (including intra-gravel development) and larval fish (benthic or pelagic) development (sensitive seasons/time periods vary by species and location). Minimize construction noise in and near fish habitats. Assess critical life stages of marine mammals in haulouts within 1 mile of deployment and associated activities. • Avoid construction/deployment in riparian zones, coastal wetlands, marine preserves, reefs, inland waterways, and wetlands since construction could potentially result in less refuge for fish, fundamental changes in channel structure (e.g., loss of pool habitats), instability of stream banks, and alteration of nutrient and prey sources within the shoreline aquatic community. • Avoid physical barriers in waterbodies during installation and operation to allow for the migration of invertebrates and other aquatic fauna. Provide for the passage of fish and wildlife in new crossings and avoid reducing the efficiency of a structure to allow passage. • Minimize the use of coastal lighting, particularly in the vicinity of known turtle nesting areas. If the use of coastal lighting in sea turtle use areas is unavoidable, use turtle safe lighting instead of normal lights (i.e., low-pressure sodium-vapor lighting or red lights that emit a very narrow portion of the visible light spectrum) and consult with local sea turtle experts on the design of the coastal lighting plan. • Minimize the amount of fill placed in wetlands and streams when constructing access roads by installing bridges and or culverts. Use culverts and bridges that are appropriately designed and sized for fish passage. • Use setbacks when clearing vegetation for construction from riparian zones to avoid removal of important fish cover such as vegetation, boulders, and large woody debris. • Implement an emergency response plan for fuel spills and environmental emergencies. Include secondary containment for hazardous materials, such as fuels, and use uplands away from streams and waterbodies for refueling of construction or operations equipment. Report spills or other observed pollutants to the appropriate agency immediately. • Implement invasive species plans to minimize introduced aquatic plant and animal species into the project area, such as inspecting and cleaning equipment and vehicles

before moving from one deployment site to another.

- Instruct all construction employees to avoid harassment and disturbance of fish and other aquatic species and report any signs of mortality to the appropriate agency immediately.
- Minimize sedimentation and turbidity in fish habitats by implementing sediment and erosion control measures, including the use of silt fences, silt curtains, erosion control blankets, and avoiding the removal of vegetation or siting projects in areas with poor bank or shoreline stability.
- Perform regular maintenance checks of equipment near protected areas to minimize detachment of components reaching critical habitat by tidal flow.

1.6.4 Threatened and Endangered Species

To avoid or minimize potential effects of deployment activities to threatened and endangered species, BMPs and mitigation measures, listed below, may be implemented as appropriate to minimize potential impacts:

Typical BMPs and Mitigation Measures

- Follow all applicable federal and state requirements for construction activities and engage in early consultation with appropriate agencies and stakeholders including, but not limited to, USFWS, NMFS, and other relevant federal, or state wildlife and natural resources agencies.
- Avoid conducting construction activities in areas with known locations or habitats for threatened and endangered species.
- Establish buffers around habitat areas of listed species. Implement seasonal and spatial buffer zones for operational and construction and other potentially disturbing activities during sensitive periods for listed species such as breeding, nesting, calving/pupping, haulout, migration, spawning, and egg development as identified by USFWS, NMFS, and/or other relevant federal or state agencies.
- Avoid bat roosting areas, particularly maternity roost colonies, during critical life stages for deployment and associated activities (i.e., approximately April to November).
- Follow food and waste management protocols to minimize attractants to the deployment site.
- Report observations of sensitive species that are injured, dead, or entangled to the appropriate agency immediately.
- Use site-appropriate native plants and invasive-free materials (e.g., seed mixes, rock, mulch, soil) for revegetation and restoration efforts.

1.7 Resource Area: Land Use, Recreation, and Airspace

Implementation of the Proposed Action and alternatives could include potential deployment and operation-related impacts to land use, recreation, and airspace resulting from activities including the construction or installation of infrastructure, or placement of deployable assets. Grantees and/or its partners would require, as practicable or feasible, the following BMPs and mitigation measures, to further reduce potential impacts:

Typical BMPs and Mitigation Measures

• Land Use
  ○ Follow applicable federal, state, and local land use and zoning plans and policies to ensure compatibility with existing and surrounding land uses.
  ○ Contact appropriate agencies, property owners, and other stakeholders early in the planning process to identify potentially sensitive land uses and land use issues and concerns specific to the region.
  ○ Signage areas, access roads, and/or easements that would require temporary closure or limited access to accommodate certain land uses.
  ○ Schedule construction activities, where to minimize impacts to existing and surrounding land uses.
  ○ Utilize existing roads, ROWs, easements, and utility corridors to minimize the number of new access roads.
  ○ Give preference to development options that involve the use of existing physical infrastructure, and/or that do not involve new aboveground structures (e.g., collocation on existing structures, new buried or undersea infrastructure, etc.), especially near recreation lands.
  ○ Avoid or minimize construction activities in areas covered by existing incompatible easements.
  ○ Retain existing vegetation wherever possible to provide visual screening of new infrastructure.
  ○ Select infrastructure designs that minimize contrast with the surrounding landscape and land uses.
• Recreation
  ○ Contact appropriate agencies, property owners, and other stakeholders early in the planning process to identify recreation activities specific to the region and their respective seasons.
  ○ Signage areas, access roads, and/or recreation trails that would require temporary closure, limited access, or detours to accommodate certain recreation activities.
  ○ Schedule deployment activities, where feasible, to not interfere with seasonal

recreation activities.

- Utilize existing roads, ROWs, easements, and utility corridors to the maximum extent feasible and to minimize the number of new access roads.
- Complete deployment activities with minor, temporary impacts to recreation resources during periods or seasons of low use.
- Give preference to infrastructure locations that are compatible with existing park or recreation planning documents.
- Complete deployment activities, to the extent practicable, outside of and away from existing recreation location.
- Select infrastructure locations that are as far from recreation lands as possible.

- Airspace
  - Follow all applicable federal, state, and local requirements for preservation of the airspace to avoid or minimize reducing existing capacity, decreasing safety, negatively impacting current operations, or increasing the risk to airspace users or persons and property.
  - Avoid deploying and operating wired and wireless sources near airports/facilities that trigger the need for an OE/AAA by the FAA based on height and airport elevation criteria.
  - For new construction, prepare site plans with sufficient detail to assess potential impacts to special use areas, restricted airspace, and general and military aviation.

1.8 Resource Area: Cultural Resources

Deployment involving ground disturbance has the potential to damage or destroy archaeological sites, and the attachment of communications equipment to historic buildings and structures has the potential to cause damage to features that are historically significant. Implementation of the Proposed Action could result in impacts to visual resources through the construction of towers, structures, roads, or other permanent features, as well as the installation of security or aviation lighting. Grantees and/or its partners would require, as practicable or feasible, the following BMPs and mitigation measures, to reduce potential impacts:

Typical BMPs and Mitigation Measures

- Follow all applicable federal requirements for agency and tribal consultation on the identification and assessment of effects to cultural resources.
- Comply with all relevant and applicable federal, state, or local regulations and guidance regarding visual and aesthetic conditions and impacts.
- Follow all applicable federal and state requirements if inadvertent discoveries of human remains are made during deployment or operations.
- Avoid deployment in areas with known historic properties and deploy equipment and facilities in alternate locations, if possible.
- Ensure usage of an appropriate indirect effects Area of Potential Effects as part of pre-siting or pre-deployment surveys to sufficiently account for potential indirect effects to cultural resources.
- Establish procedures for pre-deployment monitoring if a project has the potential to adversely and indirectly affect historic properties to collect baseline data, monitor potential indirect effects during deployment, and determine if effects have occurred post-deployment.
- Develop BMPs and mitigation measures as part of a Memorandum of Agreement or Programmatic Agreement to address any potential effects, if they were to occur.
- Use low-impact construction alternatives, when feasible. For instance, ripping could be used as an alternative to blasting near structures or archaeological sites identified as at risk of effects from vibration. Other techniques, such as bored piling, could be used to minimize the vibration generated.
- Restrict the timing of deployment activities so as not to disturb the use of historic properties. Stop work at certain times when traditional and/or religious properties are in use, such as religious festivals or cultural ceremonies.
- Consult with site users through a community liaison team to understand site usage and how the project could affect user access.
- Arrange alternative access using stakeholder input if access to an important cultural heritage site is restricted or blocked. Notify the public of the blockage and alternate means of access.
- Select infrastructure designs that minimize construction footprints.
- Design projects to mitigate potentially negative visual and auditory impacts of facilities, such as noise-reducing barriers, low-profile constructions, proper siting to maximize the use of topography and vegetation, screening, blending with topographic forms and existing vegetation patterns, and use of environmental coloration or advanced camouflage techniques to limit visual effects.
- Proposed design should take into account the scenic character of the surrounding area to reasonably minimize or avoid visual impacts to the surrounding area when viewed from existing roadways or shorelines (design structures to complement the natural landscape; for example, use paint that blends with the surrounding landscape).

- Give preference to development options that involve use of existing physical infrastructure (e.g., collocation on existing structures, new buried or undersea infrastructure, etc.), and specifically avoid the construction of new aerial fiber optic plant and/or new wireless communication towers within or in locations within sight of federal or other lands where visual resources are regulated (e.g., units of the National Park System, or areas where local zoning regulations emphasize protection of views or aesthetic conditions), or where residents and visitors have come to expect high visual quality and the absence of human-built structures.
- Utilize non-reflecting coatings to towers, antennas, buildings, and associated structures where possible.
- Select infrastructure locations that are screened from view by topography and/or vegetation, that do not require noticeable permanent changes in landforms (i.e., cut and fill) or vegetation, and that are as far from surrounding residences as possible.
- Implement sensitive grading techniques that blend with the natural terrain, and where appropriate, use vegetation as screens to block views of structures and roadways.
- Revegetate disturbed areas as progressively and quickly as practicable to restore vegetative cover.
- Reduce or eliminate the need for lighting on poles or structures or restrict the duration and directionality of needed lighting.
- Comply with the BMPs and mitigation measures for towers required by USFWS, as detailed in Section 1.6.2, Wildlife Resources.

1.9 Resource Area: Air Quality

The Proposed Action has the potential to generate air pollutant emissions through construction and deployment activities, including the use of large vehicles, heavy machinery, or generators.

Grantees and/or its partners would require, as practicable or feasible, the following BMPs and mitigation measures to further reduce potential impacts:

Typical BMPs and Mitigation Measures

- Follow all applicable federal, state, and local requirements for obtaining air pollution control permits for applicable emission sources and follow standards for nuisance and fossil fuel-powered generators.
- Avoid constructing and operating emission sources in extreme or severe nonattainment areas and Class I Areas, and ensure all activities comply with general conformity requirements in nonattainment and maintenance areas.
- For equipment with internal combustion engines, use engines certified to the lowest emission standards and engines that burn alternative fuels (e.g., natural gas, biofuels), and/or install emission control devices.

- Ensure all diesel engines are compliant with USEPA emission standards for the corresponding engine class, and when possible, use low-sulfur or ultra-low-sulfur diesel fuel in construction equipment, trucks, vehicles, and generators.
- When possible, use vehicles with hybrid or electric technology to reduce or eliminate criteria pollutant emissions from fuel combustion.
- Obtain permits, where required, to install and operate fossil fuel-powered generators. If possible, consider using hydrogen-fueled generators to reduce nitrous oxide emissions.
- To control dust from construction or other land-disturbing activities, spray water on roads/construction areas, limit the area of uncovered soil to the minimum needed for each activity, site staging areas to minimize fugitive dust, use a soil stabilizer (chemical dust suppressor), mulch areas or use a temporary gravel cover, limit the number and speed of vehicles on the site, and cover trucks hauling dirt.
- Implement a dust control plan for construction activities and any travel over unpaved roads, and post and enforce speed limits on dirt/gravel roads to reduce airborne fugitive dust.
- Limit idling time of construction vehicle and equipment and conduct proper vehicle maintenance.
- Minimize the time of operation of UAS or aircraft below the mixing height (i.e., typically estimated at 3,000 feet above ground level), and use electric or alternate fueled ground support equipment for UAS or other aircraft.
- Ensure all activities conform to the latest air quality regulations called State Implementation Plan (SIP) which are approved by the EPA.
- Ensure all equipment is appropriately sized for the project.
- Ensure all fuel-burning equipment including, but not limited to, heavy construction equipment, power generators, and aerial platforms are maintained in accordance with manufacturer's specifications.

1.10 Resource Area: Noise and Vibrations

The Proposed Action has the potential to generate noise and vibration during construction activities, deployment, and operation of various equipment. Grantees and/or its partners would require, as practicable or feasible, the following BMPs and mitigation measures, to reduce potential impacts:

Typical BMPs and Mitigation Measures
• Follow all applicable federal, state, and local requirements for construction noise and vibration restrictions. • For those projects involving heavy equipment for deployment that can generate noise and vibration, avoid deployment in areas with highly sensitive receptors and construct facilities in alternate locations. Such sensitive areas include foraging or breeding areas for

disturbance-sensitive congregatory species (such as some species of bats, colonial waterbirds, and seabirds), particularly those species that are listed as threatened or endangered, as well as wilderness areas (where recreational activities such as hiking, bird watching, etc. occur).

- For construction and grading activities near populated areas, heavy equipment should use noise mufflers to limit noise exposure on noise-sensitive receptors.
- For construction and grading activities near other noise sensitive receptors, including parks or other protected areas, heavy equipment should use noise mufflers to limit noise exposure, and the use of such equipment should be limited to operation only during daytime hours.
- Follow all state and federal guidelines for limiting aircraft noise on populated areas and over national parks.
- Equipment that is expected to generate significant noise and vibration should include mitigation measures during the design and implementation phases of the project (e.g., use of noise barriers such as walls, shrubbery).
- Limit construction activities to daytime hours (7 a.m. to 7 p.m.) to the extent possible when increased noise and vibration levels are more tolerable and avoid construction on Sundays and legal holidays.
- Implement BMPs and mitigation measures as directed by the local jurisdiction such as avoiding unnecessary revving of engines, switching off equipment when not in use, changing location of stationary construction equipment, minimizing drop height of materials, replacing conventional audible reversing alarms with more quiet alternative reversing warning systems, setting equipment away from noise sensitive areas (if practicable), notifying adjacent residents in advance of construction work, installing temporary acoustic barriers around stationary construction noise sources, and other controls as needed to reduce increased noise levels.
- Ensure, as practicable, all heavy equipment, power generators, and boats are maintained in accordance with manufacturer's specifications.

1.11 Resource Area: Human Health and Safety

Deployment involving construction activities has the potential for occupational injury to telecommunications workers. Grantees and/or its partners would require, as practicable or feasible, the following BMPs and mitigation measures, to further reduce potential impacts:

Typical BMPs and Mitigation Measures
• Follow all applicable federal, state, and local requirements for hazardous materials and hazardous waste management. • Utilize trained and licensed heavy equipment operators when available or required. • Develop site-specific Health and Safety Plans that identify all potential physical and

chemical hazards present at the site, including historic contamination.

- Develop and utilize Standard Operating Procedures for site preparation activities and include description of work practice controls and administrative controls.
- Ensure workers wear proper safety equipment, such as high visibility safety vests, hard hats, steel toe boots, gloves, eye protection, and hearing protection.
- Provide daily safety meetings to review activities, potential hazards, and safety objectives.
- Avoid site preparation work in areas with high vehicle traffic volume, such as road ROWs or in areas known to contain environmental contamination or mines.
- Incorporate all BMPs and mitigation measures listed in Section 1.4: Water Resources, Section 1.12: Air Quality and, Section 1.2: Soils
- Conduct air and noise monitoring to ensure levels stay within health-protective levels for communities and workers, and as required, that workers are trained and comply with personal protective equipment requirements as established by the Occupational Safety and Health Administration (OSHA).
- Search for the location of known contaminated sites prior to site selection in the area where the Proposed Action site is being considered, for new or existing infrastructure projects.
- Ensure that appropriate measures are taken in compliance with applicable regulations (including Resource Conservation and Recovery Act and Comprehensive Environmental Response, Compensation, and Liability Act) if construction occurs in an area where there is the potential for legacy contamination, to protect workers and the public from unacceptable levels of exposure to contaminants as a result of deployment activities.
- Establish an emergency response plan (including emergency preparedness and response activities, resources, and responsibilities) to attend to specific emergencies (e.g., accidental spills) that could arise during deployment.
- Ensure that reporting requirements are followed in the event that Emergency Planning and Community Right-to-Know Act reporting thresholds are reached for the shipping, handling or storage of gasoline or diesel used for equipment and generators.

2. Project Type: Specific to Wired Projects

2.1 Resource Area: Wetlands

Typical BMPs and Mitigation Measures
New Build – Buried Fiber Optic Plant • Avoid stockpiling material from directional drilling in a wetland, or where the stockpile could cause sedimentation into a wetland or dam water, causing flooding of a wetland area. Avoid setting up drilling equipment in a wetland. • Conduct dewatering in a manner that prevents erosion and prevents heavily silt-laden water from flowing directly into any wetland or waterbody if dewatering during an excavation. • Replace topsoil and restore original contours to the greatest extent practicable. • Install buried cable along existing road ROWs wherever possible to minimize vegetation clearing and other potential impacts to wetlands. • Use structures or devices to prevent sub-draining or groundwater movement along new trenched-in buried conduit such as anti-seepage collars, intermittent clay barriers, trench plugs, or clay saddles. New Build – Aerial Fiber Optic Plant • Install overhead transmission lines along existing road ROWs wherever possible to minimize vegetation clearing and other potential impacts to wetlands. New Build – Submarine Fiber Optic Plant • Avoid stockpiling material from directional drilling in a wetland, or where the stockpile could cause sedimentation into a wetland or dam water, causing flooding of a wetland area. Avoid setting up drilling equipment in a wetland. • Conduct dewatering in a manner that prevents erosion and prevents heavily silt-laden water from flowing directly into any wetland or waterbody if dewatering during an excavation

2.2 Resource Area: Wildlife

Typical BMPs and Mitigation Measures
New Build – Aerial Fiber Optic Plant • Install bat exclusions and/or deterrents on existing and new structures. • Follow recommendations and guidelines outlined by the Avian Power Line Interaction Committee and USFWS (APLIC, 2006) (APLIC and USFWS, 2005) (APLIC, 2012) for any aboveground lines or cables (e.g., use of diverters and anti-nesting devices).

2.3 Resource Area: Fisheries and Aquatic Habitats

Typical BMPs and Mitigation Measures
New Build – Buried Fiber Optic Plant • Use horizontal directional drilling where possible for stream crossings to avoid potential impacts to the streambed, banks, and associated fish habitat.

2.4 Resource Area: Threatened and Endangered Species

Typical BMPs and Mitigation Measures
New Build – Aerial Fiber Optic Plant • Follow guidelines outlined by the Avian Power Line Interaction Committee and USFWS (APLIC, 2012) for any above-ground lines or cables (e.g., use of diverters) or other structures (e.g., perch and nest diverters). Collocation on Existing Aerial Fiber Optic Plant • Follow guidelines outlined by the Avian Power Line Interaction Committee and USFWS (APLIC, 2012) for any above-ground lines or cables (e.g., use of diverters) or other structures (e.g., perch and nest diverters). Use of Existing Buried or Aerial Fiber Optic Plant or Existing Submarine Cable • Minimize underwater construction noise in all aquatic habitats by minimizing vessel speed, using quieter equipment or technologies, or deploying bubble curtains or other noise screens during underwater work. • Implement a marine observer program during construction and operation to avoid and minimize boat strikes.

2.5 Resource Area: Noise and Vibrations

Typical BMPs and Mitigation Measures
New Build – Submarine Fiber Optic Plant • Do not permit underwater blasting and pile driving activities in any waterbody.

3. Project Type: Specific to Wireless Projects

3.1 Resource Area: Wildlife

Typical BMPs and Mitigation Measures

New Wireless Communication Towers
• Site towers away from known communal bat use areas and high bird use areas to the extent practicable or feasible.
• Where practicable or feasible, locate towers more than three miles from any ocean or Great Lake shoreline.
  ○ If towers are closer than three miles to the shoreline, there should be site-specific studies and a preference for self-standing (un-guyed) towers that are short enough to not require lighting.
  ○ If towers are closer than three miles to the shoreline and sufficiently tall to require lighting, there should be site-specific studies and a preference for self-standing (unguyed) towers with lighting that does not include steady-burning lights.
• Follow updated FAA lighting requirements to eliminate steady-burning, flashing obstruction lights and use only flashing obstruction lights (FAA, 2016a).
• Implement guidance contained in the FCC notice “Opportunities to Reduce Bird Collisions with Communications Towers While Reducing Tower Lighting Costs” (FCC, 2017).
• Follow guidelines outlined by USFWS for Communication Tower Design, Siting, Construction, Operation, Retrofitting, and Decommissioning (USFWS, 2021):
  ○ Collocation of the communications equipment on an existing communication tower or other structure (e.g., billboard, water and transmission tower, distribution pole, or building mount) is strongly recommended. Depending on tower load factors and communication needs, anywhere from 6 to 10 providers should collocate on an existing tower or structure, provided that frequencies do not overlap/‘bleed’ or where frequency length or broadcast distance requires higher towers. New towers should be designed structurally and electronically to accommodate the applicant’s antenna, and antennas of at least two additional users—ideally 6 to 10 additional users, if possible—unless the design would require the addition of lights and/or guy wires to an otherwise unlit and/or unguyed tower. This recommendation is intended to reduce the number of towers needed in the future.
  ○ If collocation is not feasible and a new tower or towers are to be constructed, it is strongly recommended that the new tower(s) should be not more than 199 feet above ground level (AGL), and that construction techniques should not require guy wires. Such towers should be unlighted if Federal Aviation Administration (FAA) regulations and lighting standards permit (FAA, 2007) (Patterson, J.,2012).12 Additionally, the Federal Communications Commission (FCC), through recent

rulemaking, now requires that new towers > 450 ft AGL contain no red steady lights. FCC also recommends that new towers 350-450 ft AGL also contain no red-steady lights, and that new towers < 350 ft AGL convert non-flashing lights to flash with existing flashing lights. LED lights are being suggested as replacements for all new construction and for retrofits, with the intent of future synchronizing of the flashes. Given these dynamics, the Service recommends using lattice tower or monopole structures for all towers < 200 ft AGL and for taller towers where feasible. The Service considers the < 200 ft AGL option the 'gold standard' and suggests that this is the environmentally preferred industry standard for tower placement, construction, and operation— i.e., towers that are unlit, unguyed, monopole or lattice, and less than 200 ft AGL.

- If constructing multiple towers, the cumulative impacts of all the towers to migratory birds—especially to Birds of Conservation Concern (USFWS, 2008) and threatened and endangered species, as well as the impacts of each individual tower, should be considered during the development of a project.
- The topography of the proposed tower site and surrounding habitat should be clearly noted, especially in regard to surrounding hills, mountains, mountain passes, ridge lines, rivers, lakes, wetlands, and other habitat types used by raptors, Birds of Conservation Concern, state and federally listed species, and other birds of concern. Active raptor nests, especially those of Bald and Golden Eagles, should be noted, including known or suspected distances from proposed tower sites to nest locations. Nest site locations for Golden Eagles may vary between years, and unoccupied, inactive nests and nest sites may be re-occupied over multiple years. The Service's 2013 Eagle Conservation Plan Guidance, Module 1, Land-based Wind Energy, Version 2 is a useful document (USFWS, 2013b).
- If at all possible, new towers should be sited within existing 'antenna farms' (i.e., clusters of towers), in degraded areas (e.g., strip mines or other heavily industrialized areas), in commercial agricultural lands, in Superfund sites, or other areas where bird habitat is poor or marginal. Towers should not be sited in or near wetlands, other known bird concentration areas (e.g., state of federal refuges, staging areas, rookeries, and Important Bird Areas), in known migratory, daily movement flyways, areas of breeding concentration, in habitat of threatened or endangered species, or key habitats for Birds of Conservation Concern (USFWS, 2008). Disturbance can result in effects to bird populations, which may cumulatively affect their survival. The Service has recommended some disturbance-free buffers, e.g., 0.5 mi around raptor nests during the nesting season, and 1-mi disturbance free buffers for Ferruginous Hawks and Bald Eagles during nesting season in Wyoming (USFWS WY Ecological Services Field Office, referenced in Manville 2007:23). The effects of towers on 'prairie grouse,' 'sage grouse,' and grassland and shrub-steppe bird species should also be considered since tall structures have been shown to result in abandonment of nest site areas and leks, especially for 'prairie grouse' (Manville, A., 2004). The issue of buffers is currently under review, especially for Bald and Golden Eagles. Additionally, towers should not be sited in areas with a high incidence of fog, mist, and low

cloud ceilings.

- 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.13 Unless otherwise required by the FAA, only white strobe or red strobe lights (red preferable since it is generally less displeasing to the human eye at night), or red flashing incandescent lights should be used at night, and these should be the minimum number, minimum intensity (< 2,000 candela), and minimum number of flashes per minute (i.e., longest duration between flashes/'dark phase') allowable by the FAA. The use of solid (non-flashing) warning lights at night should be avoided (Patterson, J., 2012) (Gehring et al., 2009)—see recommendation #2 above. Current research indicates that solid (non-flashing) red lights attract night-migrating birds at a much higher rate than flashing lights (Gehring et al., 2009) (Manville, A., 2009). Recent research indicates that use of white strobe, red strobe, or red flashing lights alone provides significant reductions in bird fatalities (Patterson, J., 2012) (Gehring et al., 2009).
- Tower designs using guy wires for support, which are proposed to be located in known raptor or waterbird concentrations areas, daily movement routes, major diurnal migratory bird movement routes, staging areas, or stopover sites, should have daytime visual markers or bird deterrent devices installed on the wires to prevent collisions by these diurnally moving species. The efficacy of bird deterrents on guy wires to alert night migrating species has yet to be scientifically validated. For guidance on markers, see Avian Power Line Interaction Committee (APLIC). 2006. Suggested Practices for Avian Protection on Power Lines -- State of the Art in 2006. Edison Electric Institute, APLIC, and the California Energy Commission. Washington, DC, and Sacramento, CA. 207 pp, and APLIC. 2012. Reducing Avian Collisions with Power Lines -- the State of the Art in 2012. Edison Electric Institute and APLIC. Washington, DC. 159 pp. Also see www.aplic.org, www.energy.ca.gov, or call 202-508-5000.
- Towers and appendant facilities should be designed, sited, and constructed so as to avoid or minimize habitat loss within and adjacent to the tower 'footprint.' However, a larger tower footprint is preferable to the use of guy wires in construction. Several shorter, un-guyed towers are preferable to one tall guyed, lighted tower. Road access and fencing should be minimized to reduce or prevent habitat fragmentation, disturbance, the creation of barriers, and to reduce above ground obstacles to birds in flight.
- If it has been determined prior to tower design, siting and construction that a significant number of breeding, feeding and roosting birds—especially Birds of Conservation Concern (USFWS, 2008), state or federally-listed bird species, and eagles—are known to habitually use the proposed tower construction area, relocation to an alternate site is highly recommended. If this is not an option, seasonal restrictions on construction are advised in order to avoid disturbance, site and nest abandonment, especially during breeding, rearing and other periods of high bird activity.
- 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 (Manville, 2011) (USFWS, 2012).

- Representatives from the USFWS or researchers from the Research Subcommittee of the Communication Tower Working Group should be allowed access to the site to evaluate bird use; conduct dead-bird searches; place above ground net catchments below the towers (USFWS, 2000); and to perform studies using radar, Global Position System, infrared, thermal imagery, and acoustical monitoring, as necessary. This will allow for assessment and verification of bird movements, site use, avoidance, and mortality. The goal is to acquire information on the impacts of various tower types, sizes, configurations, and lighting protocols.
- 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.
- In order to obtain information on the usefulness of these guidelines in preventing bird strikes and better understanding impacts from habitat fragmentation, please advise USFWS personnel of the final location and specifications of the proposed tower, and which measures recommended in these guidelines were implemented. If any of these recommended measures cannot be implemented, please explain why they are not feasible. This will further advise USFWS in identifying any recurring problems with the implementation of the guidelines, which may necessitate future modifications.
- Follow the FAA requirements to eliminate steady-burning flashing obstruction lights and use only flashing obstruction lights in accordance with FAA Advisory Circulars AC 70/7460-1M and AC 150/5345-43H (FAA, 2016a) (FAA, 2016b) (FCC, 2017).

Collocation on Existing Wireless Tower, Structure, or Building

- Follow the FAA requirements to eliminate steady-burning flashing obstruction lights and use only flashing obstruction lights in accordance with FAA Advisory Circulars AC 70/7460-1M and AC 150/5345-43H (FAA, 2016a) (FAA, 2016b) (FCC, 2017).

3.2 Resource Area: Threatened and Endangered Species

Typical BMPs and Mitigation Measures

New Wireless Communication Towers

- Follow guidelines outlined by USFWS for Communication Tower Design, Siting, Construction, Operation, Maintenance, and Decommissioning (USFWS, 2021) mentioned above in Section 3.1, Wildlife.

3.3 Resource Area: Land Use, Recreation, and Airspace

Typical BMPs and Mitigation Measures
New Wireless Communication Towers • Select the shortest possible structures necessary to meet the system's needs, and only deploy towers less than 200 feet in height, wherever possible. • Place new infrastructure near existing similar infrastructure to minimize the total number of new aerial navigation hazards. • Work closely with the National Park Service (NPS) to address any concerns they might have if a tower needs to be placed in an area that might affect the nighttime sky at an NPS unit. • Avoid placing new infrastructure near airports or the areas regulated under the FAA's Part 77 regulations (FAA, 2016). • Avoid placing new infrastructure within Military Operations Areas or under Military Training Routes unless coordinated with the relevant military unit.

4. Project Type: Specific to Deployable Technologies

4.1 Resource Area: Wetlands and Floodplains

Typical BMPs and Mitigation Measures
• Station all deployables and aboveground structures outside of the 100-year floodplain. If deployables or aboveground structures must be placed in the 100-year floodplain, station them such that they are not vulnerable to be damaged by flood flows and do not themselves impede or restrict flood flows.

4.2 Resource Area: Wildlife

Typical BMPs and Mitigation Measures
• Avoid activities within migratory bird flyways and in the immediate vicinity of bat roosts. • Do not operate aircraft at an altitude that could disturb known natural roosting sites of bats, with the only exception being severe weather conditions. • Do not operate aircraft at an altitude lower than 1,500 feet within 0.5 mile of known calving/lambing areas during critical life stages, with the exception only for severe weather conditions. • Do not operate aircraft at an altitude lower than 1,500 feet within 0.5 mile of known seal haulouts observed on land, with the exception only for severe weather conditions.

4.3 Resource Area: Threatened and Endangered Species

Typical BMPs and Mitigation Measures
• Restrict aircraft operation at altitudes lower than 1,500 feet within 0.5 mile of known pupping or haulout areas during critical life stages, with the exception only for severe weather conditions. • Keep aircraft above altitudes higher than 1,500 feet within 0.5 mile of seals hauled out on land, with the exception only for severe weather conditions.

4.4 Resource Area: Land Use, Recreation, and Airspace

Typical BMPs and Mitigation Measures
• Coordinate early with FAA on aerial deployable technologies (flying unmanned aerial systems [UAS] and balloon launches) to establish procedures that are in place prior to the need to use these technologies during emergency response events.

- Limit the use of Deployable Airborne Communications Architecture to areas less likely to be used by commercial, military, or private aviation (to the degree feasible, and in consultation with the FAA and Department of Defense).

4.5 Resource Area: Cultural Resources

Typical BMPs and Mitigation Measures
• Select parking locations for deployable technologies that are screened from view by topography or vegetation, that are as far away from as many observers as possible, and that are not in or near areas considered scenic, such as shorelines, ridgelines, or scenic roads. • Select deployable designs that minimize the use of nighttime lighting, that include shielded or directional nighttime lighting, and/or that use the minimum nighttime lighting required for safe operations.

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Appendix: U.S. Fish and Wildlife Service Alaska Region BMPs

The information contained in this appendix has been sourced from the U.S. Fish and Wildlife Service directly via publicly available information, published on the web at https://www.fws.gov/service/technical-assistance-broadband-projects.

In anticipation of substantial expansion of broadband capability in Alaska, the Alaska Region of the US Fish and Wildlife Service (Service) has compiled Best Management Practices (BMPs) for project proponents to consider early in the planning and project development process to avoid and minimize impacts to wildlife populations and habitats.

Although these BMPs are designed to be broadly applicable across projects, each individual project will likely have unique environmental and wildlife considerations, and we encourage project proponents to reach out directly to either the Northern Alaska Fish and Wildlife Field Office or Southern Alaska Fish and Wildlife Field Office, depending on the location of the project.

To determine if your proposed project is on land managed by the Service (i.e., National Wildlife Refuges) or has Service trust resources (e.g., Threatened and Endangered species, eagles, migratory birds, marine mammals, wetlands, etc.) in the vicinity of or within the project footprint, see the Service's Information Planning and Consultation (IPaC) tool (ipac.ecosphere.fws.gov/). To use IPaC, click on 'Get Started', and select the project area by manually drawing project boundaries or uploading a shapefile.

In addition to universal BMPs that will be broadly applicable across all activity types, activity specific BMPs are organized based on the type of broadband deployment method being used (i.e., terrestrial, riverine, and marine cable lay as well as broadband towers). Additional sections on species-specific BMPs and regulatory BMPs are provided and should be considered when additional species or resources are identified within or adjacent to the project area in IPaC. Contact the relevant Field Office (listed on the IPaC Resource List printout) with any questions and for additional guidance on avoiding and minimizing impacts to resources.

Universal Best Management Practices

Migratory birds

- The Service has developed a timing guidelines table for migratory birds in Alaska to help avoid the take of nesting birds based on location, habitat, and bird species. Visit fws.gov/alaska-bird-nesting-season to view the table online and download a PDF version.
- Prevent increase in lighting of native habitats during the bird breeding season.
- To the maximum extent practicable, limit construction activities to the time between dawn and dusk to avoid the illumination of adjacent habitat areas.

- If construction activity time restrictions are not possible, use down shielding or directional lighting to avoid light trespass into bird habitat (i.e., use a 'Cobra' style light rather than an omnidirectional light system to direct light down to the roadbed). To the maximum extent practicable, while allowing for public safety, low intensity energy saving lighting (e.g., low pressure sodium lamps) should be used.
- Minimize use of high-intensity lighting, steady-burning, or bright lights such as sodium vapor, quartz, halogen, fluorescent, or other bright spotlights.
- Minimize illumination of lighting on associated construction or operation structures by using motion sensors or heat sensors. Use switches to keep lights off when not required.
- Avoid installing lights offshore or within 0.5 miles of the coast.
- Cap pipes and cover and seal all small dark spaces where birds may enter and become trapped.
- Install anti-perching devices on facilities and equipment where birds may commonly nest or perch.
- Cover or enclose all potential nesting surfaces on the structure with mesh netting, chicken wire fencing, or other suitable exclusion material prior to the nesting season to prevent birds from establishing new nests. The netting, fencing, or other material should have no opening or mesh size greater than 19 millimeters and should be maintained until the structure is removed.

Oil spills

- To fulfill Federal and State reporting requirements, all spills of oil, petroleum, or other hazardous substances, of any size, should be reported to the National Response Center (1-800-424-8802) and the Alaska Department of Environmental Conservation Spill Reporting Hotline (1-800-478-9300).

Method-specific Best Management Practices

Terrestrial broadband

- Reduce the project footprint to the maximum extent practicable, and locate proposed projects and their associated activities in already disturbed areas or lower functioning or lower quality habitat.
- Collocate infrastructure whenever possible in permanently disturbed areas such as rights-of-way (e.g., place utilities in existing road corridors, use existing pipeline or transportation corridors for new infrastructure construction, place new antenna on existing towers or place new structures near existing structures whenever possible).
- Avoid placement of infrastructure and fill materials in wetlands whenever possible. Effects to wetlands are usually proportional to the size of the impact. Therefore, if avoidance is not possible, minimization should be employed by choosing broadband options with smaller footprints (i.e., single tower vs. miles of overhead cable poles with cleared right-of-way) that do not obstruct hydrologic flow across the landscape.

- If impacts to wetlands are unavoidable, make them temporary impacts by restoring the site to pre-existing conditions (e.g., hydrology, grade, vegetation). Permanent impacts (e.g., placement of fill, alteration of hydrology) should be offset with the purchase of compensatory mitigation within the same or a nearby watershed. This will reduce subsidence, scarring, and habitat alteration.
- Avoid sensitive soils such as highly erosive soils, thaw-stable, and thaw-unstable permafrost.
- Avoid ground-disturbing activities during the bird nesting season when possible.
- Preserve stream and riparian buffers to protect water quality, maintain stream channel and bank stability, maintain fish and wildlife habitat, and provide flood water protection. See https://www.fws.gov/Riparian-Management-Interior-Alaska for more information on riparian buffers.
- Trenching should be avoided in terrestrial areas of thaw-sensitive soils (i.e., continuous and discontinuous permafrost). The activity of trenching, even during freezing temperatures where a stable, frozen platform is available for digging and backfill, creates linear density differences within the trench, allowing groundwater to collect and pass more easily than the surrounding non-disturbed soils. The higher permeability of backfilled trenches usually causes a French-drain effect, aggregating surface flows and groundwater, which then melts surrounding permafrost and causes water flow, further exacerbating the permafrost degradation. Subsequent water quality and habitat degradation causes numerous negative effects. Alternatives for trenching include direct cable lay, overhead cable with poles, or use of non-cable broadband such as 4G and 5G networks via network towers.

Invasive species

- Equipment must arrive and leave the project clean without visible soil clumps, plant, or animal material. Use a pressure washer, paying special attention to wheel wells, areas behind the bumper, trailers, and other areas that are likely to catch vegetation or seeds. Equipment washing should occur at the same location during project operations; this site should then be surveyed regularly and treated as necessary. Do not clean equipment in or near waterways as it may promote the spread of invasive plant species downstream. Conduct project operations in uninfested areas first to ensure that invasive species do not contaminate equipment and get moved to new areas.
- Prevent invasive plant contamination of project materials when stockpiling materials. Ensure the area is free of invasive species, and cover gravel and construction materials to prevent accidental introduction of plant parts such as seeds, roots, and propagules (i.e., reproductive vegetative parts). Remove any plant parts from materials before deploying them into the field.
- Use certified weed free gravel (plants.alaska.gov/invasives/weed-free-gravel.htm)
- Use certified weed free hay in straw wattles (plants.alaska.gov/invasives/weed-free-forage.htm)
- Soil disturbance includes contouring, grubbing, logging, moving, removing, excavating, and cutting. Soil disturbance destabilizes and exposes soil, which can impact water and air

movement, biological activity, root growth, and seedling emergence. Disturbed soil provides an opportunity for invasive plants to establish and spread, to compete with native species, and to colonize new areas. Disturbed soil should be stabilized and covered as soon as possible to prevent the germination and growth of invasive plants. If a worksite is infested with invasive plants, schedule treatment of these plants prior to ground disturbance to minimize spread of invasive plants into other uninfested areas. Project materials such as fill, aggregate, and erosion control materials can also carry invasive plant seeds, which further increase the risk for infestation after soil disturbance. Refer to the weed free hay and gravel above.

- When possible, wear clothing, boots, and gear that do not retain soil and plant material. Clean clothing, boots, and gear before entering and leaving worksite. Remove soil, mud, seeds, and any plant material from clothing, boots, and gear with appropriate equipment. This may include wire brushes, small screwdrivers, boot brushes, extra rinse water, and bags for plant material. Inform coworkers about possible seeds or other propagules carried on their clothing, footwear, and gear.
- Vertebrate invasive species can be transported in cargo planes and ships where they stowaway in grain, straw, and hay. Eradicate free-roaming rats and mice whenever they are detected on or in equipment to ensure they are not inadvertently relocated elsewhere. Eliminate rat attractants including shelter, edible refuse, and food. Keep trash and foodstuffs in metal or other rodent-proof containers.
- Never release live rats or mice into the wild, and never throw captured rats overboard; they are excellent swimmers and may reach land. Other tips for rat prevention and control are available in the Alaska Department of Fish and Game's State Invasive Rodent Plan (adfg.alaska.gov/static/species/nonnative/invasive/pdfs/invasive_rodent_plan.pdf).

Direct cable lay on tundra

- Depending on the type of tundra, some sections of the cable may never subside when directly laid on the ground. Ensure above ground cable sections remain in a line and do not curl up to avoid entanglement by wildlife (e.g., birds, caribou, etc.).
- When necessary, cable slack on the ground to prevent impacts of temperature expansion, contraction, and cable settling may be necessary. However, the cable slack should be laid on the ground in a waving line instead of twisted in circles to prevent entanglement of birds, caribou, and other wildlife.
- The extra effort to place the cable on the ground, regardless of the thickness or height of shrubs, will prevent potential entanglement of birds.
- Be aware that wildlife (e.g., grizzly bears, polar bears, foxes, rodents, etc.) may attempt to chew on cables. This could also occur for cables that are trenched shallowly.

Overhead between poles

- To reduce bird collisions, place transmission lines associated with the development underground to the extent possible unless burial of the lines is prohibitively expensive (i.e., where shallow bedrock exists) or where greater impacts to biological resources would result.

- Overhead lines may be acceptable if they are sited away from areas used by high numbers of birds crossing between roosting and feeding areas or between lakes, rivers, and nesting areas.
- Use bird flight diverters (i.e., flappers) or related deterrent devices that are durable and visible to reduce collision risk. Studies suggest that most bird collisions occur with the shield wire – the smallest diameter and highest wire on a transmission line. The observed reduction in collision rates can range from about 10 percent to as much as 80 percent (Barrientos et al. 2011[1]) and appears to vary with location, habitat, wire, pole configurations, and other factors. The type and spacing of diverters will also affect the degree to which collision risk is reduced.
- Above water crossings of the cables may still impact birds, regardless of the bird diverters. This primarily may happen with thick fog during fall migration or during breeding when birds are flying in circles, etc. to impress a potential mate. Placing the cable under water, and perhaps under the bottom of streams or rivers, likely will be the best solution to avoid avian impacts.
- On the North Slope of Alaska, where ravens depend on manmade structures for perching and nesting, install deterrent features on poles to reduce their availability as artificial perching and nesting platforms.

Riverine broadband

- Adhere to permit construction timing windows to avoid sensitive fish life stages such as spawning, incubation, and migration.
- Preserve stream and riparian buffers to protect water quality, maintain stream channel and bank stability, maintain fish and wildlife habitat, and provide flood water protection. See fws.gov/node/378411 for more information on riparian buffers.
- Use screened intake for water withdrawals. The Alaska Department of Fish and Game Habitat Division Technical Report No. 97-8 (adfg.alaska.gov/static/license/uselicense/pdfs/97_08.pdf) contains additional information on screening criteria for various species and life stages of fish as well as methods for design and fabrication of cylindrical water intakes. Appropriate screening prevents suction entrapment and entrainment injury to small and juvenile fish present in the area of the withdrawal.
- For riverine fiber-optic and traditional cable overhead wire crossing, horizontal directional drilling (HDD) is highly recommended as a crossing method. This is especially true for Navigable Waters regulated under Section 10 of the Rivers and Harbors Act and rivers that are navigable in fact. HDD should be used over the 100-year floodplain extent to maintain lateral movement of the river without obstructions from protective broadband infrastructure. This ensures protection of wildlife from the infrastructure obstructions and

[1] Barrientos, R., J.C. Alonso, C. Ponce, and C. Palacín. 2011. Meta-analysis of the effectiveness of marked wire in reducing avian collisions with power lines. *Conservation Biology* 25:893-903.

entanglements, decreases regulatory oversight from potential obstructions to navigation, and increases infrastructure lifespan by avoidance of damage from flooding.

- The use of plastic fiber erosion control fabrics is not acceptable to mitigate streambank erosion or maintain erosion control on steep slopes in or near flowing waterbodies. Instead, use bioengineering techniques and materials that will not pose hazards to wildlife if escapement occurs. For examples, see the Alaska Department of Fish and Game Streambank Revegetation and Protection: A Guide for Alaska (adfg.alaska.gov/index.cfm?adfg=streambankprotection.main).

Spill mitigation

- Maintain a minimum 200-foot setback from waterways when storing hazardous or toxic material.
- Ensure that secondary containment is provided for the storage of fuel or hazardous substances and sized as appropriate to container type and according to governing regulatory requirements in 18 AAC 75 and 40 CFR 112.
- Containers with an aggregate storage capacity of greater than 55 gallons that contain fuel or hazardous substances should not be stored within 100 feet of a waterbody or within 1,500 feet of a current surface drinking water source.
- During equipment storage or maintenance, ensure that the site is protected from leaking or dripping fuel and hazardous substances by the placement of drip pans or other surface liners designed to catch and hold fluids under the equipment or by creating an area for storage or maintenance by using an impermeable liner or other suitable containment mechanism.
- During fuel or hazardous substance transfer, ensure that a secondary containment or a surface liner is placed under all container or vehicle fuel tank inlet and outlet points, hose connections, and hose ends. Appropriate spill response equipment, sufficient to respond to a spill of up to five gallons, should be on hand during any transfer or handling of fuel or hazardous substances.

Sedimentation and pollutants

- Isolate wetlands and waterbodies from project-generated sediment and pollutants (i.e., soil sediments, fuels, grease, and oil) with project specific measures to avoid and minimize water quality degradation to protect respiratory gill function of fish. Measures may include maintaining riparian zone setbacks and bank stabilization or restoration practices. During the construction phase, properly installed silt fencing, silt curtains, etc. should be used interim to proper bank stabilization with vegetation. Long-term use of silt fencing must be avoided due to level of maintenance necessary to maintain and the likelihood of plastics escapement to the environment.

Invasive species

- Aquatic Best Management Practices follow the principles of Clean, Drain, Dry:
    - Clean – Inspect and clean off plants, animals, and mud from clothing, vehicles (i.e., float planes and boats), and equipment including waders, footwear, ropes,

anchors, and field gear before leaving water access. Use the local water source initially to help remove heavy deposits. Remove plant fragments, and scrub off any visible material with a stiff brush.

  - Drain – all water from watercraft, motor, bilge, bladder tanks, live well, and portable bait containers before leaving water access.
  - Dry – equipment, vehicles, and gear before moving between waterbodies. Dispose of unwanted materials in the trash; do not dump them in the water or on land.

- Refer to the Alaska Region's Guidelines for Preventing the Spread of Aquatic Invasive Species (fws.gov/media/aquatic-invasive-species-prevention-guidelines-pdf) for more information.

Marine broadband

- Select cable routing to avoid listed eider and short-tailed albatross concentration areas to reduce potential behavioral and disturbance effects.
- Depending on the project area, Protected Species Observers may be necessary to avoid potential take of Endangered Species Act-listed species and marine mammals protected by the Marine Mammal Protection Act.
- Keep cable lines tight to decrease entanglement risk.
- Take all precautions necessary to minimize the risk of spilling fuels or other materials in the marine environment.
- Avoid project activities, particularly those that disturb subsurface vegetation, in areas of eelgrass and kelp growth. Eelgrass and kelp provide rearing and refugia habitat for a wide variety of small and juvenile marine fish and invertebrate species that provide food for listed eiders. Northern sea otters are also associated with kelp forests, which they use to escape from marine predators.
- Minimize the use of external lighting at night, and angle lights downward toward the surface of the water to reduce potential for collisions with vessels and gear. The use of bright lights at night, especially during inclement weather, increases risk of collision and mortality events. Bright lights on vessels at night can serve as an attractant or can cause temporary visual impairment, which increases the risk of birds colliding with vessel gear or rigging that is difficult to see at night. Weather patterns can further reduce visibility and the lower cloud ceiling enhances light where birds tend to fly at lower altitudes. Further information on vessel strikes in the marine environment is available at fws.gov/service/technical-assistance-prevent-bird-vessel-strike-alaska-marine-environment
- Vessels should not discharge materials (i.e., trash or other debris) into the ocean that may attract seabirds, including short-tailed albatross.
- Vessels will not allow tow lines to remain in the water, thereby reducing the potential for entanglement.

Invasive species

- Alaska relies on the US Coast Guard to enforce national standards for ballast water and biofouling.
- Commercial ships use ballast water, typically loading ballast when offloading cargo and discharging ballast when onloading cargo. However, when loading ballast, small organisms are often also brought onboard with the water. If unmanaged, water can then be transferred to areas and discharged with viable organisms in the effluent. Organisms that are then deposited can cause harm to native flora and fauna in the new area they inhabit.
    - Empty/Refill Exchange: pump the ballast tank or tanks and refill the tank with mid-ocean waters at least 200 nautical miles from any coast.
    - Flow through exchange: pump in mid-ocean water, at least 200 nautical miles from any coast, at the bottom of the tank and continuously overflow the tank from the top until three full volumes of the ballast water tank capacity have been changed.
    - Onboard Treatment: Use a properly functioning treatment system approved by the US Coast Guard that is designed to kill all living organisms in the ballast water.
    - Freshwater: Use ballast water from a municipal water supply from the US or Canada.
    - Sealed tanks: Use ballast water in sealed tanks incapable of discharging ballast water.
- Biofouling accumulation on a submerged vessel can begin within minutes. The process begins with bacteria and algae recruiting onto the vessel, progressing into a slime layer (biofilm) within days. Then further advancing into a macrofouling community in weeks. Macrofouling happens especially in the niche areas (i.e., propeller shafts, rudder, sea chest intake, bow thruster gratings, etc.), which act as protective spaces for biofouling organisms. Applying the proper antifouling hull paint and maintaining the coating to the manufacturer's specifications may substantially reduce vessel operating costs and minimize environmental impacts. Following best management practices for managing biofouling "early and often" at the slime layer level will cut biofouling management and fuel costs, thereby reducing vessel carbon emissions in addition to reducing biosecurity risks ports.
- Vertebrate invasive species can be transported in cargo planes and ships where they stowaway in grain, straw, and hay. Eradicate free-roaming rats and mice whenever they are detected on or in equipment to ensure they are not inadvertently relocated elsewhere. Eliminate rat attractants including shelter, edible refuse, and food. Keep trash and foodstuffs in metal or other rodent-proof containers.
- Never release live rats or mice into the wild, and never throw captured rats overboard; they are excellent swimmers and may reach land. Other tips for rat prevention and control are available in the Alaska Department of Fish and Game's State Invasive Rodent Plan (adfg.alaska.gov/static/species/nonnative/invasive/pdfs/invasive_rodent_plan.pdf).

Broadband towers

- Guy wires and tower lighting should be avoided when possible. Use self-supporting towers when applicable. If guy wires are necessary, bird flight diverters or high visibility marking devices should be used. When guy wires are necessary, each wire should be marked for its full-length using markers colored to contrast with the wire and surrounding environment during daylight hours. The Service can provide information as needed on types that have proven durable as not all markers have withstood use in Alaska. Markers should be checked and maintained periodically to ensure continued functionality for the life of the project.
- Use visual contrasting colors on towers to improve visibility.
- Use motion detectors and down-shield lights to reduce collisions and light loss when lighting facilities.
- Towers and associated facilities should be designed, sited, and constructed to avoid or minimize habitat loss within and adjacent to the tower "footprint" (including guy wire circumference). Several shorter, un-guyed towers may be preferable to a single, tall, guyed and lit tower.
- If a tower is in the path of a potential bird migration corridor, the Service recommends mortality monitoring. Representatives from the Service or other experienced biological monitors (i.e., from other agencies, biological consulting companies, etc.) should be allowed access to the site to evaluate bird use; conduct dead-bird searches; place above ground net catchments below the towers; and to perform studies using radar, infrared, thermal imagery, and acoustical monitoring, as necessary.
- Use monopole structures when possible, rather than lattice structures to discourage perching and nesting by ravens, raptors, and other birds of prey unless a monopole structure would require additional guywires on an otherwise un-guyed tower. Nesting by ravens and raptors can result in increased rates of predation. In these cases, the applicant should work with the Service to incorporate anti-perching and anti-nesting devices into project design.
- Powerlines should be buried in roadbeds or placed in electrical trays strung on Voltage Sensing Modules when possible.
- Locate towers to avoid placement of fill in or disturbance to wetlands, which are prime breeding and forage areas for migratory birds and other trust species.
- Towers should not be sited on ridgelines or 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, or in habitat of Threatened or endangered species.
- Avoid installing towers offshore or within 0.5 miles of the coast.
- It is recommended that new towers should not be more than 199 feet above ground level. This height increases the mean free airspace between the top of the tower and the height at which birds generally migrate, reducing collision risk.

- Lights are a primary source of bird aggregation around towers, thus minimizing all light is recommended. Eliminating tower lighting is the preferred option if allowed by FAA regulations and lighting standards (Patterson 2012[2]). See (faa.gov/documentlibrary/media/advisory_circular/ac_70_7460-1l_.pdf) for more detailed information about FAA guidelines. To meet FAA requirements for visibility lighting of towers the Service recommends (in order of least to most likely to affect birds): red strobe, dual red and white strobe, strobe-like, or flashing and not steady state lights. Pilot warning lights should fire synchronously.
- 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.
- On the North Slope of Alaska, where ravens depend on manmade structures for perching and nesting, design towers to reduce their suitability as artificial perching and nesting platforms.

Species-specific Best Management Practices

Additional best management practices are provided for species protected under the Endangered Species Act and/or Marine Mammal Protection Act.

Northern sea otter

- For all vessel-based activities within the sea otter range, take precaution to avoid harassment or harm of sea otters. Vessel strikes are a cause of injury and death for sea otters and the probability of death or serious injury to a marine mammal increases as vessel speed increases. Use established navigation channels or commonly recognized vessel traffic corridors and avoid alongshore travel in shallow water (less than 20 m) whenever practicable. Follow the Service's sea otter vessel guidelines for Alaska (fws.gov/sea-otters-boater-guidance).
- Vessels should avoid approaching within 100 meters (328 feet) of areas with kelp at the surface when operationally possible. If vessels must approach kelp canopy areas more closely, apply extra vigilance to look for sea otters (e.g., assign an additional spotter), and maintain an appropriate distance from sea otter individuals or groups.
- Sea otters may be disturbed or harmed by loud in-water noise, and the Service considers sea otter to be harassed when exposed to in-water sound levels exceeding 160 dB re 1 µPa SPL_{RMS}. If activities involve in-water noise production in sea otter habitat above this level, contact the Service's Marine Mammals Management office (FW7_AK_Marine_Mammals@fws.gov; 800-362-5148).

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

- Coordinate with Tribal organizations to ensure activities do not disrupt sea otter subsistence harvest. The Service's Marine Mammals Management office may be able to assist with coordination.
- Depending on the project area, Protected Species Observers may be necessary to avoid potential take of sea otters.
- Areas have been designated as critical habitat for northern sea otters. These areas represent locations that are of particular importance to the species. The Service asks that project proponents are cognizant of the importance of these locations to sea otters and limit actions within these areas when possible.

Pacific walrus

- Walruses are sensitive to disturbance from noise, sights, and smells associated with human activities. Take caution to avoid disturbing walruses that are in the water or are hauled out on ice or land. Follow the Service's guidelines for avoiding disturbance, including from marine vessels and aircraft: fws.gov/walrus-approach-viewing-guidelines
- When planning work in the Bering or Chukchi Seas, consult the Pacific Walrus Coastal Haulout Database 1852-2016 (alaska.usgs.gov/products/data.php?dataid=74) for information regarding location and use patterns of known terrestrial walrus haulouts in Alaska. Note there are five regularly used walrus haulouts in Bristol Bay, located at Round Island and Hagemeister Islands and Capes Peirce, Newenham, and Seniavin. During the months of May through December, walruses may be encountered in the water and resting on land in these areas. In the Chukchi Sea, there are especially large, sensitive haulouts at Point Lay and Cape Lisburne. The sea ice edge is also a sensitive congregation and migration area. When walruses are present, haulouts should be avoided by the stand-off distances from the Service's marine vessel guidelines, reiterated here:
    - Vessels less than 50 feet in length should remain at least 0.5 nautical miles away from a walrus haulout.
    - Vessels 50 feet or more but less than 100 feet in length should remain at least 1 nautical mile away from a walrus haulout.
    - Vessels 100 feet or more in length should remain at least 3 nautical miles away from a walrus haulout.
    - All vessels should refrain from anchoring or conducting tendering operations within 3 nautical miles of a walrus haulout.
- If aircraft are being used, it is very important to follow the aircraft measures included in the guidelines linked above.
- For more information on a specific haulout, reach out to the contact noted in the Pacific Walrus Coastal Haulout Database or the Service's Marine Mammals Management office (FW7_AK_Marine_Mammals@fws.gov; 800-362-5148). If activities must occur within 3 nautical miles of a haulout, near the sea ice edge, or are within the Bering Strait, reach out to the Service.

- Walruses may be disturbed or harmed by loud in-water noise, and the Service considers walruses to be harassed when exposed to in-water sound levels exceeding 160 dB re 1 µPa SPL_{RMS}. If activities involve in-water noise production in walrus habitat above this level, contact the Service.
- Coordinate with Tribal organizations to ensure activities do not disrupt walrus subsistence harvest. The Service's Marine Mammals Management office may be able to assist with coordination. Specifically, activities near communities in the Bering Strait and near Saint Lawrence Island between April and June would likely overlap with subsistence walrus hunting activities.
- Depending on the project area, Protected Species Observers may be necessary to avoid potential take of walruses.

Polar bear

- Polar bears use sea ice, marine waters, and terrestrial areas in northern and northwestern Alaska for resting, feeding, denning, and seasonal movements. They are most likely to be encountered within 25 miles of the coastline, especially along barrier islands during July–October. Polar bears may also be encountered farther inland, especially females during the denning period (November–April). Be aware that polar bears also occur within human settlements such as villages, camps, and work areas. If any work in polar bear habitat may occur, see the Service's best management practices for minimizing impacts to polar bears in Appendix A of the Species Status Assessment for the Polar Bear (https://ecos.fws.gov/ServCat/DownloadFile/238581), which also includes polar bear encounter guidelines and reporting procedures. Following as many relevant measures as possible through the development and implementation of a polar bear avoidance and encounter plan will help protect both human and bear safety.
- Denning is a critical, sensitive period in polar bear life history. Human disturbance of maternal dens at any stage, including after emergence, could result in the taking (harassment or harm) of polar bears. This may include the possibility of lethally taking cubs. Projects with operations between November and April and within 25 miles of the Bering, Chukchi, or Beaufort coasts (outside of communities) may impact denning, and planners should contact the Service's Marine Mammals Management office (FW7_AK_Marine_Mammals@fws.gov; 800-362-5148) as early as possible to discuss activities.
- For any project with operations on sea ice or within five miles of the Alaska Arctic coast from the Canadian border to Point Hope, within one mile of the western coast from Point Hope to Nome, or along the coast of St. Lawrence Island, contact the Service Marine Mammals Management office to discuss activities.

Short-tailed albatross

- Short-tailed albatross spend most of their lives in marine environments and are known to forage primarily on continental shelf breaks in Alaskan waters but may also be found near shore when upwelling creates prey-rich concentrations. They can be attracted to vessel debris, such as bait used in the hook-and-line commercial fishery in Alaska, and therefore

can be vulnerable to entrapment, entanglement, or bycatch. Specifics for preventing bird-vessel strike can be found at: fws.gov/service/technical-assistance-prevent-bird-vessel-strike-alaska-marine-environment. Also refer to the 'Marine Broadband' section above for more guidance.

Spectacled eider / Steller's eider

- Listed eiders are at risk of colliding with moving or stationary marine vessels around Alaska. Impaired visibility and vessel lighting may increase the likelihood of bird strikes. Generally, the Service recommends keeping deck lighting to a minimum and shielding lights to direct illumination inboard and downward to the extent possible while still maintaining compliance with navigation rules. Concern for eider-vessel collision risk is particularly high between August and November, during which time Steller's and spectacled eiders frequently fly in large groups between nesting, molting, and wintering areas. This timing coincides with decreasing hours of daylight and a high potential for inclement weather, both of which may impair eider visibility to human observers and increase the likelihood that birds may become disoriented by ship lighting, in turn, reducing their ability to avoid colliding with structures. More specifics for preventing bird-vessel strike can be found at: fws.gov/service/technical-assistance-prevent-bird-vessel-strike-alaska-marine-environment. Also refer to the 'Marine Broadband' section above for more guidance.

- Steller's eiders and spectacled eiders are migratory birds. Refer to the 'Migratory Bird' section for more BMPs.

- Listed eiders are at risk of injury or death due to collision with communication towers and wires. Refer to the 'Broadband Towers' section above for appropriate mitigation measures to reduce eider collisions.

- Areas have been designated as critical habitat for both spectacled and Steller's eiders (review if your project occurs within critical habitat at ipac.ecosphere.fws.gov/). These areas represent locations that are of particular importance to each species or locations at which birds are particularly vulnerable to disturbance. We ask that project proponents are cognizant of the importance of these locations to each species and limit actions within these areas. For projects with marine components, we ask that vessels limit their transit and actions within these areas and be extra cautious about vessel lighting. Furthermore, we ask that mariners do not disturb congregations of eiders within these areas as they may be flightless and unable to move away from vessels.

- Depending on the project area, Protected Species Observers may be necessary to avoid potential take of listed eiders.

Regulatory Best Management Practices

Bald and Golden Eagle Protection Act

- For any project that may result in take or disturbance of eagles or their nests, the USFWS recommends a survey by a qualified raptor biologist prior to conducting activities to document locations of nests and help inform avoidance and minimization measures and the need for a permit. Surveys should be conducted within the project footprint and extending 0.5 miles beyond the project footprint, including cliffs of tributary streams, to determine if and where eagles may be nesting.

- The Alaska Bald Eagle Nest Atlas (eagle.abrinc.com/) is a useful first step to identify potential bald eagle nest locations in and around project areas. However, the Atlas should not be used as a replacement for recommended, location-specific surveys to verify the presence of nests identified in the Atlas and document additional nests.

- The Service's National Bald Eagle Management Guidelines (fws.gov/media/national-bald-eagle-management-guidelines) provide activity-specific buffers to help avoid disturbance to nesting bald eagles.

- The Service in Alaska has provided additional information and guidance on bald eagle nesting windows and sensitivity to disturbance (fws.gov/Alaska-eagle-nesting).

- In general, golden eagles are more sensitive than bald eagles, and, in Alaska, the Service recommends a 0.5-mile buffer for most, but not all activities. For more information on historical golden eagle nests in the project area or for additional questions or guidance on eagles, please contact the local Field Office.

- The Service's National Eagle Management webpage (fws.gov/program/eagle-management) provides an overview of the types of eagle take permits.

- If needed, permit applications are submitted through the Service's ePermits portal (fwsepermits.servicenowservices.com/fws/). Please note that permits can take up to 90 days to process once a completed application is submitted.

Clean Water Act

- Wetlands and waters of the US are regulated by the US Army Corps of Engineers under the Clean Water Act and the US Environmental Protection Agency.

- These habitats are often considered important habitat for aquatic life, migration and movement, migratory bird staging, forage and reproduction, and resident wildlife populations. Therefore, the Service regulates activities within the same footprint under different statutory authorities. However, consultation with the Service is often necessary pursuant to project permitting under the Clean Water Act due to the nexus of high-value habitat provided by wetlands and waters.

Endangered Species Act

- The purpose of the Endangered Species Act (ESA) is to provide a means to conserve the ecosystems upon which Endangered and Threatened species depend and provide a program for the conservation of such species. The ESA directs all federal agencies to participate in conserving these species. Specifically, section 7(a)(1) of the ESA charges federal agencies to aid in the conservation of listed species, and section 7(a)(2) requires the agencies to ensure their activities are not likely to jeopardize the continued existence of federally listed species or destroy or adversely modify designated critical habitat.

- Additionally, the ESA prohibits, with certain exceptions, the take of listed species. Take means “to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct.”

- IPaC (ipac.ecosphere.fws.gov/) will generate a letter including a list of Threatened and Endangered species, designated critical habitat, and other sensitive resources in your project area. If consultation or further assistance is needed, contact the appropriate Service Field Office named in the letter.

Executive Orders

- Executive Order (EO) 13751, Safeguarding the Nation from the Impacts of Invasive Species (federalregister.gov/documents/2016/12/08/2016-29519/safeguarding-the-nation-from-the-impacts-of-invasive-species) was issued December 5, 2016, and Amends EO 13112. This EO aims to prevent the introduction of invasive species and provide for their control, and to minimize the economic, plant, animal, ecological, and human health impacts that invasive species cause.

Fish and Wildlife Coordination Act

- Under the Fish and Wildlife Conservation Act, the Service is directed and authorized to evaluate Federal actions that affect any stream or other body of water and provide recommendations to minimize impacts on fish and wildlife resources.

- Proponents with projects involving rivers or other water bodies should reach out to the Service during project planning to coordinate on minimizing impacts.

Marine Mammal Protection Act

- The Marine Mammal Protection Act (MMPA) prohibits, with certain exceptions, the take of all marine mammal species in US waters. Take is defined as "to harass, hunt, capture, or kill, or attempt to harass, hunt, capture, or kill". Harassment includes behavioral disturbance.

- In Alaska, the Service implements the MMPA for walruses, sea otters, and polar bears. The National Marine Fisheries Service has jurisdiction over pinnipeds and cetaceans.

- When certain requirements are met, the Service may authorize incidental take of small numbers of Pacific walruses, polar bears, or northern sea otters through an incidental take

authorization under Section 101(a)(5) of the MMPA (see fws.gov/ITA-general-info and fws.gov/ITA-applicant-instructions). Note that issuance of an incidental take authorization can take over a year, and early coordination with the Service's Marine Mammals Management (MMM) Regulatory Program is very important. Contact the MMM Regulatory program with any questions on incidental take authorizations (R7mmmregulatory@fws.gov).

Migratory Bird Treaty Act

- Intentional take of migratory birds may be permitted in limited situations (fws.gov/program/migratory-bird-permit).

- Incidental take (i.e., unintentional take from an otherwise lawful activity) of migratory birds cannot be permitted. The best way to avoid incidental take and comply with the Migratory Bird Treaty Act is to avoid vegetation clearing, ground disturbance, and other site construction activities during the nesting season. Visit fws.gov/alaska-bird-nesting-season to view nesting season dates for migratory birds based on location, habitat, and bird species.

Rivers and Harbors Act

- For rivers listed as Navigable Waters of the US, overhead structures or structures or cables laid in-stream on the riverbed are often considered potential impediments to navigation and to aquatic life migration and movement. Therefore, the Service may engage in consultation under this statute.