United States Department of the Interior

FISH AND WILDLIFE SERVICE

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September 26, 2017

Jennifer L. McCarthy, Chief
Regulatory Division
Corps of Engineers
696 Virginia Road
Concord, Massachusetts 01742-2751

David E. Robbins, Regional Environmental Officer
Federal Emergency Management Agency, Region 1, Mitigation Division
Environmental & Historic Preservation Office
99 High Street, 6th Floor
Boston, Massachusetts 02110

Peter Lamothe, Maine Fish and Wildlife Service Complex Manager
U.S. Fish and Wildlife Service
P.O. Box A
East Orland, Maine 04431

Dear Ms. McCarthy, Mr. Robbins, and Mr. Lamothe:

This letter transmits the U.S. Fish and Wildlife Service's (Service) programmatic Endangered Species Act (ESA) section 7 consultation package, including a programmatic biological opinion (PBO), based on the Service's review of your agencies' proposal to permit, fund, or carry out specific activities associated with road-stream crossings in Maine. This programmatic consultation is a collaborative effort by our three agencies with the specific goal of contributing to the conservation and recovery of the endangered Atlantic salmon by addressing the threats to aquatic habitat connectivity and fish passage associated with many existing road-stream crossings in Maine.

The PBO addresses the effects of the proposed action on the endangered Gulf of Maine Distinct Population Segment (GOM DPS) of Atlantic salmon (*Salmo salar*) and its designated critical habitat in accordance with section 7(a)(2) of the Endangered Species Act of 1973, as amended

(16 U.S.C. 1531 et seq.). Your agencies[1] collectively initiated section 7 consultation with the Service through an April 14, 2017 letter and accompanying Biological Assessment.

While the focus of this consultation is on the Atlantic salmon and its critical habitat, it also addresses other federally listed species that might occur with the range of the GOM DPS including Canada lynx (*Lynx canadensis*), northern long-eared bat (*Myotis septentrionalis*), small whorled pogonia (*Isotria medeoloides*), and rusty patched bumble bee (*Bombus affinis*). Included in the programmatic consultation package is the Service's concurrence with your determination that some activities in certain locations are not likely to adversely affect Atlantic salmon and Canada lynx.

In the PBO, the Service concludes that the actions, as proposed, are not likely to jeopardize the continued existence of the Atlantic salmon and that all effects to critical habitat are either insignificant or discountable. As required by section 7 of the ESA, the Service is providing an incidental take statement with this PBO. The PBO's take statement sets forth nondiscretionary terms and conditions which the Federal action agencies and any person involved with a particular project must comply with in accordance with section 9 of the ESA.

This program embraces the principles of the U.S. Forest Service's *Stream Simulation* approach for designing road-stream crossings, an approach which our agencies have successfully used on previous projects to support recovery of Atlantic salmon by restoring stream habitat. This new streamlining approach was designed to encourage other partners to contribute to the recovery of Atlantic salmon while addressing critical transportation infrastructure needs in Maine.

Thank you for your cooperation with this programmatic consultation. We look forward to our continued collaboration on conservation of Atlantic salmon and other aquatic species in Maine. Please contact Wende Mahaney by telephone at 207/902-1569 or by email at *wende_mahaney@fws.gov* if you have any questions.

Sincerely,

Anna Harris

Anna Harris
Project Leader
Maine Fish and Wildlife Service Complex
Maine Field Office

Enclosure

cc: Shawn Mahaney, Corps – Augusta, Maine
LeeAnn Neal, Corps – Augusta, Maine

[1] As an action agency, the U.S. Fish and Wildlife Service includes any program and any office which may propose or assist with an eligible road-stream crossing project and is not limited to the Maine Fish and Wildlife Service Complex.

Eric Kuns, FEMA – Boston, Massachusetts
Max Tritt, NMFS – Orono, Maine
Cheryl Martin, FHWA – Augusta, Maine
Judy Gates, MDOT – Augusta, Maine
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Jeremy Bell, TNC – Brunswick, Maine
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ENDANGERED SPECIES ACT SECTION 7 CONSULTATION

PROGRAMMATIC CONSULTATION PACKAGE AND BIOLOGICAL OPINION

Lead Action Agencies:	U.S. Army Corps of Engineers, Federal Emergency Management Agency, and U.S. Fish and Wildlife Service
Activity:	Stream Connectivity Restoration Activities to Benefit Atlantic Salmon Recovery in Maine
Consultation Conducted By:	U.S. Fish and Wildlife Service, Maine Field Office [05E1ME00-2015-F-0389]

Approved by: Anna Harris 9/26/2017

Anna Harris, Project Leader Date

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Acronyms

ACM = aquatic conservation measures
BMP = best management practices
CWA = Clean Water Act
CM = conservation measure
CPUE = catch per unit effort
Corps = U.S. Army Corps of Engineers
DRT = design review team
ESA = Endangered Species Act
FEMA = Federal Emergency Management Agency
GOM DPS = Gulf of Maine Distinct Population Segment
HMA = Hazard Mitigation Assistance
HU = habitat units
IPaC = Information for Planning and Consultation
LAA = likely to adversely affect
M = migration (one of the physical and biological features of critical habitat)
NFIA = National Flood Insurance Act
NLAA = not likely to adversely affect
NMFS = National Marine Fisheries Service
NTU = nephelometric turbidity units
MDMR = Maine Department of Marine Resources
MDOT = Maine Department of Transportation
OHWM = ordinary high water mark
PAH = polycyclic aromatic hydrocarbons
PBA = programmatic biological assessment
PBO = programmatic biological opinion
PBF = physical and biological features
PCE = primary constituent elements
PDC = project design criteria
PNF = project notification form
RHA = Rivers and Harbors Act
Service = U.S. Fish and Wildlife Service
SEWPCP = Soil Erosion and Water Pollution Control Plan
SHRU = salmon habitat recovery unit
SPCCP = Spill Prevention Control and Containment Plan
SR = spawning and rearing (one of the physical and biological features of critical habitat)
TNC = The Nature Conservancy
USASAC = U.S. Atlantic Salmon Assessment Committee
USFS = U.S. Forest Service
USGS = U.S. Geological Survey
YOY = young-of-the-year

CHAPTER 1 INTRODUCTION TO THE PROGRAMMATIC CONSULTATION

This programmatic Endangered Species Act (ESA) section 7 consultation was designed with the express purpose of providing long-term conservation benefits to the endangered Atlantic salmon (*Salmo salar*) and its designated critical habitat. While stream restoration is the primary goal for most projects covered under this consultation, tangible community benefits will also be realized with improved transportation infrastructure. Poorly designed road stream crossings cause problems for fish passage and degrade aquatic habitat but also increase the risk of road flooding and erosion, leading to increased transportation maintenance costs. The projects covered under this programmatic consultation will result in more conservation for Atlantic salmon and their habitats as the result of a successful partnership between multiple agencies with different missions and goals. Recent progress made in Maine to address aquatic habitat connectivity issues associated with road-stream crossings will benefit from streamlining measures like this programmatic consultation.

1.1 Background

Over the last two hundred years, Maine's history of dam construction, log drives, stream channelization, and poorly constructed road-stream crossings has altered and eliminated access to important Atlantic salmon habitat throughout the State (National Marine Fisheries Service (NMFS) and U.S. Fish and Wildlife Service (Service) 2005). Although road-stream crossings were acknowledged as having an impact on Atlantic salmon and their habitat when the species was first listed under the ESA as endangered in the year 2000, our understanding of the magnitude of the impact and the effort required to address the threat has evolved in recent years. Since the implementation of the first Atlantic salmon recovery plan in 2005, the impact of road-stream crossings on the recovery of the species has shifted from being a potential hindrance to recovery to now being considered a significant factor affecting the recovery of the Gulf of Maine Distinct Population Segment (GOM DPS) (NMFS and Service 2005; Service and NMFS 2016). The new 2016 Atlantic salmon Draft Recovery Plan aims to improve access to Atlantic salmon's freshwater spawning and rearing habitat by specifically including culvert removal and replacement as a high priority recovery action related to enhancing habitat connectivity:

> *"Culverts and other road crossings can block the migration of salmon and other migratory fish, particularly in headwater areas where culverts are ubiquitous across the landscape. Headwater habitats can serve as spawning and nursery habitats and are often important areas for temporary or long-term feeding and thermal refuge by Atlantic salmon parr. The effects of known passage barriers can be ameliorated by culvert removal (often through road de-commissioning), culvert replacement (i.e., resizing to 1.2 bank-full width or greater), or bridge construction." (Part IV(A)(1.7)) (Service and NMFS 2016).*

While State and Federal agencies, Tribes, and other conservation partners have made progress in addressing habitat connectivity issues for Atlantic salmon, considerable work throughout the Atlantic salmon's range remains to be done. The Maine Stream Habitat Viewer is a tool that depicts stream habitats important to various fish species across the State and barriers to stream connectivity and aquatic organism passage. While not an exhaustive survey, much of the GOM

DPS has been surveyed for barriers associated with road-stream crossings. As of April 2017, a total of 16,525 road-stream crossing have been surveyed throughout Maine with 5,465 barriers[1] and 6,527 potential barriers[2] identified on both private and public roads (Abbot 2017 pers. comm.). Information about surveyed road-stream crossings within a community is available at the Maine Stream Habitat Viewer at: (*https://www1.maine.gov/dacf/mcp/environment/streamviewer*; accessed April 2017).

In 2014 the Maine Department of Environmental Protection announced the Maine water bond, which provided 5.4 million dollars earmarked for stream crossing improvement projects that benefit water quality; improve public safety by reducing the risk of infrastructure failure; and improve habitat for fish, wildlife and other aquatic organisms. During the first grant cycle in 2015, 15 projects were funded at 0.8 million dollars. In 2016, 2.4 million dollars in grant funds were awarded to 29 projects. The final round of bond funding was awarded in 2017 and provided 28 grants totaling over 2.2 million dollars. In 2017 the Maine Legislature is considering a second general fund bond to assist towns with making further improvements to road-stream crossing infrastructure.

A number of road-stream crossing improvement projects that address transportation infrastructure needs, as well as stream habitat and aquatic organism connectivity needs, have already been constructed in the GOM DPS; and it is anticipated that such projects will continue into the future, supported by various funding opportunities like the Maine water bond. Many of these projects will create a Federal nexus through requiring a permit from U.S. Army Corps of Engineers (Corps), receiving technical assistance or funding through the Service or qualifying for Federal Emergency Management Agency (FEMA) funding. Any proposed Federal action that "may affect" a plant or animal listed under the ESA of 1973, as amended (16 U.S.C. 1531 et seq.), must proceed through the ESA section 7 consultation process prior to project implementation and before permitting or funding by a Federal agency. These projects, when utilizing the design and construction criteria as described in the Programmatic Biological Assessment (PBA)[3] and the following Programmatic Biological Opinion (PBO), can take advantage of a streamlined consultation and Corps permitting process.

This programmatic section 7 consultation involves three Federal action agencies - the Corps, the FEMA, and the Service. A particular road-stream crossing restoration project may involve only one of these Federal agencies, some combination of two agencies, or in certain situations all three action agencies. The role of each of these action agencies pursuant to the ESA is briefly described below.

The Corps issues two basic categories of permits, General Permits for projects with minimal environmental consequence and Standard (or Individual) Permits for projects that do not meet the terms and conditions of a General Permit. For projects meeting the criteria of this PBO, but not the terms and conditions of a General Permit, the Corps will issue a Letter of Permission in

[1]Barriers are generally those crossing structures that are either perched or blocked by debris such that aquatic organism passage is impaired or prevented.

[2] Partial barriers are generally those crossing structures that are undersized and result in increased water velocities through the structure.

[3] A PBA was submitted to the Service by the joint Federal action agencies (the FEMA, the Corps, and the Service) on April 14, 2017.

lieu of an Individual Permit. The Letter of Permission is a permitting mechanism serving the same function and meeting the same requirements as the Individual Permit but allowing for an internal streamlined process for the Corps. The proposed action also has the flexibility to adopt other permit streamlining options should they become available in the future. A Corps permit is required for all work below mean high water in navigable waters of the United States under Section 10 of the Rivers and Harbor Act (RHA) of 1899. In Maine, for purposes of Section 10, navigable waters of the United States are those waters subject to the ebb and flow of the tide and also include the Kennebec River inland to Moosehead Lake and the Penobscot River to the confluence of its east and west branches at Medway. Permits are also required under Section 404 of the Clean Water Act (CWA) for those activities involving the discharge of dredged or fill material below the high tide line in tidal waters and below the ordinary high water mark (OHWM) in all other waters of the United States. Waters of the United States include not only navigable waters but also inland rivers, lakes and streams and their adjacent wetlands. On the coastline, the Corps' jurisdiction under the CWA extends landward to the extreme high tide line or to the landward limit of any wetlands.

The FEMA derives its authorities from the Robert T. Stafford Disaster Relief and Emergency Assistance Act, as amended (42 U.S.C. 5121 et seq.) and the National Flood Insurance Act of 1968, as amended (NFIA) (42 U.S.C. 4001 et seq.). Sections 203, 404, 406 of the Stafford Act (Pre-Disaster Mitigation, Hazard Mitigation Grant Program and Public Assistance Programs, respectively) and Section 1366 of the NFIA (Flood Mitigation Assistance Program) authorize both disaster and non-disaster grant programs that could fund eligible road-stream crossing projects. Together, the Pre-Disaster Mitigation, Hazard Mitigation Grant and Flood Mitigation Assistance Programs form the FEMA's Hazard Mitigation Assistance (HMA) Program. These programs operate with a cost share between FEMA and the grant applicant. The FEMA requirements for program eligibility and Benefit-Cost Analysis are separate from the requirements of this programmatic consultation.

The Service carries out or is a partner in stream restoration projects that benefit Atlantic salmon and a variety of other aquatic species in Maine, both on and off Service properties. Various Service programs and offices may contribute either funding or in-kind services to projects, such as completing engineering and topographical surveys or stream assessments and providing construction equipment or equipment operators.

1.2 Proposed Action and Programmatic Objective

Section 7(a)(1) of the ESA requires Federal agencies, in consultation with the Service, to "utilize their authorities in furtherance of the purposes of this Act by carrying out programs for the conservation of endangered and threatened species." Section 7(a)(2) requires any Federal agency, in consultation with the Service, to insure that any action it "authorizes, funds, or carries out is not likely to jeopardize the continued existence of any listed species or result in the destruction or adverse modification of critical habitat."

In an effort to fulfill both their section 7(a)(1) and 7(a)(2) responsibilities under the ESA, the Service, the Corps and the FEMA, as action agencies, developed a **voluntary program** specifically to facilitate the conservation and recovery of endangered Atlantic salmon through the adoption and implementation of the U.S. Forest Service's (USFS) Stream Simulation methodology for road-stream crossing structures (USFS 2008) that are permitted and funded through each agency's respective programs. Although some projects proposed under the umbrella of this programmatic consultation will have stream restoration as their primary goal, others will have transportation infrastructure needs as their primary goal. This latter category of projects, however, will result in net improvements to stream habitat and aquatic connectivity (for structure removals and replacements) and contribute to the conservation of Atlantic salmon. New road-stream crossings, when designed according to this program, will avoid the habitat and fish passage problems often associated with many existing structures in Maine and will be consistent with Atlantic salmon recovery goals.

This programmatic consultation creates a streamlined and transparent process, with efficiencies being realized by all involved Federal agencies, as well as project proponents seeking Federal funding or permits. By defining a clear set of program eligibility requirements upfront and providing a standardized process for individual project reviews, this streamlined approach will facilitate projects that are consistent with the long-term conservation needs of Atlantic salmon while still ensuring that all participating agencies meet their obligations under the ESA consultation process.

This streamlined consultation process, which focuses on the restoration of stream habitat connectivity in association with road-stream crossings, includes the following four categories of activities:

- road-stream crossing removal and associated stream channel restoration
- road-stream crossing replacement with a stream simulation structure
- Installation of a new stream simulation crossing structure for new road construction
- maintenance or repair of a stream simulation crossing structure

A detailed description of the proposed action, including project design criteria and conservation measures designed to avoid and minimize effects to listed species and critical habitat, is given below in **Chapter 2** section **2.1** of the PBO.

1.3 Geographic Scope

The geographic scope of this programmatic consultation includes all inland waters located within the State of Maine including the non-tidal portions of the federally designated navigable waters in the Penobscot River and Kennebec River (Section 10 Rivers and Harbors Act of 1899) and that are located within the geographic range of the Atlantic salmon GOM DPS. In estuarine and marine waters (or below the head of tide), the NMFS has the lead responsibility for all activities needing ESA section 7 consultation, including road-stream crossings. This programmatic consultation is limited to road-stream crossings in freshwater habitats where the Service has the lead responsibility for ESA section 7 consultations and, therefore, does not include any projects located in marine or estuarine waters.

1.4 Number of Proposed Projects

During the five-year period from October 12, 2010 through October 12, 2015, the Corps issued 104 permits for non-Maine Department of Transportation (MDOT) road-stream crossing projects for a variety of applicants including towns, counties, other State agencies, and private landowners. Of those, 73 were located within the GOM DPS. During the same five year period, FEMA funded four HMA grant projects within the GOM DPS. Additionally, the Service's Gulf of Maine Coastal Program contributed either funding or technical assistance to approximately 15 projects within the GOM DPS (Wright 2016 pers. comm.) while other Service programs contributed to a similar number of projects. Many of these projects funded by the Service or FEMA also needed a permit from the Corps.

During the five-year lifecycle of this programmatic consultation, we expect to process about 120 projects with an average of 24 projects annually. Based on an analysis of MDOT data (Service 2017), we anticipate that 67 (56 percent) of the projects will require informal section 7 consultation and 53 (44 percent) will require formal section 7 consultation. We expect to have fewer than the annual average of projected projects for the 2018 construction season but anticipate an increase in the number of projects in the future as knowledge of and experience with this streamlined process grows.

1.5 Programmatic Duration

This programmatic consultation expires five years from the date the Service issues their PBO. At the end of the five-year period, the Federal agencies will have the opportunity to renew the existing programmatic consultation or to reinitiate ESA section 7 consultation if changes to the programmatic consultation are necessary to address 1) any unanticipated effects to listed species or designated critical habitat, 2) newly listed species, or 3) changes or additions to the scope of covered activities.

1.6 Listed Species and Critical Habitat That May be Affected

The following federally listed species and designated critical habitats may be affected by the proposed action, whose geographic scope encompasses the entire geographic range of the Atlantic salmon GOM DPS:

- Atlantic salmon (*Salmo salar*) and designated critical habitat
- Canada lynx (*Lynx canadensis*) and designated critical habitat
- northern long-eared bat (*Myotis septentrionalis*)
- small whorled pogonia (*Isotria medeoloides*)
- rusty patched bumble bee (*Bombus affinis*)

The **Figure 1** below displays the geographic scope of this programmatic consultation, along with the ESA listed species under the jurisdiction of Service that overlap with the range of the GOM DPS. The section 7 consultation ranges shown in **Figure 1** are the same as those used by the Service's Web site *Information for Planning and Consultation* (IPaC) (*https://ecos.fws.gov/ipac/;* accessed September 2017*)*, which is used to obtain an official species list for any proposed project in Maine.

1.7 Endangered Species Act Section 7 Consultation Summary and Letter of Concurrence

1.7.1 Atlantic Salmon and Designated Critical Habitat

The PBO that follows below analyzes all of the expected effects from the proposed activities on both Atlantic salmon and their designated critical habitat. This analysis includes effects that are adverse, as well as those that are either insignificant or discountable. In those cases where projects are located in designated critical habitat, our analysis demonstrates that all programmatic activities are not likely to adversely affect Atlantic salmon critical habitat because all effects are either insignificant or discountable.

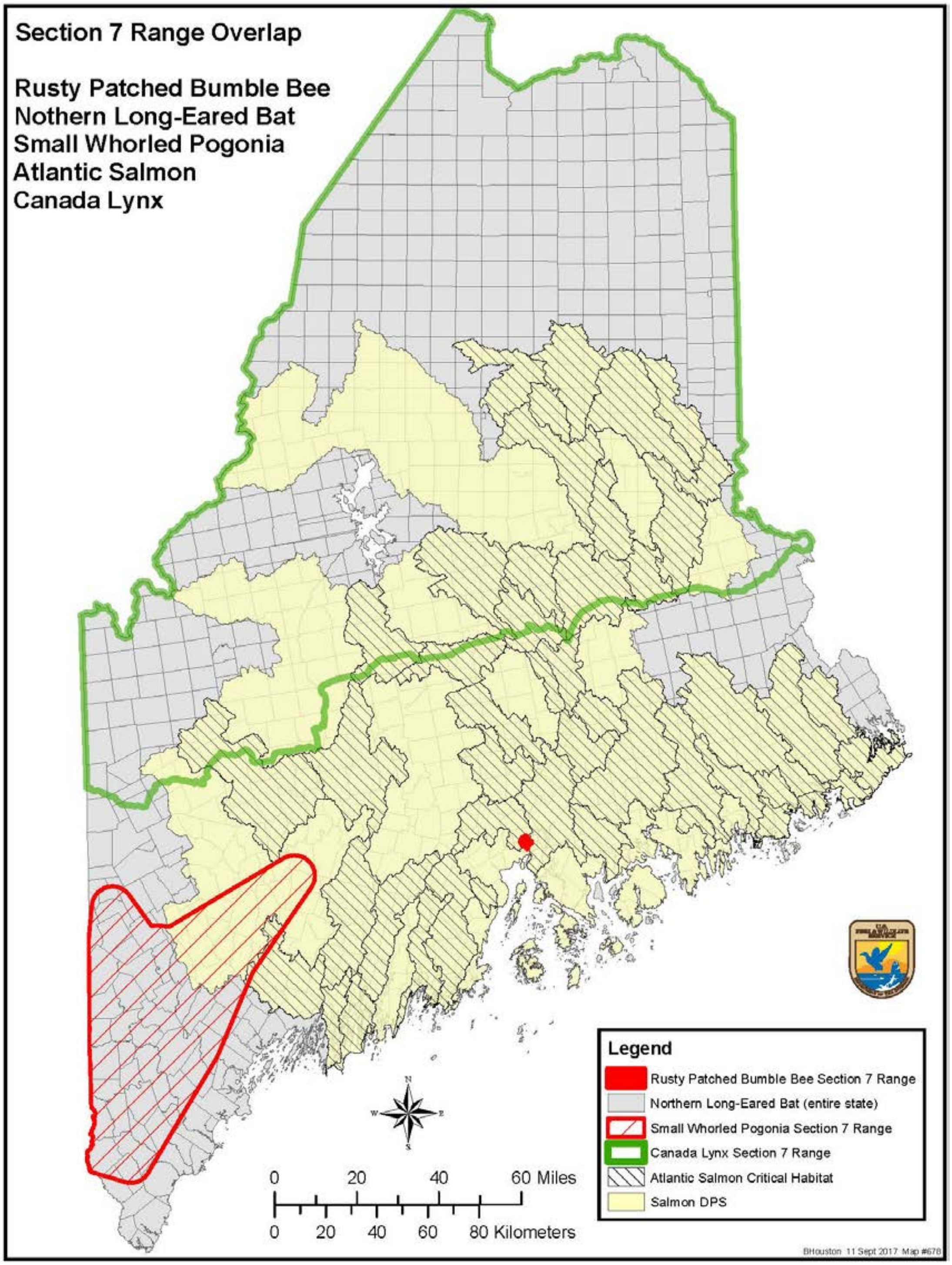
The PBO analyzes a variety of effects to individual Atlantic salmon, ranging from the effects of elevated turbidity and temporary migration barriers during construction to the effects of fish handling and relocation. These effects range from those that are insignificant or discountable to those that are adverse and could result in injury or death of individual Atlantic salmon.

The conclusion on whether or not a given project proposed under this programmatic consultation is likely to adversely affect Atlantic salmon is contingent on whether or not Atlantic salmon are likely present with the action area. If Atlantic salmon are not likely present, we can conclude that any of the four proposed activities are not likely to adversely affect Atlantic salmon. When Atlantic salmon are likely present in the action area, we conclude that projects will result in adverse effects to Atlantic salmon.

Support for these conclusions regarding effects to the species and to critical habitat is provided in the PBO that follows. We, therefore, provide concurrence with the Federal action agencies' determination that project activities located in areas where Atlantic salmon are not likely to occur are not likely to adversely affect both Atlantic salmon and their critical habitat.

Over the five year term of this programmatic consultation, we estimate a total of 120 projects will be constructed. Based on a recent analysis done by the MDOT of their past and upcoming projects that would affect waters in the GOM DPS, we estimate that approximately 56 percent of the 120 projects will require informal section 7 consultation (NLAA determination) and 44 percent will require formal section 7 consultation (LAA determination) (Service 2017). Therefore, we expect this programmatic consultation to cover approximately 67 projects with an NLAA determination and 53 projects with a LAA determination. These projects might occur anywhere in the non-tidal rivers and streams of the GOM DPS range.

Figure 1. Listed species section 7 consultation ranges covered by the road-stream crossing programmatic consultation[4].



[4] The geographic scope of this programmatic section 7 consultation does not include estuarine or marine waters.

1.7.2 Canada Lynx and Designated Critical Habitat

The range of the threatened Canada lynx in Maine overlaps with the northern half of the Atlantic salmon's range. Additionally, there is some overlap between designated critical habitat for the Canada lynx in northern Maine and the Atlantic salmon's range and critical habitat. More information on the Canada lynx and its critical habitat in Maine (boreal forest landscapes occupied by the Canada lynx's primary prey, snowshoe hares) can be found in the PBA (pages 47-51 and page 61).

As described below in the PBO in **Chapter 2** section **2.1.8** this programmatic consultation requires the adoption of one conservation measure (CL1, page 43) to minimize effects to Canada lynx and their critical habitat. Any road-stream crossing project that cannot comply with this conservation measure is not eligible to use this programmatic consultation process and must go through a project-specific ESA section 7 consultation.

The PBA for this programmatic consultation considers effects to the threatened Canada lynx and its designated critical habitat from three of the four covered activities, namely road stream crossing removals, road stream crossing replacements, and repairs of existing stream simulation structures. As summarized below, the Service provides concurrence that these activities are not likely to adversely affect Canada lynx and their critical habitat because all effects will be either insignificant or discountable. For all proposed projects that involve installation of a new stream crossing structure in association with new road construction, the Federal action agency will most likely need to consult separately with the Service regarding effects to Canada lynx and critical habitat. The probable effects from new road construction and any related new development will generally be beyond the scope of this programmatic consultation and in some instances may lead to adverse effects to Canada lynx and their critical habitat. Projects involving the installation of a new road stream crossing structure, however, may still be eligible to use this programmatic consultation process related to effects to Atlantic salmon and their critical habitat if the project otherwise meets all program requirements.

The project-specific action areas for the three activities noted in the previous paragraph are very small compared to the home range of an individual Canada lynx in Maine. The average home range of a female is 10 square miles and a male is 21 square miles (Vashon *et al.* 2008). With the exception of stockpile or staging areas, all project activities will occur within the existing road prism and the nearby stream channel in a relatively small area (typically less than one acre of overall disturbance). Staging and stockpile areas, which are generally only a fraction of one acre in size, are often within the road right-of-way but may occur in other nearby areas that have forested habitat suitable for Canada lynx. A very small amount of vegetation removal, including tree clearing, may be necessary to allow access to the construction site and to provide for staging and stockpile areas. Where vegetation removal occurs in a stockpile or staging area, the area must be revegetated with native plant species to facilitate restoration of Canada lynx habitat. Given the very small area of disturbance for the proposed activities, where the focus of the disturbance is in a stream channel, we conclude that all effects to Canada lynx habitat, including critical habitat, are insignificant.

Given the small area of disturbance associated with the proposed activities and the fairly short duration of construction-related disturbance (generally a few days), it is very unlikely that an individual Canada lynx would encounter any given project during construction. Given a Canada lynx's large home range, any Canada lynx in the vicinity of a project could readily move into nearby forested habitat to avoid the temporary and short-term disturbance associated with construction. Because of their large-scale movements, Canada lynx are vulnerable to mortality from vehicle collisions while crossing roads. Since none of the proposed activities will result in either increased vehicle speeds or numbers on the associated roadways, there will be no change in the expected threat of collision mortality for Canada lynx. The removal or replacement of existing under-sized road-stream crossing structures with properly sized structures based on Stream Simulation principles might provide some benefit to Canada lynx movements along stream corridors. We conclude that all effects to Canada lynx are either insignificant or discountable.

1.7.3 Northern Long-Eared Bat

When not hibernating, the northern long-eared bat may occur anywhere within the range of the GOM DPS in a variety of forested habitats. At this time, there are no known winter hibernacula used by northern long-eared bats within the range of the GOM DPS. More information on the northern long-eared bat is available in the PBA (pages 51-55 and page 61).

Any project proposed under this programmatic consultation that involves cutting down trees three inches or greater diameter at breast height will result in a "may affect" determination for the northern long-eared bat unless an approved survey determines that this species is likely absent from the project site. As described below in the PBO in **Chapter 2** section **2.1.8** this programmatic consultation requires the adoption of three conservation measures for northern long-eared bats (NLEB1, NLEB2, and NLEB3, page 43). Any project that cannot comply with these conservation measures is not eligible to use this programmatic consultation and must go through a project-specific section 7 consultation.

In regard to effects to the northern long-eared bat, the Federal action agencies are relying on a streamlined ESA section 7 consultation framework developed by the Service in 2016 (*https://www.fws.gov/Midwest/endangered/mammals/nleb/s7.html*; (accessed September 2017). This framework relies on a PBO that the Service prepared for the final 4(d) rule for this species. The PBO allows for streamlining the section 7 consultation process where a proposed Federal action may affect the northern long-eared bat but will not cause prohibited take as described in the 4(d) rule.

For projects considered under this road-stream crossing programmatic consultation that may affect the northern long-eared bat, most likely because of the need to cut down trees in the project action area, the lead Federal action agency will submit a streamlined consultation notification form to the Service as part of the project review process (which is more thoroughly explained in the following PBO). This form provides for a determination by the action agency that the proposed project will not result in any prohibited incidental take. In the very rare circumstance where a proposed project will result in prohibited take of northern long-eared bats pursuant to the 4(d) rule, a project-specific consultation for this species will be necessary. Such projects may, however, still be eligible to use this programmatic consultation process regarding effects to Atlantic salmon and their critical habitat.

1.7.4 Small Whorled Pogonia

The range of the threatened small whorled pogonia overlaps with a small portion of the GOM DPS in the southwestern part of the Atlantic salmon's range. The small whorled pogonia is a perennial orchid that grows in a variety of upland, mid-successional forested habitats that usually have a relatively open understory and a thick layer of leaf litter on the forest floor. This species may occur on slopes near small streams. More information on the small whorled pogonia is available in the PBA (pages 55-57 and pages 61-62).

As described below in the PBO in Chapter 2 section **2.1.8** this programmatic consultation requires that all projects must avoid any effects to small whorled pogonia by adopting three conservation measures (SWP1, SWP2, and SWP3, page 43-44) that ensure that construction activities avoid impacting all locations where the plant is present. Consequently, any project that "may affect" the small whorled pogonia is not eligible for this programmatic consultation. Early coordination with the Federal Action Agency(ies) for projects within the range of the small whorled pogonia may help with identifying project modifications to avoid effects to this species or to facilitate a project-specific section 7 consultation outside the scope of this programmatic consultation when necessary.

1.7.5 Rusty Patched Bumble Bee

The rusty patched bumble bee was listed as an endangered species effective March 21, 2017 (*Federal Register* 2017, 3186)[5]. The current range of this species in Maine, a small area in Waldo County, occurs within a very limited portion of the geographic range of this programmatic consultation. Because of the newness of this listing and the very small number of projects that might affect this species given its known occurrence in Maine, this programmatic consultation does not analyze potential effects to the rusty patched bumble bee. Proposed projects that "may affect" the rusty patched bumble bee, but otherwise meet the requirements of this programmatic consultation, must initiate a separate section 7 consultation for the bumble bee. The Lead Action Agency will be responsible for ensuring that this consultation is completed with the Service. This programmatic process, however, can still be used to address section 7 consultation for the Atlantic salmon and their critical habitat.

1.8 Adaptive Management

The Corps, the FEMA, and the Service will apply adaptive management strategies throughout the effective lifetime of this consultation. Incorporating new information on the effects of the action and the function of the program will allow the agencies to ensure that effects of the proposed actions are effectively minimized and that the programmatic consultation continues to be consistent with stated efficiency and conservation goals. Changes to this programmatic consultation will be considered on an annual basis but may also occur at any time deemed appropriate. At an annual review meeting, the agencies will discuss individual project implementation, monitoring results, application of conservation measures (CMs) and other

[5] Although the final listing rule for the rusty patched bumble bee lists the effective date as February 10, 2017, the effective date was subsequently extended by the Service to March 21, 2017.

commitments and assumptions made herein to ensure that this programmatic consultation is being appropriately and successfully implemented.

1.9 Consultation History

- **January 16, 2015 –** The Service and the Corps meet with The Nature Conservancy (TNC) to discuss a potential programmatic section 7 consultation process for road-stream crossings to promote recovery of Atlantic salmon.
- **May 14, 2015 –** The Service, the Corps, and TNC meet for further discussions on a programmatic section 7 consultation.
- **June 9, 2015 –** The Service and the FEMA meet to discuss participation in a programmatic section 7 consultation process with the Corps for road-stream crossings.
- **August 19, 2015 –** The Service, the Corps, and the U.S. Forest Service (USFS) have a conference call to discuss the programmatic consultation and the possibility of technical support from the USFS.
- **August 20, 2015 –** The Service has a conference call with TNC to discuss how TNC might assist with the programmatic consultation effort with the Corps and the FEMA.
- **October 27, 2015 –** The Service and the FEMA have a conference call to discuss preparation of a biological assessment for the road-stream crossing programmatic consultation.
- **November 2, 2015 –** The Service, the Corps, the FEMA, the Federal Highway Administration, and the MDOT have a conference call to discuss the two programmatic section 7 consultation s under development for road-stream crossing projects. The FEMA wanted to explore whether they should participate in the MDOT programmatic as a Federal action agency.
- **November 9, 2015 –** Service staff meet to discuss design criteria for road-stream crossing projects that could be covered by a programmatic section 7 consultation with the Corps and FEMA.
- **November 16-20, 2015 –** The Service hosts Scott Peets from the USFS (Oregon), who is providing technical assistance to the Corps and the FEMA in preparation of a BA for the programmatic consultation. Various site visits and meetings are held during the week, including coordination with TNC.
- **December 1, 2015 –** The Federal agency team[6] has a conference call to begin work on the BA.
- **December 7, 2015 –** Service staff meet to continue development of the design criteria for projects.
- **December 14, 2015 –** The Federal agency team meets with TNC, Project SHARE, and Wright-Pierce Engineering to discuss progress on design standards.
- **January 15, 2016 –** The Federal agency team has a conference call to discuss progress on the BA.

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[6] The Federal agency team consists of various staff from the Service, the Corps, the FEMA, and the USFS. Use of this term throughout the consultation history is general and does not imply that staffs from each agency were necessarily present at each meeting or conference call. Other than during the week of November 16-20, 2015, USFS participation was always via conference call or email.

- **January 21, 2016 –** The Federal agency team meets to continue work on design criteria, program objectives, etc.
- **February 12, 2016 –** Federal agency team has a conference call with Bob Gubernick, USFS, to review draft design criteria (based on Stream Simulation) and required data and information needs for projects, in support of drafting the BA.
- **March 10, 2016 –** Federal agency team has a conference call to discuss the draft BA.
- **March 15, 2016 –** The FEMA sends the first complete draft of the BA to the Service for review.
- **March 21, 2016 –** Federal agency team has a conference call to discuss Service comments on draft BA.
- **March 30, 2106 –** Federal agency team has conference call to discuss draft BA.
- **March 31, 2016 –** Service sends comments on draft BA to the rest of the Federal agency team.
- **April 6, 2016 –** Federal agency team has conference call to discuss draft BA.
- **May 20, 2016–** Federal agency team has conference call to discuss draft BA.
- **August 1, 2016 –** Federal agency team has conference call to discuss draft BA.
- **September 27, 2016 –** Federal agency team meets with TNC to give update on the programmatic consultation and streamlined permitting process.
- **November 16, 2016 –** The FEMA sends a revised draft of BA to the Service for review and comment.
- **February 10, 2017 –** Federal agency team has a conference call to discuss bringing the effects analysis portion of the draft BA in line with the recently completed programmatic consultation for MDOT projects.
- **February 15, 2017 –** The Service sends comments on the draft BA back to the action agencies.
- **February 28, 2017 –** Federal agency team has a conference call to review and discuss the draft project notification form.
- **March 21, 22, and 31, 2017 –** The FEMA and Service staff meet to work on re-writing the Effects of the Action section of the draft BA.
- **April 14, 2017 –** The FEMA, the Corps, and the Service initiate formal section 7 consultation with the Service. The letter indicates that while requesting immediate initiation of consultation, there will continue to be dialogue among the agencies regarding some outstanding issues.
- **May 4, 2017 –** The FEMA, the Corps, and the Service meet to work on several forms necessary for project reviews under the programmatic consultation.
- **June 16, 2017 –** The FEMA, the Corps, and the Service have a conference call to discuss several proposed minor modifications to the project description.
- **June 20, 2017 –** The Service sends a revised project description out for review to the FEMA and the Corps.
- **September 6, 2017 –** Draft PBO sent out to the Federal Action Agencies for review and comment.

CHAPTER 2 PROGRAMMATIC BIOLOGICAL OPINION

This Programmatic Biological Opinion (PBO) presents the Service's review of the status of Atlantic salmon, the condition of designated critical habitat, and the environmental baseline for the action area, as well as our analyses of all the effects of the actions as proposed and the cumulative effects (50 CFR 402.14(g), *Federal Register* 1986, 19957; as amended by *Federal Register* 1989, 40350; *Federal Register* 2008, 76287; *Federal Register* 2009a, 20423; *Federal Register* 2015, 26844). For the jeopardy analysis, the Service analyzed these combined factors to conclude whether the proposed action could appreciably reduce the likelihood of survival and recovery of Atlantic salmon. The Service did not analyze whether the proposed action would result in an adverse modification to critical habitat, since all effects to critical habitat were determined to be either insignificant or discountable.

This PBO is based on the following resources:

- information provided in the FEMA/Corps/Service initiation letter requesting formal consultation and the accompanying Biological Assessment;
- Final Endangered Status for a Distinct Population Segment of Anadromous Atlantic Salmon (*Salmo salar*) in the Gulf of Maine (*Federal Register* 2000, 69459);
- Status Review for Anadromous Atlantic Salmon (*Salmo salar*) in the United States (Fay *et al.* 2006);
- Determination of Endangered Status for the Gulf of Maine Distinct Population Segment of Atlantic salmon; Final Rule (*Federal Register* 2009b, 29344);
- Designation of Critical Habitat for Atlantic Salmon Gulf of Maine Distinct Population segment (*Federal Register* 2009c, 29300; and *Federal Register* 2009d, 39903);
- field investigations;
- previous section 7 consultations with the action agencies on road-stream crossing projects;
- meetings and telephone conversations; and
- scientific literature.

A complete administrative record of this consultation will be maintained by the Service's Maine Field Office in East Orland, Maine. The Service log number is 05E1ME00-2015-F-0389.

2.1 Description of the Proposed Action

The following description of the proposed action is largely based on the PBA developed by the Federal action agencies. The Corps, the Service, and the FEMA propose to permit or fund four categories of stream connectivity restoration activities under this programmatic consultation. To provide context for these categories, this section includes the following: 1) Programmatic Activity Categories; 2) Project Design Criteria (PDC); 3) Program Administration; 4) Excluded Projects; 5) Stream Connectivity Construction Methods, Impacts and Incorporated Conservation Measures; 6) Aquatic Conservation Measures; 7) Work Area Isolation and Atlantic salmon Evacuation Conservation Measures; and 8)Terrestrial Species and Habitat Conservation

Measures. The PDC and CMs were collaboratively developed to minimize the short-term construction related effects to Atlantic salmon and designated critical habitat, while maximizing the long-term benefits for Atlantic salmon, the aquatic environment in general, and other species, including non-ESA listed species.

2.1.1 Programmatic Activity Categories

Four categories of activities, all based on the Stream Simulation design methodology, are included in this programmatic consultation. These four activity categories are briefly described below.

2.1.1.1 Road-Stream Crossing Removal and Associated Channel Restoration

A crossing structure will be removed and the affected area will be restored to a more natural state. Following structure removal, the stream channel will be reconstructed to match natural bankfull width, channel slope and active floodplain dimensions, which exist upstream and downstream of the structure being removed. This activity will occur to restore physical and biological aquatic habitat connectivity, most notably, passage for the endangered Atlantic salmon. All structure removal projects will occur in association with a closed or decommissioned road and not a low-water ford stream crossing. Installation of low-water fords is not included as an activity covered by this programmatic consultation.

2.1.1.2 Road-Stream Crossing Replacement with a Stream Simulation Structure

A crossing structure will be removed and replaced with a Stream Simulation culvert or open-bottomed structure. Culvert refers to a variety of closed-bottomed metal and concrete structures. Open-bottomed structures include arches, three-sided boxes and bridges. Structure widths will be at least 1.2 times bankfull width with stable bank rocks on both sides. Structures will be constructed in a manner that accommodates 100-year flows and allows for natural stream processes including sediment and wood transport to the greatest degree possible given the structure dimensions. Flood relief culverts on unconfined floodplains may be used. Crossings with large unconfined floodplains may require additional capacity or may include floodplain relief structures.

2.1.1.3 Installation of a New Stream Simulation Structure for New Road Construction

A new Stream Simulation culvert or open-bottomed structure will be installed in association with construction of a new road in a location that previously did not have a stream crossing structure. Culvert refers to a variety of closed-bottomed metal and concrete structures. Open-bottomed structures include arches, three-sided boxes and bridges. Structure widths will be at least 1.2 times bankfull width with stable bank rocks on both sides. Structures will be constructed in a manner that accommodates 100-year flows and allows for natural stream processes including sediment and wood transport to the greatest degree possible given the structure dimensions. Flood relief culverts on unconfined floodplains may be used. Crossings with large unconfined floodplains may require additional capacity or may include floodplain relief structures.

2.1.1.4 Maintenance and Repair of a Stream Simulation Structure

Maintenance and repair activities will be allowed for existing structures that are designed and constructed utilizing Stream Simulation methodologies consistent with the design criteria in this PBO, including those that were designed and constructed utilizing Stream Simulation methodologies before this programmatic consultation. Maintenance actions include minor changes or repairs to structure footer protection, embankments or banklines; replacement of stream substrate within the structure; and removal of vegetative or anthropogenic debris that may have gathered at the structure inlet during flood events. Removed wood may be placed immediately downstream of the structure to meet large wood objectives, unless the placement poses a threat to downstream infrastructure.

2.1.2 Project Design Criteria

Stream Simulation designs are intended to replicate the natural stream processes at a road-stream crossing within and immediately adjacent to a culvert or opened-bottom structure. Aquatic organism passage, sediment transport and flood and wood conveyance within the structure are intended to imitate the stream conditions upstream and downstream of the crossing, as close to natural conditions as the structure type allows. Culverts and open-bottomed structures, when properly sized and designed, can accomplish these natural stream processes. Culverts will be partially filled with material that simulates the natural streambed. Open-bottomed structures will contain substrate that matches the natural stream channel.

Implementation of a Stream Simulation project requires a high level of information and site-specific data regarding stream hydrology and geomorphology, as well as engineering and construction expertise. Project design criteria include several components as described below.

2.1.2.1 Structure Width

The width of structures (at bankfull or top of bank elevation) must be equal to or greater than 1.2 times bankfull channel width. A single structure must span this width (i.e., multiple culverts are not allowed). The minimum structure width of a culvert must be five feet to allow placement of Stream Simulation material. The width of the structures within the vertical adjustment potential must be equal to or greater than 1.2 times bankfull channel width. No piers, footers, piles, or abutments within 1.2 times bankfull width will be allowed.

2.1.2.2 Structure Alignment

The structure should achieve optimal orientation relative to both the road and stream channel. Replacement structures are sometimes shifted to achieve better alignment with the natural stream channel pattern at the crossing location.

2.1.2.3 Structure Capacity

The structure must accommodate a 100-year flood flow without significant change in substrate size and composition. To meet this requirement, unconstrained channel types may require structures wider than 1.2 times bankfull or additional flood relief structures. The headwater depth to structure height ratio should not exceed 0.8:1 for 100-year flows in order to allow for additional vertical clearance for wood and sediment transport.

2.1.2.4 Channel Slope

The structure slope should match an appropriate reference reach of the natural stream (assessed at a minimum of approximately 20-30 times the channel width upstream and 20-30 times the channel width downstream of the site, though a suitable reference reach could be located further upstream or downstream). The maximum slope must not exceed 3.5 percent because of difficulties in retaining substrate within the structure at higher gradients, increasing both costs and design complexity.

2.1.2.5 Embedment

If a culvert is used, the bottom of the culvert must be buried into the streambed not less than 2 feet or 20 percent of the culvert height beyond 2 feet.

2.1.2.6 Elevation

For open-bottomed structures, the footings or foundation must be designed to be stable for the maximum scour depth. The structure must also provide a low flow channel.

2.1.2.7 Substrate

Material in structures must match the natural stream channel. Bed materials should match natural stream bed mobility characteristics. Bank and other key bed structural elements (e.g. steps, weirs, ribs, etc.) must be stable at the 100-year flow.

2.1.2.8 Geotechnical analysis

Structure design and construction methods may be influenced by soil composition and subsurface conditions including, but not limited to, the presence of bedrock and clay. The need for geotechnical analysis is determined on a project-specific basis and is not always necessary.

2.1.3 Program Administration

Administration of this programmatic section 7 consultation will be guided by the reporting, meeting, and coordination requirements as discussed below.

2.1.3.1 Definitions

- **Action Agency**: The Corps, the FEMA, the Service or any combination thereof.

- **Applicant**: Throughout the remainder of this document the Applicant will be defined as an applicant for a Corps permit, a Corps permittee, a contractor for the permittee, a FEMA grant applicant, a FEMA recipient or sub-recipient, or a recipient of Service technical assistance or funding.

- **Lead Agency**: The Action Agency that is serving as the lead agency for purposes of ESA section 7 consultation for a project proposed under this programmatic consultation. When both the Corps and the FEMA or Service are involved, by agreement, the Corps will serve as the lead agency.

2.1.3.2 Implementation of the Programmatic Consultation

As individual projects are proposed, the Action Agency(ies) will review each action to determine if it 1) qualifies as one of the activity categories covered in this programmatic consultation, 2) meets the basic design criteria, and 3) meets all of the applicable conservation measures necessary to avoid and minimize effects to listed species and critical habitat. This consistency determination will be documented in the project notification form (PNF), the ESA Section 7 Verification Form, and the Design Review Form, which taken together will demonstrate how each project tiers to the PBO. Project-specific consultation will be required for all "may affect" road-stream crossing projects that do not fit within one of the programmatic categories, do not meet all of the programmatic design criteria or conservation measures, or include effects not considered for a species under this programmatic consultation.

As soon as a proposed project location is identified, the Lead Agency will engage in early coordination with Service. The purpose of this early coordination is to determine the likely presence or absence of Atlantic salmon at the project-specific action area. Early coordination with State resource agencies, such as the Maine Department of Marine Resources (MDMR), or others familiar with the project site, will occur as needed to assist in determining the likely presence of Atlantic salmon.

If the presence of Atlantic salmon is determined to be likely, the Lead Agency must make a "likely to adversely affect" determination for Atlantic salmon. The presence of Atlantic salmon will also trigger the need for the Applicant to incorporate a fisheries biologist(s) or other qualified personnel to conduct mandatory fish evacuation (see **Chapter 2** section **2.1.7.2**) from the project site. While State or Federal agency staff may be available to complete fish evacuation for some projects, Applicants should be prepared to make other arrangements when necessary.

The Lead Agency will submit a completed PNF and all required plans, photographs, and other documentation to the design review team (DRT), the Service, and any other Action Agency. The DRT review will determine if the proposed project meets the required Stream Simulation design elements, as documented on the Design Review Form. This review can result in a request for additional information or for design modifications, which will be funneled back through the Lead Agency to coordinate with the applicant. The DRT review may also result in the project being deemed not eligible for the programmatic process due to major design or data deficiencies. Should this happen, applicants can submit a new PNF to the Lead Agency when the deficiencies have been appropriately addressed. Projects that are approved by the DRT will continue through the programmatic process.

For those projects that are approved by the DRT, the Lead Agency will then submit the approved Design Review Form and the ESA Section 7 Verification Form to the Service. When all of the required information is provided and the project qualifies for programmatic coverage, informal

Tier 2 consultations will be completed within 14 calendar days of receipt by the Service and formal Tier 2 consultations within 30 calendar days of receipt by the Service. In consideration of the required instream work window of July 15 – September 30, action agencies will routinely encourage Applicants to submit PNFs as early as possible to allow adequate time for the Federal agency coordination and permitting process to be completed.

2.1.3.3 Designer Qualifications

The Applicant must provide the Action Agency(ies) with a description of their design team's training and previous project experience with Stream Simulation structures. Examples of qualification include, but are not limited to, completion of USFS Stream Simulation courses and previous design experience with Stream Simulation projects.

2.1.3.4 Integration of Project Design Criteria and Conservation Measures into Project Design and Contract Language

The Action Agency(ies) shall insure that the Applicant incorporates all appropriate aquatic and terrestrial CMs and Stream Simulation project design criteria listed in this PBO into contract language. The Action Agency(ies) will also ensure that appropriate CMs, design criteria, and other program requirements are reflected in permit conditions and grant conditions.

2.1.3.5 Project Notification Form (PNF)

The Applicant will provide the Lead Agency with a site specific PNF that contains the information described below. The PNF will be provided to all Action Agencies, the Design Review Team, and the Service.

- **A.** Project Name – Use the same project name consistently from notification to completion

- **B.** Location – 5th field HUC (HUC - 10 Code), stream name, latitude and longitude (decimal degrees; to 5 decimal places) and U.S. Geological Survey (USGS) Map Location

- **C.** Project Contact – Project point of contact name, phone number, and email address

- **D.** Timing – Projected start and end dates

- **E.** Activity Type – List one of the four stream connectivity activity categories

- **F.** Project Description – Brief narrative of the project and objectives

- **G.** Extent – Number of stream miles restored for Atlantic salmon access or stream connectivity using the Maine Stream Habitat Viewer (*http://www.maine.gov/dacf/mcp/*environment*/streamviewer/*; accessed September 2017)

H. ESA-listed Species in the Project Area – Official IPaC species list *(https://ecos.fws.gov/ipac/*; accessed September 2017) of ESA listed species and critical habitat present in the project action area.

I. Presence/absence of Atlantic salmon at project site – Note the likely presence or absence of Atlantic salmon within the project action area based on prior agency coordination. For proposed projects where Atlantic salmon are likely present, identify who is conducting fish evacuation. If someone other than State or Federal resource agency staff will be doing fish evacuation, submit information on the qualifications of the personnel that will be involved.

J. Date of Submittal

K. Design Materials to be Submitted:

a) Title Sheet

b) Project location map – State location map and USGS quad showing watershed area upstream of site

c) Existing site photos (inlet, outlet, upstream and downstream). Inlet and outlet photos (where applicable) should be taken between 25 and 50 feet from the structure in a manner that shows the stream structure and road on either side

d) Proposed Design – Appropriate design methodology steps are documented in Chapter 6 of *Stream Simulation: An Ecological Approach to Providing Passage for Aquatic Organisms at Road-Stream Crossings* (USFS 2008)

1) Plan views:

- Provide a site-specific topographic map that depicts the following locations: existing and proposed structure; staging areas; stockpile areas; temporary access roads and stream crossings; a minimum of one permanent benchmark location with three being preferable, as well as elevations of the stream channel; and floodplain, culvert, road or any other relevant features. For replacement projects, document and explain any proposed changes in structure alignment.

- Dewatering and sediment control plan **– If Atlantic salmon are likely present within the proposed project action area fish evacuation, including electrofishing, is mandatory before dewatering**. See **Chapter 2**, section **2.1.7.2** below for details.

- Bed and bank plan view inside structure (show banklines and any added bed or bank elements)

2) Cross Section Views – Crossing elevation view showing existing structure and proposed structure – including footings, bed materials, banklines, road surface, and low flow channel elevations, widths and depths.

3) Additional details – key features, stream structure elements, and any use of vegetative material to meet large wood objectives.

4) Structure and stream profile showing proposed structure elevations, expected bed elevations, step or bed feature details.

5) Hydrologic and hydraulic analysis

- Provide a range of expected discharges (bankfull and 100-year flows) generated from professionally accepted methodologies (USGS StreamStats (Dudley 2015) or other professionally accepted methodologies).

- Provide graphic with headwater elevations and outlet velocity in relation to structure elevation for the 100-year flow to ensure that the structure will pass this flow using professionally accepted methodologies (HEC-RAS, HY-8, etc.). Headwater depth to structure height ratio should not exceed 0.8:1 for the 100-year flow.

6) Mobility and stability analysis

- Bed materials – Provide percentiles from the reference reach (D95, D84, D50, and D16) and the design reach. Include a narrative on how and why they were or were not modified based on the structure selection and design gradient.

- Key pieces and bedforms – Provide percentiles from the reference reach (D95, D84, D50, and D16) and the design reach. Include a narrative on how and why they were or were not modified based on the structure selection and design gradient.

7) Supplemental Design Data

e) Documentation of existing structure (for replacement activities) and geomorphic conditions which are required to create a Stream Simulation structure. Appropriate survey protocols are documented in Chapter 5 of

Stream Simulation: An Ecological Approach to Providing Passage for Aquatic Organisms at Road-Stream Crossings (USFS 2008)

1) Topographic Survey and Existing Conditions:

- Dimensions, materials, and elevations of existing structures; plan view showing existing surficial conditions (alignment, edges of pavement or gravel, culvert, road, road fill, utilities, etc.).

- Bank elevations and channel elevations adjacent to existing structure.

2) Geomorphic Conditions:

- Stream channel and floodplain reference reach representative cross sections with photos, including bankfull widths and floodplain dimensions.

- Stream gradient – a longitudinal profile that extends well outside the influence of the existing crossing structure (approximately 20-30 times the stream width upstream and 20-30 times the stream width downstream of the site, but could be much further if nearby not suitable as a reference reach) showing bed features, key grade controls, location of bedrock/ledge, maximum scour and aggradation potential limits (vertical adjustment potential).

- Reference reach channel substrate and key piece characterization.

2.1.3.6 Design Review Team (DRT)

The DRT will consist of qualified personnel from agencies, non-governmental organizations, or private companies. The DRT will analyze the complete proposed project design packet and determine if the proposed design meets the structure and stream channel design criteria described in Section B above and the principles of Stream Simulation as outlined in *Stream Simulation: An Ecological Approach to Providing Passage for Aquatic Organisms at Road-Stream Crossings* (USFS 2008). Project proposals deemed incomplete by the DRT will be returned to the Lead Agency, who will then further coordinate with the Applicant as appropriate to either obtain the necessary information or withdraw the project. The DRT may interact directly with the Applicant to facilitate their review but will keep the Action Agencies informed of their communications as appropriate.

The exact makeup of the DRT will be commensurate with the complexity of the proposed project. The DRT will meet once per month during any month where projects are submitted for their review.

2.1.3.7 Project Completion Report

The Applicant will submit a completed report to the Action Agency(ies) no later than 60 days after project completion. The Lead Agency will submit reports to the Service no later than 90 days after project completion. Reports will mirror the PNF and will include the following information:

A. Project name (same name as in notification)

B. Location – 5th field HUC (HUC - 10 Code), stream name, latitude and longitude (decimal degrees; to 5 decimal places) and USGS Map Location

C. Project Contact – Project point of contact name, phone number, and email address

D. Timing – Actual project start and end dates

E. Activity Type – One of the four stream connectivity categories

F. Project Description – A brief narrative of the completed project and objectives. Include any unexpected events and remedial actions taken, including any dates work ceased due to high flows.

G. Photos – Photos of the construction process (emphasis on aspects related to avoiding and minimizing impacts to listed species) and of the completed project.

H. Extent – Number of stream miles restored for Atlantic salmon access or stream connectivity (Maine Stream Habitat Viewer or other method can be used)

I. ESA listed Species Affected – Fish or wildlife species and critical habitat affected by the project

J. Fish Evacuation (if required) – Stream conditions, summary of Atlantic salmon removal methods, and the number of Atlantic salmon handled, injured, or killed. Report results in reference to the Incidental Take Statement.

K. Date of Submittal

2.1.3.8 Post Project Monitoring

In addition to submitting the Project Completion Reports to the Service, the Action Agencies will collectively monitor a random selection equaling twenty percent of the completed project sites annually for a five year period. Action Agencies may monitor more than the minimum twenty percent should they choose to do so. For each project, the Action Agency will conduct a walk through and visual observation to determine if there are any post-project problems that need to be addressed and include photo documentation. The Action Agencies will use the following to guide monitoring actions:

A. Stream Connectivity Structures – Note any problems with channel scour or bedload deposition; substrate, banklines and bankfull width within the structure; or discontinuous stream flow.

B. Revegetation – Site restoration plantings need to have a 70 percent survival rate after two growing seasons.

2.1.3.9 Annual Program Report

The Action Agencies will provide an annual program report to the Service by February 15 of each year that describes the projects implemented under this programmatic consultation. The report will include the following information:

A. A summary of all project completion reports.

B. An assessment of overall program activity.

C. A summary of known incidental take associated with Atlantic salmon removal and relocation activities or other project activities.

D. A map showing the location of all projects carried out under the programmatic consultation.

E. Results of Post Project Monitoring actions.

F. Other data or analyses that the Action Agencies deem necessary or helpful to assess program accomplishments, including lessons learned.

2.1.3.10 Annual Program Coordination Meeting

The Action Agencies will meet with the Service by April 30 each year to discuss the annual program report and any proposed actions, including adaptive management strategies, which will improve conservation under this programmatic consultation or make the program more efficient or accountable.

2.1.4 Excluded Actions

The actions or project circumstances listed in **Table 1** are specifically excluded from programmatic coverage and will require project-specific ESA section 7 consultation. On occasion, there may be other circumstances not identified here where either the Action Agencies or the Service determines that a road-stream crossing project is not eligible for programmatic coverage. Early coordination by the Applicant with the Federal agencies will allow this determination to be made as soon as possible and then facilitate initiation of a project-specific section 7 consultation.

Table 1. Projects excluded from the programmatic consultation and associated justifications.

EXCLUDED PROJECTS	JUSTIFICATION
1. Projects that lead to headcutting *below* the natural stream gradient	Upstream headcutting below the natural stream gradient degrades stream channels and may create an upstream passage barrier.
2. Structure widths less than 1.2 times bankfull width	Structures less than 1.2 times bankfull width do not meet the Services' requirements for Atlantic salmon recovery goals.
3. Culvert widths less than five feet	Culverts less than five feet in width inhibit manual or mechanical placement of substrate within the structure.
4. Culverts and Open-bottomed structures at a slope greater than 3.5 percent	Substrate and materials are prone to washout at gradients greater than 3.5 percent increasing cost and design complexity.
2. Sills in culverts	Inclusion of sills designed for bed retention do not meet Stream Simulation criteria for gradients less than six percent.
3. Baffled culverts	Baffles within culverts can create turbulence that prevents aquatic organism passage and therefore does not meet Stream Simulation criteria and Atlantic salmon recovery goals.
4. Culvert Retrofitting	Culvert retrofitting (e.g. slip lining and invert lining, culvert extensions) does not meet Stream Simulation criteria and Atlantic salmon recovery goals.
5. Active Channel and Hydraulic Design methods	These design methods do not meet Stream Simulation criteria and Atlantic salmon recovery goals.
6. Bankfull widths greater than 75 feet	Cost and design complexity.
7. Multiple spans or structures for primary channel	No piers, piles or multiple culverts or structures as they do not meet Stream Simulation criteria.
8. Projects not within in-water work window	Work outside the in-water work window may lead to adverse effects not assessed under this PBO.
9. Projects below head of tide	Require ESA section 7 consultation for Atlantic salmon with NMFS and not the Service.

2.1.5 Stream connectivity Construction Methods, Impacts, and Incorporated Conservation Measures

This section describes each construction phase required to complete the four programmatic activity categories described in **Chapter 2** section **2.1.1**. Construction phase descriptions include methods and physical impacts, followed by a list of conservation measures which are intended to minimize and in some cases avoid associated effects to ESA listed species and designated critical habitat. In this section, the word "impact" refers to the physical alteration—type and scope—of the action area (those areas affected directly or indirectly by construction).

Although required conservation measures are listed in this section, they are fully described below in **Chapter 2** section **2.1.6** (**Aquatic Conservation Measures**), **Chapter 2** section **2.1.7** (**Work Area Isolation and Atlantic Salmon Evacuation Conservation Measures**), and **Chapter 2**section **2.1.8** (**Terrestrial Species and Habitat Conservation Measures**).

2.1.5.1 Equipment Used During Construction Phases

Equipment used for all projects would typically consist of a mix of the following: back hoe, bulldozer, tractor, grader, dump truck, front-end loader, excavator, crane, concrete pumper truck, paving machine, pile driver, pumps, hydraulic hammers, hydro-seeding truck, large and small compactors, hand shovels, and rakes.

2.1.5.2 Site Preparation and Staging Area

This construction phase applies to all four of the activities included in this programmatic consultation.

A. **Construction Methods –** The commencement of the project includes the following actions: 1) Flag boundaries of staging areas, stockpile areas, and other locations where impacts are expected. If sufficient staging or stockpile areas do not exist, areas of sufficient size may be cleared and grubbed; 2) Place material, which may be excavated during this time, in the stockpile area; 3) Store machinery, equipment, and materials in the staging area; 4) Where needed, place sediment barriers or silt fences around impacted areas to prevent erosion into the stream channel, wetlands and road ditches.

B. **Construction Impacts –** If staging and stockpile areas are cleared of trees and vegetation, topsoil will be exposed to potential erosion. Newly cleared areas should be no larger than what is required for staging.

C. **Conservation Measures –** To minimize effects to Atlantic salmon and associated critical habitat, employ **Chapter 2** section **2.1.6** (**Aquatic Conservation Measures**) to minimize construction impacts as follows: **2.1.6.2** Soil Erosion and Water Pollution Control Plan; **2.1.6.3** Site Preparation; and **2.1.6.4** Heavy

Equipment Use. To avoid or minimize effects to mammal and plant species, refer to **Chapter 2** section **2.1.8** Terrestrial Species and Habitat Conservation Measures as needed.

2.1.5.3 Excavate Road Fill Above the Wetted Perimeter

This construction phase applies to the following activity categories: Road-Stream Crossing Removal and Associated Channel Restoration and Road-Stream Crossing Replacement with a Stream Simulation Structure.

A. **Construction Methods –** Excavate road fill around culvert to just above wetted perimeter. Excavating equipment would typically work from the road fill, and excavated material would be stored at a nearby stockpile site subject to erosion control measures or taken to a permanent waste area if new material is to be brought in for backfilling. Excavation to the wetted perimeter is necessary for dewatering procedures. For culvert removal projects, remove road fill within the active floodplain and haul to a permanent waste area. All heavy machinery will work from the road, the banks, or the dewatered area.

B. **Construction Impacts –** The road fill material around the culvert will be exposed to potential erosion along with the road prism associated with culvert removals. Stream channel substrate will be disturbed if machinery crosses a stream. Therefore, aggregate construction impacts will likely include the construction of staging and stockpile areas, removal of road fill around the culvert, use of designated stream crossings, and possibly the removal of the road prism crossing the flood plain.

C. **Conservation Measures –** To minimize effects to Atlantic salmon and associated critical habitat, employ **Chapter 2** section **2.1.6** Aquatic Conservation Measures to minimize construction impacts as follows: **2.1.6.1** In-Water Work Windows; **2.1.6.2** Soil Erosion and Water Pollution Control Plan; and **2.1.6.5** Heavy Equipment Use.

2.1.5.4 Capture and Transport of Atlantic salmon

This construction phase applies to all four of the activities included in this programmatic consultation but is only required for project sites where Atlantic salmon have been determined likely present.

A. **Capture and Transport Methods –** Prior to constructing a water diversion at the project site, place block nets up and downstream of the culvert to isolate the construction activity area. Remove as many Atlantic salmon as possible, using less invasive methods first before electroshocking. For most projects, maintain the block nets throughout the extent of instream construction work. Generally, block nets are not removed until cofferdams are removed.

B. Conservation Measures – To minimize effects to Atlantic salmon and associated critical habitat, employ **Chapter 2** section **2.1.6**. Aquatic Conservation Measures **2.1.6.1**. In-Water Work Windows and **Chapter 2** section **2.1.7 Work Area Isolation and Atlantic salmon Evacuation**.

2.1.5.5 Isolate Construction From Stream Flow

This construction phase applies to all four of the activities included in this programmatic consultation. Construction sites are to be properly isolated from stream flow before removing a culvert or performing other work inside the stream channel.

A. Construction Methods

a) Dewater Construction Site – The dewatering (diversion) structure is typically a temporary cofferdam built just upstream of the project site with sand bags that are filled with clean gravel and covered with plastic sheeting. A portable bladder dam or other non-erosive diversion technologies may be used to contain stream flow. In most cases, a pipe or plastic lined ditch will carry the stream flow from the cofferdam around the project site to a location immediately downstream of the construction zone. The length of the dewatered stream channel will vary, depending on the width of the road prism at the stream crossing. It may be necessary to have temporary equipment access through the riparian area to the site of the dewatering structure. Atlantic salmon may be allowed to move downstream through the diversion, depending on the method of diversion (i.e., channel and piped diversions versus pumped diversions).

Dewatering will be accomplished slowly with a qualified crew on hand to capture and move Atlantic salmon that appear as the water level drops at the construction site. Standard fish handling procedures will be used to minimize stress to the captured Atlantic salmon. Captured Atlantic salmon will usually be released upstream from the project area in suitable habitat.

b) Reroute Stream Flow within Existing Channel – In some situations, stream flow will be rerouted to one side of the existing channel with diversion structures, such as sandbag or sheet pile cofferdams, portable bladders, or other non-erosive diversion technologies used to contain stream flow. The conditions in which in-channel rerouting can occur are when the stream channel is wide enough to accommodate both the diversion path and the construction area. This can include using a pipe or one side of the existing channel. When used, this method would typically be associated with the construction of open-bottomed arches and bridges. Under this scenario, fish **c)**can pass freely up or downstream. When a pipe is used, however, only downstream movement may be possible.

B. Construction Impacts

a. Dewater Construction Site – The construction of a temporary access road through the riparian zone to the stream's edge, in preparation for construction of a cofferdam, will likely remove riparian vegetation. However, the amount of vegetation removed is expected to be minimal and have insignificant effects to aquatic or riparian functions. Therefore, aggregate construction impacts include the exposed staging and stockpile areas, road fill at the stream crossing, dewatered stream channel, designated stream crossings, and possibly the road prism crossing the flood plain.

b. Reroute Stream Flow within Existing Channel – The stream flow between the diversion inlet and outlet will be rerouted to one side of the existing channel. The length of stream reroute will vary, depending on the width of the road prism at the stream crossing. Therefore, aggregate construction impacts include the exposed staging and stockpile areas, road fill at the stream crossing, designated stream crossings, and possibly the road prism crossing the floodplain.

C. Conservation Measures – To minimize effects to Atlantic salmon and critical habitat, employ **Chapter 2** section **2.1.6** Aquatic Conservation Measures to minimize construction impacts: **2.1.6.1** In-Water Work Windows; **2.1.6.2** Pollution and Erosion and Control Measures; and **2.1.6.4** Heavy Equipment Use. To minimize effects also employ **Chapter 2** section **2.1.7** Work Area Isolation and Atlantic Salmon Evacuation Conservation Measures.

2.1.5.6 Remove Existing Culvert and Excavate Channel Substrate

This construction phase applies to the following categories: Road-Stream Crossing Removal and Associated Channel Restoration, Road-Stream Crossing Replacement with a Stream Simulation Structure, and Installation of a new Stream Simulation Structure for New Road Construction.

A. Construction Actions – Remove remaining road fill and store at a nearby stockpile site or haul to a permanent waste area (if being replaced). At this point, the culvert will be removed (except for new road construction) followed by excavation of the remaining material down to bottom of construction elevations and wide enough to accommodate a 1.2 times bankfull width culvert, open-bottom arch, or bridge footings. This may include ledge or bedrock removal. Excavating equipment will work from the road fill and cross the stream within the dewatered area or a designated stream crossing. During excavation, excess groundwater would be removed from the work area by pumping to a treatment area prior to discharge back into the stream.

B. Construction Impacts – The stream channel and road fill down to the construction elevation will be exposed to potential erosion. Therefore, aggregate construction impacts will likely include the exposed staging and stockpile areas, road fill at the stream crossing, the dewatered stream channel, designated stream crossings, and possibly the road prism crossing the floodplain.

C. Conservation Measures – To minimize effects to Atlantic salmon and associated critical habitat, employ **Chapter 2** section **2.1.6** Aquatic Conservation Measures to minimize construction impacts: **2.1.6.1** In-Water Work Windows; **2.1.6.2** Pollution and Erosion and Control Plan; and **2.1.6.4** Heavy Equipment use.

2.1.5.7 Construct Stream Simulation Structure, Replace Backfill, Embed Structure and Fill Plunge Pool

This construction phase applies to the following categories: Road-Stream Crossing Removal and Associated Channel Restoration, Road-Stream Crossing Replacement with a Stream Simulation Structure, and Installation of a new Stream Simulation Structure for New Road Construction.

A. Construction Methods

a) Culvert Removal Projects – After the culvert or other road crossing structure is removed, the stream channel cross-section and gradient within the area formerly occupied by the culvert will be reconstructed in a manner that mimics reference reach conditions found up and downstream. Further, the floodplain will be restored to mimic floodplain elevations and dimensions that occur up and downstream of the project site. Large wood or boulders may be placed in the reconstructed stream channel and floodplain to meet stream habitat complexity objectives when such material naturally occurs in the project area.

b) Culvert Replacement and Backfill – Place and shape culvert-bedding material, assemble and place culvert in position, and then place fill around it in successive layers to begin the restoration of the road prism. Place embankment fill to at least one-half of the culvert height before placing substrate within the culvert. The backfill may be placed to an elevation as to construct the road prism and if so headwalls may be constructed at this time. Machinery placing the culvert will work from the road fill and cross the stream within the dewatered area or at a designated stream crossing. When necessary, flood relief culverts will be installed in the road-fill for streams with unconfined floodplains. Concrete may be poured to provide bedding for pipe arches and for footings for bridge abutments and open-bottomed culverts. No uncured concrete or form materials will be allowed to enter the active stream channel. To embed the culvert with substrate, haul infill material from an offsite location or use suitable material from a project stockpile. Place properly sized substrate, compact and spray in layers inside culvert to the required height.

c) Open-Bottom Arch Placement and Backfill – Likely construction methods would include placement of footing forms, pouring and curing of concrete, placement of streambed material, followed by the assembly of the arch and its attachment to the concrete footings. Fill would then be placed in thin layers around the structure to begin restoration of the road prism. The backfill may be placed to an elevation to construct the road prism, in which case headwalls may be constructed at this time. Construction machinery would typically operate from the road fill and cross the stream within the dewatered area or at a designated stream crossing. When necessary, install flood relief culverts for stream types associated with unconfined floodplains. To embed the open-bottomed arch with substrate, haul infill material from an offsite location or use suitable material from a project stockpile. Properly sized substrate would be placed and compacted in thin layers to the required height between the footings.

d) Bridge Placement – One of following three construction methods will likely be used and in each case will occur outside the 1.2 times bankfull width: (a) Construct pile abutments by driving piles below stream channel elevation then forming and pouring concrete cap; (b) Build cast-in-place concrete footings or piers below stream channel elevation through excavation and placement of forms followed by pouring and curing of concrete; (c) Place pre-cast footings and compacted fill protected by stable rock material on slopes outside the 1.2 times bankfull width.

Headwalls may be constructed to protect the road fill prism. Fill would be placed where necessary to help restore the road prism. Machinery would typically work from the road fill and cross the stream within dewatered area or at a designated stream crossing. Other construction actions will likely include the following: placement of substrate material and fill-slope stable rock material, beams, grout seam, build deck, form curbs, place guardrails and approach rails, and paving. Further, reconstruct the stream channel cross-section and gradient within the area formerly occupied by the culvert in a manner that reflects more natural conditions found up and downstream. Haul excavated material offsite. Large wood or boulders maybe placed in the reconstructed stream channel and floodplain. If necessary, install flood relief culverts for stream types with unconfined floodplains.

B. Construction Impacts – With the exception of a new structure associated with new road construction, all construction for each of the road activities will occur in areas already impacted by earlier construction phases. In cases where flood relief culverts or additional bridge spans are required, isolated segments of the road prism within the floodplain will be disturbed. For projects that involve new road construction,

this will be the first time that the stream channel and floodplain have been impacted. Therefore, aggregate construction impacts include the exposed staging and stockpile areas, road fill at the stream crossing, dewatered stream channel, designated stream crossing, and possibly the road prism crossing the flood plain.

B. Conservation Measures – To minimize effects to Atlantic salmon and associated Critical Habitat, employ **Chapter 2** section **2.1.6** Aquatic Conservation Measures to minimize construction impacts: **2.1.6.1** In-Water Work Windows; **2.1.6.2** Soil Erosion and Water Pollution Control Plan; and **2.1.6.4** Heavy Equipment Use.

2.1.5.8 Remove Stream Diversion and Restore Stream Flow

This construction phase applies to all four of the activities included in this programmatic consultation.

A. **Construction Actions –** Remove cofferdam and water routing equipment. Heavy machinery, operating from the bank or within the dewatered channel, may be used to aid in removal of diversion structures. Re-watering the construction site occurs at a sufficiently slow rate as to prevent loss of surface water downstream as the construction site streambed absorbs water.

B. **Construction Impacts –** Stream channel substrate will be minimally disturbed with the removal of the cofferdam. Restored stream flow will flush out substrate fines within the formerly dewatered area, resulting in increased but short-lived stream turbidity of approximately one hour (Ham 2016 pers. comm.). Therefore, aggregate construction impacts now include the exposed staging and stockpile areas, road fill at the stream crossing, the formerly dewatered stream channel, designated stream crossing, possibly the road prism crossing the flood plain, and a short-term influx of turbidity within the stream.

C. **Conservation Measures –** To minimize effects to Atlantic salmon and associated Critical Habitat, employ **Chapter 2** section **2.1.6**. Aquatic Conservation Measures to minimize construction impacts: **2.1.6.1** In-Water Work Windows; **2.1.6.2** Soil Erosion and Water Pollution Control Plan; and **2.1.6.4** Heavy Equipment Use. To minimize effects also employ **Chapter 2** section **2.1.7** Work Area Isolation and Atlantic salmon Evacuation, **Chapter 2** section **2.1.7.6**.

2.1.5.9 Backfill to Road Surface

This construction phase applies to the following categories: Road-Stream Crossing Removal and Associated Channel Restoration, Road-Stream Crossing Replacement with a Stream Simulation Structure and Installation of a new Stream Simulation Structure for New Road Construction.

A. **Construction Methods –** Headwalls may be constructed at this time. Place and compact fill in thin layers over the culvert or open-bottomed arch to top of the subgrade. Haul in backfill material from stockpiling or outside sources. Construct the road surface.

B. Construction Impacts – All construction activities for each of the road crossing structures will occur in areas already impacted by earlier construction phases. Most, if not all, work will occur on the road prism.

C. Conservation Measures – To minimize effects to Atlantic salmon and associated critical habitat, employ **Chapter 2** section **2.1.6** Aquatic Conservation Measures to minimize construction impacts: **2.1.6. 1** In-Water Work Windows; **2.1.6** .**2** Pollution and Erosion Control Plan; and **2.1.6 .4** Heavy Equipment Use.

2.1.5.10 Site Restoration

This construction phase applies to all four of the activities included in this programmatic consultation.

A. Construction Methods – Install road fill erosion protection measures, such as boulder-sized stable rock material, plantings, erosion control fabric, seed, and mulch. Stockpiled wood may be scattered within the riparian or floodplain area or placed instream, if needed, to meet large wood objectives. Remove equipment and excess supplies, clean work stockpile areas, and lastly remove temporary erosion control materials. To prevent erosion or for Canada lynx and small whorled pogonia conservation measures, seed or plant embankment and other impacted areas.

B. Construction Impacts – All actions are intended to be restorative in nature and will be confined to areas impacted throughout the project.

C. Conservation Measures – To minimize effects to Atlantic salmon and associated critical habitat, employ **Chapter 2** section **2.1.6** Aquatic Conservation Measures to minimize construction impacts: **2.1.6.1** In-Water Work Windows (when necessary); **2.1.6.2** Pollution and Erosion Measures; and **2.1.6.5** Site Restoration. For measures that minimize and avoid effects to mammal and plant species, employ **Chapter 2** section **2.1.8 Terrestrial Species and Habitat Conservation Measures**.

2.1.5.11 Maintenance and Repair

This construction phase applies to the programmatic activity category referred to as Maintenance and/or Repair of a Stream Simulation Structure and is associated with projects that were previously constructed under the three remaining project types, Road-Stream Crossing Removal and Associated Channel Restoration, Road-Stream Crossing

Replacement with a Stream Simulation Structure and Installation of a new Stream Simulation Structure for New Road Construction.

A. Construction Methods – Maintenance actions may involve the removal of large wood that has accumulated at the inlet of a culvert, open-bottomed arch, or bridge. Wood will be removed and placed immediately downstream of the outlet unless doing so will jeopardize another structure downstream. When access permits, large wood can be placed within the bankfull channel to meet large wood objectives. Machinery used to remove and place large wood will operate from the road prism or from temporary access to the stream channel. In most cases, maintenance activities will usually be completed in two days or less.

Based on U.S. Forest Service experience, it is anticipated that for culvert replacements implemented under this programmatic consultation, substrate degradation within a culvert or open-bottomed arch or scour at the outlet will occur on a very low percentage of the projects (Peets 2016 pers. comm.). Under these rare circumstances, remedial actions will be taken to restore substrate within the structure or scour pool. Such actions will occur only when the substrate size originally placed within the structure and scour pool was inadvertently undersized and not because the size or gradient of culvert was inappropriate.

Additional repairs may include headwall repair and replacement of stable rock material. Maintenance and repair actions are expected to be infrequent, usually after a large flood event.

B. Construction Impacts – Depending on the complexity of the repair or maintenance action, construction impacts can range from the use of a road-placed excavator that removes large wood to stream isolation and Atlantic salmon removal to allow for the replacement of stream-bed substrate within the road-crossing structure.

C. Conservation Measures – To minimize effects to Atlantic salmon and associated critical habitat, employ **Chapter 2** section **2.1.6** Aquatic Conservation Measures to minimize construction impacts: **2.1.6.1** In-Water Work Windows; **2.1.6.2** Soil Erosion and Water Pollution Control Plan; **2.1.6.3** Site Preparation; **2.1.6.4** Heavy Equipment Use; and **2.1.6.5** Site Restoration. Also employ **Chapter 2** section **2.1.7** Work Area Isolation and Atlantic salmon Evacuation.

2.1.6 Aquatic Conservation Measures

Aquatic Conservation Measures (ACMs) are intended to minimize effects to the aquatic environment. The following ACMs apply to all four stream connectivity restoration categories.

2.1.6.1 In-Water Work Window

All construction activities at or below the OHWM will only occur during periods of low flow and during the in-water construction window of July 15 to September 30. Work above the OHWM may occur outside the in-water work window. Any project proposal to work below the OHWM outside this time-of-year work window will not be eligible under this programmatic consultation. Any request for an in-water work window extension past September 30 is not guaranteed. Any in-water work after September 30 shall not occur without coordination between and written approval from the Action Agency(ies) and the Service. Projects should be carefully planned and timed to allow for completion of in-water work by September 30.

2.1.6.2 Soil Erosion and Water Pollution Control Plan (SEWPCP)

No intentional pollutant discharges of any sort are permitted in association with construction activities. An SEWPCP, designed to avoid and minimize the effects of erosion and pollution on aquatic organisms and habitats, will include at least the following components:

- **A.** Project Contact - Identify a project contact (name, phone number and address) who will be responsible for implementing the SEWPCP.
- **B.** Schedule and sequence of all activities involving soil disturbance.
- **C.** Emergency storm response procedures including a list of materials which will be kept on-site to handle emergencies, and procedures for corrective actions. Work shall cease under high flows, except for efforts to avoid or minimize resource damage.
- **D.** Type and location of all temporary erosion and sedimentation control measures.
- **E.** Mulching type, thickness of mulch, and frequency of application for disturbed earth areas.
- **F.** Location and frequency of temporary seeding.
- **G.** Dust control procedures for staging areas, stockpile areas, haul roads, and any other areas.
- **H.** Location and method of temporary sedimentation control at inlets and outlets of existing and proposed catch basins and at outlet areas.
- **I.** Description of all in-water work, including the timing of work, temporary stream diversions and the types, location, and size of cofferdams; no uncured concrete or form materials will be allowed to enter the active stream channel.
- **J.** Description of the design and location of any sedimentation basins for dewatering the cofferdams, including alternative plans when the sedimentation basin overflows.
- **K.** Inspection and maintenance schedules for all erosion and sedimentation control measures, temporary and permanent, including the method, frequency, and disposal location of sediment removed.

L. Procedures and schedule for removal of all temporary erosion and sedimentation control measures.

M. Procedures to confine, remove, and dispose of construction waste, including every type of debris, discharge water, concrete, cement, grout, washout facility, welding

slag, petroleum product, or other hazardous materials generated, used, or stored on-site.

N. **Spill Prevention Control and Containment Plan (SPCCP) –** The contractor will be required to have a written SPCCP, which provides emergency information, response information and describes measures to prevent or reduce impacts from potential spills (fuel, hydraulic fluid, etc.). The SPCCP shall contain a description of the hazardous materials that will be used including inventory, stockpile, handling and monitoring.

a) All vehicles carrying fuel shall have specific equipment and materials needed to contain or clean up any incidental spills at the project site. Equipment and materials include, but are not limited to, spill kits appropriately sized for specific quantities of fuel, absorbent pads, shovels, straw bales, containment structures and liners, and booms.

b) During use, all pumps and generators shall have appropriate spill containment structures and/or absorbent pads in place.

c) Fuel will be stored on an impervious surface at least 100 feet from streams (MDOT 2014), such as a plastic tarp, to minimize ground contamination and aid in cleanup should a spill occur

d) Temporarily store any waste liquids generated at the staging areas under cover on an impervious surface, such as tarpaulins, until such time they can be properly transported to and treated at an approved facility for treatment of hazardous materials

2.1.6.3 Site Preparation

Flagging Sensitive Areas – Prior to construction, flag critical riparian vegetation areas, wetlands, and other sensitive sites to minimize ground disturbance.

A. **Staging Area –** Staging areas established for the storage of vehicles, equipment, and fuels will be located outside of the 100-year floodplain and will be a distance greater

than 100 feet from streams (MDOT 2014) and 200 feet from groundwater wells or 400 feet from public wells.

B. Temporary Erosion Controls – Adhering to best management practices (BMPs) used by the MDOT (MDOT 2008), place sediment barriers prior to construction around sites where erosion may enter the stream directly or through road ditches. Temporary erosion controls will be in place before any significant alteration of the project site and will be removed once the site has been stabilized following completion of construction activities.

C. Clearing and Grubbing – Minimize vegetation clearing adjacent to the stream and elsewhere to the maximum extent practicable. Cutting of trees and shrubs, where necessary, shall occur at ground level, leaving the root stock in place, to facilitate soil stabilization, reduce post construction erosion, and promote regrowth. Tree removal (greater than 3 inches diameter at breast height) will require northern long-eared bat conservation measures or a presence/absence survey; see **Chapter 2** section **2.1.8.2** below.

D. Stockpile Materials – During excavation, large wood, topsoil, and native channel material displaced by construction will be stockpiled for later use during site restoration at a location above the bankfull elevation where it cannot reenter the stream. Materials needed to meet large wood objectives or for stream channel restoration (e.g., large wood, boulders, etc.) may be staged within the 100-year floodplain.

2.1.6.4 Heavy Equipment Use

A. Choice of Equipment – Heavy equipment will be commensurate with the project and operated in a manner that minimizes adverse effects to the environment (e.g., minimally-sized, low pressure tires, minimal hard turn paths for tracked vehicles, temporary mats or plates within wet areas or sensitive soils).

B. Fueling, Cleaning and Inspection for Petroleum Products and Invasive Weeds

a) All equipment used for instream work will be cleaned of petroleum accumulations, dirt, plant material (to prevent the spread of noxious weeds); and any leaks will be repaired prior to entering the project area. Such equipment includes large machinery, stationary power equipment (e.g. generators) and gas-powered equipment with tanks larger than five gallons.

Equipment used for instream or riparian work shall be fueled and serviced within the established staging area. When not in use, vehicles will be stored within the staging area.

b) Inspect equipment daily for fluid leaks before leaving the vehicle staging area for operation.

c) Thoroughly clean equipment before operation below the OHWM or within 50 feet of any natural water body or areas that drain directly to streams or wetlands and as often as necessary during operation to remain grease free.

d) Contaminated soil will be disposed of as soon as possible in accordance with State and Federal regulations.

C. Temporary Access Roads – Existing roadways or travel paths will be used whenever possible. Minimize the number of temporary access roads to lessen soil disturbance and compaction and impacts to vegetation. Temporary access roads will not be built on slopes where grade, soil, or other features suggest a likelihood of excessive erosion or failure. Temporary access roads will be obliterated and revegetated after construction is completed. Temporary roads in wet or flooded areas will be restored by the end of the applicable in-water work period. Construction of new permanent roads for construction access is not permitted.

D. Stream Crossings – To minimize turbidity, sedimentation and injury to Atlantic salmon, all stream crossings should be within the dewatered area whenever possible. Where temporary stream crossings by construction equipment outside the dewatered area are deemed essential, site-specific (case-by-case) exceptions can be approved by the DRT provided the following criteria are met:

a) No equipment is permitted in the flowing water portion of the stream channel except at designated stream crossings;

b) Crossings shall be within the stream area isolated by the block nets;

c) Crossings shall be identified on project plans, designated in the field at the project site, shall not increase risks of channel re-routing due to high water conditions and will avoid potential Atlantic salmon spawning areas;

d) Stream crossings shall be minimized and conducted at right angles to the main channel where possible; and

e) No heavy construction equipment will be allowed to travel into or through any flowing streams with erodible substrates (i.e., sand, silt, and clay).

E. Work from Top of Bank – Heavy equipment will work from the top of the bank or on top of the existing roadway and out of flowing water.

F. Ledge Removal – This programmatic consultation does not consider the effects of blasting for ledge removal and is limited to the use of a hoe-ram/hydraulic hammer. To prevent acoustic trauma to Atlantic salmon, the equipment operator will incorporate a "soft start" when using a hoe ram to break ledge or bedrock. The idea behind the soft start is to gradually allow contact between the hydraulic hammer and bedrock, reducing the initial acoustic levels and allowing nearby Atlantic salmon the opportunity to move away, through the startle response, from the project area before acoustic levels rise to a level sufficient to cause injury.

G. Timely Completion – Minimize time in which heavy equipment is in stream channels, riparian areas, and wetlands. Complete earthwork (including drilling, excavation, dredging, filling and compacting) as quickly as possible.

2.1.6.5 Site Restoration

A. Areas of disturbed soil adjacent to the waterways will be stabilized and revegetated with a native conservation seed mix appropriate for riparian areas in Maine. If, due to the lateness of the season, such seed mix is not likely to take root sufficiently well enough to stabilize the banks, protection against erosion will be provided by geotextile in combination with staked hay bales and riprap as needed. All temporary stabilization measures, including geotextile, hay bales, and extra riprap, are to be removed once vegetation can be established in the following growing season.

B. When necessary, loosen compacted areas, such as access roads and paths, stream crossings, staging, and stockpile areas.

C. For culvert removal or bridge projects where a culvert is being replaced, reconstruct the stream channel cross-section and gradient within the area formerly occupied by a culvert in a manner that reflects natural conditions found upstream and downstream as informed by the Stream Simulation design. Large wood and boulders may be placed in the reconstructed stream channel and floodplain.

D. Instream or floodplain restoration materials, such as large wood and boulders, shall mimic as much as possible those found in the project vicinity. Such materials may be salvaged from the project site or hauled in from offsite but cannot be taken from streams, wetlands, or other sensitive areas.

E. When necessary, use steep-slope terracing.

F. Complete necessary site restoration activities within five days of the last construction phase.

2.1.7 Work Area Isolation and Atlantic Salmon Evacuation Conservation Measures

The requirements in this section apply to all construction activities that include concentrated and major excavation within streams where Atlantic salmon are determined to be likely present. These requirements are designed to isolate the construction area and remove Atlantic salmon from the project site. Fish evacuation including electrofishing is required for all projects located within streams that have been determined to likely have Atlantic salmon present.

All projects, regardless of the presence or absence of Atlantic salmon, are required to work in the dry accomplished through the installation of cofferdams; but it is possible that some proposed projects will occur on intermittent streams and fish evacuation may not be necessary because of the absence of water at the time of construction. Working within an intermittent stream does not obviate the need for the Applicant or the Applicant's contractor to plan accordingly for the reoccurrence of stream flows during construction activities. While fish evacuation of non-ESA listed species in streams where Atlantic salmon are determined not to be present is highly recommended, it is not an absolute requirement of the State of Maine and will be left to the discretion of the Applicant, unless specifically required by a State permit.

2.1.7.1 Isolate Work/Capture Area

Install block nets across the channel at upstream and downstream locations outside of the construction zone and leave in a secured position to exclude Atlantic salmon from entering the project area. Leave nets secured to the stream channel bed and banks until construction activities within the stream channel are complete. If block nets remain in place more than one day, monitor the nets at least on a daily basis to ensure they are secured to the bed and banks and are free of organic accumulation.

2.1.7.2 Fish Evacuation

Atlantic salmon trapped within the isolated work area will be captured using techniques to minimize the risk of injury, then released at a safe release site, preferably upstream of the isolated reach in a pool or other area that provides cover and flow refuge. Fish evacuation will include one or a combination of the following methods to most effectively capture Atlantic salmon parr while minimizing harm. When multiple methods are used, fish evacuation shall proceed from the least invasive method to most invasive, culminating with electrofishing. Site conditions and other logistics may dictate the practicality of the methodology(ies) used. When the work area to be isolated is small, depths are shallow, and conditions are conducive to fish capture, it may be possible to isolate the work area and remove all fish life prior to dewatering or flow diversion. When the work area to be isolated is large, depths are not shallow, where flow volumes or velocities are high, or conditions are not conducive to easy fish capture, it may be necessary to commence with dewatering or flow diversion staged in conjunction with fish capture and removal (Brennan-Dubbs 2012).

A. **Herding –** During the installation of the block nets, herd Atlantic salmon out of the work area. Starting at the upstream side of the structure to be replaced, use a block net as a seine to herd fish in an upstream direction. Repeat on the downstream side. Where the area to be isolated includes deep pools, undercut banks, or other cover attractive to fish (e.g., thick overhanging vegetation, root wads, logjams, etc.), it may be appropriate to isolate a portion or portions of the work area in phases, rather than attempting to herd fish from the entirety of the work area in a single pass.

B. Hand Netting – Collect fish by hand or dip-nets, as the area is slowly dewatered.

C. Seining – Seine using a net with mesh of such a size as to ensure entrapment of the residing Atlantic salmon parr. Seine the entire width of the channel working downstream to upstream taking care to keep the bottom of the net on the bottom of the channel bed.

D. Trapping – Minnow traps (or gee-minnow traps) are net or wire enclosures with funnel shaped openings that trap live fish. Traps should be baited and fished overnight.

E. Electrofishing – Electrofishing is required for projects located in streams that are likely to have Atlantic salmon present. See **Chapter 2** section **2.1.7.3** below.

Atlantic salmon must be handled with extreme care and kept in water the maximum extent possible during transfer procedures. A healthy environment for the stressed Atlantic salmon shall be provided, such as large disinfected buckets (five-gallon minimum to prevent overcrowding). Handling time of Atlantic salmon should be kept to the minimum necessary. Place larger Atlantic salmon in buckets separate from smaller fish to eliminate predation. Monitor the water temperature within the buckets to ensure the well-being of captured Atlantic salmon. If buckets are not being immediately transported, use aerators to maintain water quality. As rapidly as possible, but after the Atlantic salmon have recovered, release fish, preferably upstream of the project site. In cases where the stream is intermittent upstream, release Atlantic salmon in downstream areas with proper habitat conditions and away from the influence of the construction. Fish evacuation will be supervised by a fishery biologist experienced with work area isolation and safe handling of Atlantic salmon. Document all Atlantic salmon that are relocated during the work site isolation process and include information on injuries or mortalities in the Project Completion Report (refer to **Chapter 2** section **2.1.3.7**).

2.1.7.3 Electrofishing

Electrofishing is required for projects located in streams that have been determined to likely have Atlantic salmon present. Prior to dewatering, but after other means of fish evacuation have been done to minimize impacts to Atlantic salmon, electrofish to maximize the removal of Atlantic salmon parr from the project site. The "Maine Department of Marine Resources Bureau of Sea-run Fisheries and Habitat Standard Operating Procedure for Juvenile Atlantic salmon Sampling by Electrofishing in Wadeable Streams" and NMFS's "Guidelines for Electrofishing Waters Containing Salmonids Listed Under the Endangered Species Act" electrofishing guidelines will be followed (MDMR 2010; NMFS 2000). These guidelines are available from the Maine Department of Marine Resources Bureau of Sea-run Fisheries and the National Marine Fisheries Service; both will be included in the Action Agencies' outreach for this programmatic effort.

A. Reasonable effort should be made to avoid handling Atlantic salmon in warm water temperatures, such as conducting fish evacuation first thing in the morning, when the water temperature would likely be coolest. No electrofishing shall occur when water temperatures are above 71.6ºF (22ºC) or are expected to rise above 71.6ºF (22ºC) prior to concluding fish evacuation.

B. Only Direct Current or Pulsed Direct Current shall be used.

C. Electrofishing must start with all settings (voltage, pulse width and pulse rate) set to the **minimums** needed to capture fish. The settings should be gradually increased to the point where fish are immobilized and captured. Use initial settings of 100 volts power, 500 µs pulse width and 30 Hz pulse rate (NMFS 2000). Gradually increase to the point where Atlantic salmon are immobilized and captured. While MDMR guidance states adequate catchability with low injury rates using 60 Hz at 400-600 volts of power, electrofishing is highly site condition dependent and will be conducted with the **minimum** effective settings to minimize injury to Atlantic salmon (MDMR 2010; Brennan-Dubbs 2012). Turn off current once fish are immobilized.

D. Do not allow fish to come into contact with anode. Do not electrofish an area for an extended period of time. Remove fish immediately from water and handle as described in the Fish Evacuation section above. Dark bands or extended recovery times indicate excessive stress or injury, suggesting a reduction in voltage and pulse frequency and longer recovery time.

E. If mortality is occurring during fish evacuation, immediately discontinue evacuation operations (unless this would result in additional fish mortality), reevaluate the current procedures, and adjust or postpone procedures to reduce mortality.

F. All electroshocking shall be conducted by personnel experienced with the aforementioned electrofishing procedures. Unless the Applicant has made arrangements to have State or Federal agency staff conduct the fish evacuation, they will need to submit qualifications of their fish evacuation team. Review and approval of the team will be part of the consultation and permitting process.

2.1.7.4 Dewater Construction Site

Dewatering of the construction site is necessary to minimize effects to Atlantic salmon and critical habitat from construction activities. For sites where the isolated area includes the entire wetted channel width, divert flow around the construction site with a coffer dam (built with non-erosive materials) and an associated pump, bypass culvert, or a water-proof lined diversion ditch. For larger streams, isolating only a portion of the stream may be possible providing sufficient work site isolation while retaining stream continuity and fish passage. For projects utilizing sheet pile cofferdams only a vibratory hammer may be used for installation.

Cofferdam sandbags can be filled with material mined from the floodplain as long as such material is replaced at end of project. Small amounts of instream material can be moved to help seal and secure the diversion structures. Pumps must have fish screens and be operated in accordance with the NMFS fish screen criteria described below in section **2.7.1.5**. Dissipate flow energy at the bypass outflow to prevent damage to riparian vegetation or stream channel. If diversion allows for downstream fish passage, place diversion outlet in a location to promote safe reentry of fish into the stream channel, preferably into pool habitat with cover. When necessary, pump seepage water from the de-watered work area to a temporary stockpile and treatment site or into upland areas and allow water to filter through vegetation prior to reentering the stream channel.

2.1.7.5 Fish Screens

Fish screens that follow the NMFS guidelines are required for projects located in waters where Atlantic salmon are determined to be likely present (NMFS 2011). To prevent entrainment and impingement of Atlantic salmon juveniles related to water diversions using a bypass pump system and during the initial dewatering of the cofferdams, the permittee or their contractors shall use a screen on each pump intake sufficiently large enough so that the approach velocity does not exceed 6.10 meters per second (0.20 feet per second). Square or round screen face openings are not to exceed 2.38 millimeters (approximately 3/32 inch) and slotted face openings will not exceed 1.75 millimeters (approximately 1/16 inch) in the narrow direction. Intake hoses shall be regularly monitored while pumping to minimize adverse effects to Atlantic salmon.

2.1.7.6 Stream Re-watering

Upon project completion, slowly re-water the construction site to prevent loss of surface water downstream as the construction site streambed absorbs water and to prevent a sudden increase in stream turbidity. If using a diversion pump system, stop the pump and slowly breach the upstream cofferdam. Capture the first flush of turbid water from the breach and pump the water through the sediment treatment system. Once turbidity behind the downstream cofferdam is visually similar to the incoming stream, slowly breach and remove the downstream cofferdam. Remove the remainder of the upstream cofferdam and the diversion system. Monitor downstream during re-watering to prevent stranding of aquatic organisms below the construction site.

2.1.7.7 Take Notice

"Take" of adult Atlantic salmon is not allowed. In the event adult Atlantic salmon are observed or otherwise determined to be within the project area, all construction activities below the ordinary water line must immediately cease and staff from the Service and the Action Agency(ies) will be contacted to determine next steps. The Service's point of contact is Wende Mahaney (*wende_mahaney@fws.gov*) at 207-902-1569. The Corps' point of contact is Shawn Mahaney (*shawn.b.mahaney@usace.army.mil*) at 978-318-8492. The FEMA's point of contact is the Regional Environmental Officer at 617-956-7522 or 978-461-5501.

Juvenile Atlantic salmon mortalities shall be immediately preserved (refrigerate or freeze) and reported to the Service (Wende Mahaney at 207-902-1569; FAX: 207-902-1588; or *wende_mahaney@fws.gov*) within 48 hours of occurrence to arrange for delivery to the Maine Fish and Wildlife Service Complex at 306 Hatchery Road, East Orland, Maine 04431. If a sick, injured, or dead specimen of another federally threatened or endangered species is found in the project area, the finder must immediately notify the Service.

2.1.8 Terrestrial Species and Habitat Conservation Measures

Conservation measures are methods applied to project design and implementation by the Applicant and are intended to avoid or minimize the potential detrimental effects to threatened and endangered species and critical habitat. The Canada lynx, northern long-eared bat, small whorled pogonia, and rusty patched bumble bee are the only federally listed terrestrial species within the geographic range of this programmatic consultation. The following criteria are **mandatory** in order for the “no effect” and “not likely to adversely affect” (NLAA) determinations made for projects included in this programmatic consultation to be valid. If these criteria cannot be met, then the project falls outside the scope of this programmatic consultation, and a separate section 7 consultation must be initiated for the project.

The project design criteria identified below must be applied to avoid or minimize effects for these species. To determine if the proposed project is within the section 7 consultation range of any terrestrial listed species, use the Service’s IPaC project planner located at (*https://ecos.fws.gov/ipac/*). An official species list generated from IPaC is required and should be submitted to the Lead Agency as part of the site specific PNF. The section 7 consultation range of the northern long-eared bat is statewide and requests for hibernacula and maternity roost tree locations should be directed to the Service’s Maine Ecological Services Maine Field Office (Wende Mahaney at 207-902-1569 or *wende_mahaney@fws.gov*). Projects resulting in adverse effects or effects from new road-stream crossings to Canada lynx, any effects to small whorled pogonia or rusty patched bumble bee, or projects implemented during the seasonal restriction period for northern long eared bat (unless a survey has determined that the species is likely absent) are not covered under this programmatic consultation and a separate section 7 consultation must be initiated by the Lead Agency with the Service.

2.1.8.1 Canada Lynx

CL1: Revegetate staging/stockpile areas with native vegetation matching species which were present before clearing.

2.1.8.2 Northern Long-Eared Bat

NLEB1: No tree removal (3 inch diameter at breast height or greater) within 1/4 mile of a known hibernaculum, at any time of year.

NLEB2: No tree removal (three inch diameter at breast height or greater) within the pup rearing season from June 1 through July 31 unless an approved survey (see NLEB3) documents that the species is likely absent from the project site.

NLEB3: The Applicant or Action Agency(ies) may choose to survey for the likely presence of northern long-eared bat within the project action area. The most current USFWS survey protocol must be used. Protocol information is located at (*https://www.fws.gov/Midwest/endangered/mammals/inba/inbasummersurveyguidance.html;* accessed September 2017). Both the survey **plans** and **results** must be coordinated with and approved by the Service's Ecological Services Maine Field Office (Wende Mahaney at 207-902-1569 or *wende_mahaney@fws.gov*). At the time of this writing, negative results (i.e., northern long-eared bat are likely absent from the project site) are good for three years; tree removal must occur within that timeframe.

2.1.8.3 Small Whorled Pogonia

SWP1: If the project's IPaC official species list identifies that the project area is within the consultation range of SWP, the lead agency will contact the Service's Ecological Services Maine Field Office (Wende Mahaney at 207-902-1569 or *wende_mahaney@fws.gov*) to determine next steps and if a survey will be required.

SWP2: Survey and documentation required for staging and stockpile areas or other areas of ground disturbance if project proposal IPaC official species list identifies the project area is within the consultation range of SWP and appropriate habitat is present at the project site in Maine.

SWP3: All aspects of the construction project will avoid locations where SWP is present.

2.1.9 Action Area

The action area is defined as all areas to be affected directly or indirectly by the Federal action and not merely the immediate area involved in the action (50 CFR 402.02). While the geographic scope of this programmatic consultation includes all inland waters located above the head-of-tide within the Atlantic salmon GOM DPS, site-specific action areas are located 1) at individual road-stream crossings where structures are to be removed, replaced or repaired or 2) at a stream where a new crossing structure will be installed in association with a new road. The overall action area for this programmatic consultation includes the combined action areas for up to 120 total projects over the 5 year period of implementation, for which exact locations within the geographic range of the GOM DPS are not yet known. The size of the additive action areas for the individual projects authorized under this PBO, however, will only include a fraction of the entire GOM DPS range and acreage.

The individual action area for each project could include upland areas, riparian areas, stream banks, and stream channels. Action areas may extend both downstream of the actual construction footprint (e.g., disturbed sediment moving downstream with stream flows) and upstream (e.g., restoring upstream fish passage by permanently removing a plugged culvert and associated roadbed and re-establishing a natural stream channel through a former road crossing). The downstream limit for each individual project action area will be approximately 1,000 feet downstream of the construction footprint given that downstream turbidity usually becomes undetectable at this point (Ham 2016 pers. comm.).

Programmatic activities may temporarily prevent stream connectivity and fish passage during construction but will permanently restore access for Atlantic salmon after construction is completed. In the case of structure replacements or removals where the existing structure is having a negative impact on stream connectivity and upstream fish passage (which will often be the case), the project will have a long-term beneficial effect on Atlantic salmon and their critical habitat that extends upstream of the road-stream crossing location. In these cases, the upstream limit of the action area will be determined by the upper limit of accessible stream habitat, which may or may not be limited by other artificial barriers including road-stream crossings or dams. In other words, if a culvert replacement project will restore access to 1.5 miles of stream habitat upstream of the crossing, then the entire 1.5 miles of stream habitat would be included in the project action area.

2.2 Status of the Species and Critical Habitat

2.2.1 Atlantic Salmon Life History

Atlantic salmon have a complex life history that includes territorial rearing in freshwater streams to extensive feeding migrations on the high seas. During their life cycle, Atlantic salmon go through several distinct phases that are identified by specific changes in behavior, physiology, morphology, and habitat requirements.

Adult Atlantic salmon return to rivers from the sea and migrate to their natal stream to spawn; a small percentage (one to two percent) of returning adults in Maine will stray to a new river. Adult Atlantic salmon ascend the rivers beginning in the spring and continuing into the fall. Although spawning does not occur until late fall, the majority of Atlantic salmon in Maine enter freshwater between May and mid-July (Meister 1958, Baum 1997). Early migration is an adaptive trait that ensures adults have sufficient time to effectively reach spawning areas despite the occurrence of temporarily unfavorable conditions that naturally occur within rivers (Bjornn and Reiser 1991). Atlantic salmon that return in early spring spend nearly five months in the river before spawning, often seeking cool water refuge (e.g., deep pools, springs, and mouths of smaller tributaries) during the summer months.

In the fall, female Atlantic salmon select sites for spawning in rivers. Spawning sites are positioned within flowing water, particularly where upwelling of groundwater occurs, allowing for percolation of water through the gravel (Danie *et al.* 1984). These sites are most often positioned at the head of a riffle (Beland *et al.* 1982); the tail of a pool; or the upstream edge of a gravel bar where water depth is decreasing, water velocity is increasing (McLaughlin and Knight 1987, White 1942), and hydraulic head allows for permeation of water through the redd (a gravel depression where eggs are deposited). Female Atlantic salmon use their caudal fin to scour or dig redds. This digging behavior also serves to clean the substrate of fine sediments that can embed the cobble and gravel substrates needed for spawning and consequently reduce egg survival (Gibson 1993).

One or more males fertilize the eggs that the female deposits in the redd (Jordan and Beland 1981). The female then continues digging upstream of the last deposition site, burying the fertilized eggs with clean gravel. A single female may create several redds before depositing all of her eggs. Female anadromous Atlantic salmon produce a total of 1,500 to 1,800 eggs per kilogram of body weight, yielding an average of 7,500 eggs per two sea-winter female (an adult female that has spent two winters at sea before returning to spawn) (Baum and Meister 1971). After spawning, Atlantic salmon may either return to sea immediately or remain in fresh water until the following spring before returning to the sea (Fay *et al.* 2006). From 1968 to 2006, approximately 1.3 percent of the naturally-reared adults (fish originating from natural spawning or hatchery fry) in the Penobscot River were repeat spawners; however, from 2007 through 2016, only 0.33 percent of adult returns in the Penobscot River were repeat spawners (U.S. Atlantic Salmon Assessment Committee (USASAC)2017).

Embryos develop in redds for a period of 175 to 195 days, hatching in late March or April (Danie *et al.* 1984). Newly hatched Atlantic salmon, referred to as larval fry, alevin, or sac fry, remain in the redd for approximately six weeks after hatching and are nourished by their yolk sac (Gustafson-Greenwood and Moring 1991). Survival from the egg to fry stage in Maine is estimated to range from 15 to 35 percent (Jordan and Beland 1981). Survival rates of eggs and larvae are a function of stream gradient, overwinter temperatures, interstitial flow, predation, disease, and competition (Bley and Moring 1988). Once larval fry emerge from the gravel and begin active feeding, they are referred to as fry. The majority of fry (greater than 95 percent) emerge from redds at night (Gustafson-Marjanen and Dowse 1983).

When fry reach approximately 1.5 inches to 2.75 inches (4 to 7 centimeters) in length, the young Atlantic salmon are termed parr[7] (Danie *et al.* 1984). Parr have eight to eleven pigmented vertical bands on their sides that are believed to serve as camouflage (Baum 1997). A territorial behavior, first apparent during the fry stage, grows more pronounced during the parr stage, as the parr actively defend territories (Allen 1940, Kalleberg 1958, Danie *et al.* 1984). Most parr remain in the river for two to three years before undergoing smoltification, the process in which parr go through physiological changes in order to transition from a freshwater environment to a saltwater marine environment. Some male parr may not go through smoltification and will become sexually mature and participate in spawning with sea-run adult females. These males are referred to as precocious parr.

First year parr are often characterized as being small parr or 0+ parr approximately 1.75 to 2.75 inches (4 to 7 centimeters long), whereas second and third year parr are characterized as large parr greater than 2.75 inches long (7 centimeters [Haines 1992]). Parr growth is a function of water temperature (Elliott 1991); parr density (Randall 1982); photoperiod (Lundqvist 1980); interaction with other fish, birds, and mammals (Bjornn and Reiser 1991); and food supply (Swansburg *et al.* 2002). Parr movement may be quite limited in the winter (Cunjak 1988, Heggenes 1990); however, movement in the winter does occur (Hiscock *et al.* 2002) and is often necessary, as ice formation reduces total habitat availability (Whalen *et al.* 1999). Parr have been documented using riverine, lake, and estuarine habitats; incorporating opportunistic and active feeding strategies; defending territories from competitors, including other parr; and congregating together in small schools to actively pursue prey (Gibson 1993, Marschall *et al.*1998, Pepper 1976, Pepper *et al.* 1984, Hutchings 1986, Erkinaro *et al.* 1998, Halvorsen and Svenning 2000, O'Connell and Ash 1993, Erkinaro *et al.* 1995, Dempson *et al.* 1996, Klemetsen *et al.* 2003).

[7] Throughout this programmatic consultation, the terms parr and juvenile will be used interchangeably. A parr is a form of juvenile Atlantic salmon after the fry stage. Since the Action Agencies are not proposing activities that will result in effects to eggs, fry, or smolts (due to the time-of-year restriction), the term juvenile will essentially mean parr.

In a parr's second or third spring (age one or age two, respectively), when it has grown to approximately 5 to 6 inches in length, (12.5 to 15.0 centimeters) a series of physiological, morphological, and behavioral changes occur (Schaffer and Elson 1975). This process, called smoltification, prepares the parr for migration to the ocean and life in salt water. In Maine, the vast majority of naturally reared parr remain in fresh water for two years (90 percent or more) with the balance remaining for either one or three years (USASAC 2005). In order for parr to undergo smoltification, they must reach a critical size of approximately 4 inches (10 centimeters) total length at the end of the previous growing season (Hoar 1988). During the smoltification process, parr markings fade and the body becomes streamlined and silvery with a pronounced fork in the tail. Naturally reared smolts in Maine range in size from approximately 5.25 to 6.75 inches (13 to 17 centimeters), and most smolts enter the sea during May to begin their first ocean migration (USASAC 2004). During this migration, smolts must contend with changes in salinity, water temperature, pH, dissolved oxygen, pollution levels, and various predator assemblages.

The physiological changes that occur during smoltification prepare the fish for the dramatic change in osmoregulatory needs that come with the transition from a fresh to a salt water habitat (Ruggles 1980, Bley 1987, McCormick and Saunders 1987, McCormick *et al.* 1998). The transition of smolts into seawater is usually gradual as they pass through a zone of fresh and saltwater mixing that typically occurs in a river's estuary. Given that smolts undergo smoltification while they are still in the river, they are pre-adapted to make a direct entry into seawater with minimal acclimation (McCormick *et al.* 1998). This pre-adaptation to seawater is necessary under some circumstances where there is very little transition zone between freshwater and the marine environment.

The spring migration of post-smolts out of the coastal environment is generally rapid, within several tidal cycles, and follows a direct route (Hyvarinen *et al.* 2006, Lacroix and McCurdy 1996, Lacroix *et al.* 2004). Post-smolts generally travel out of coastal systems on the ebb tide and may be delayed by flood tides (Hyvarinen *et al.* 2006, Lacroix and McCurdy 1996, Lacroix *et al.* 2004, Lacroix and Knox 2005). Lacroix and McCurdy (1996), however, found that postsmolts exhibit active, directed swimming in areas with strong tidal currents. Studies in the Bay of Fundy and Passamaquoddy Bay suggest that post-smolts aggregate together and move near the coast in "common corridors" and that post-smolt movement is closely related to surface currents in the bay (Hyvarinen *et al.* 2006, Lacroix and McCurdy 1996, Lacroix *et al.* 2004). European post-smolts tend to use the open ocean for a nursery zone, while North American post smolts appear to have a more near-shore distribution (Friedland *et al.* 2003). Post-smolt distribution may reflect water temperatures (Reddin and Shearer 1987) or the major surface current vectors (Lacroix and Knox 2005). Post-smolts live mainly on the surface of the water column and form shoals, possibly of fish from the same river (Shelton *et al.* 1997).

Some Atlantic salmon may remain at sea for another year or more before maturing. After their second winter at sea, the Atlantic salmon over-winter in the area of the Grand Banks before returning to their natal rivers to spawn (Reddin and Shearer 1987). Reddin and Friedland (1993) found immature adults located along the coasts of Newfoundland, Labrador, and Greenland, and in the Labrador and Irminger Sea in the later summer and autumn.

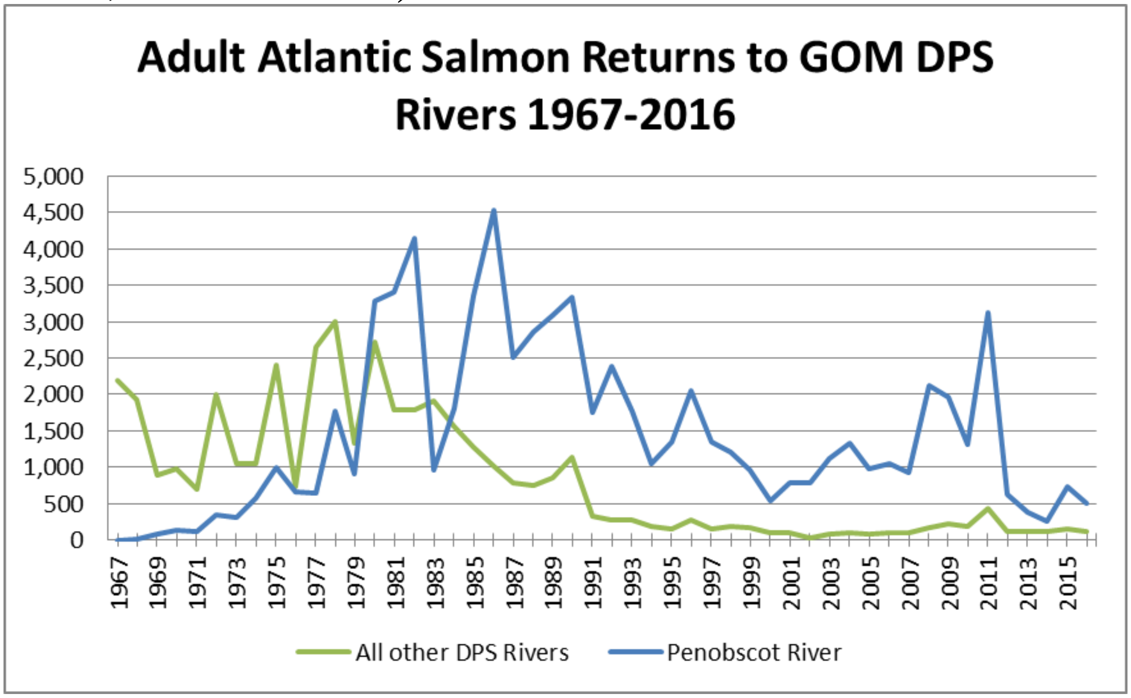
2.2.2 Status of the Atlantic Salmon

The abundance of Atlantic salmon has been generally declining since the 1800s (Fay *et al.* 2006). Data sets tracking adult abundance are not available throughout this entire time period; however, a comprehensive time series of adult returns of Atlantic salmon dating back to 1967 exists (Fay *et al.* 2006, USASAC 2001–2017, **Figure 2**). It is important to note that contemporary abundance levels of Atlantic salmon are several orders of magnitude lower than historical abundance estimates. For example, Foster and Atkins (1869) estimated that roughly 100,000 adult Atlantic salmon returned to the Penobscot River alone before the river was dammed, whereas contemporary estimates of abundance for the entire Atlantic salmon GOM DPS have rarely exceeded 5,000 individuals in any given year since 1967 (Fay *et al.* 2006, USASAC 2017). Contemporary abundance estimates are informative in considering the conservation status of the Atlantic salmon today.

After a period of population growth in the 1970s, adult returns of Atlantic salmon declined steadily between the early 1980s and the early 2000s. Although adult return numbers temporarily improved again from 2008-2011(with a high of 3,125 returns in the Penobscot in 2011), adult returns to the GOM DPS have been at record low numbers since 2012. The population growth observed in the 1970s is likely attributable to favorable marine survival and increases in hatchery capacity, particularly from the construction of Green Lake National Fish Hatchery in 1974. Marine survival remained relatively high throughout the 1980s, and Atlantic salmon populations remained relatively stable until the early 1990s. In the early 1990s marine survival rates decreased, leading to the declining trend in adult abundance observed since then.

Adult Atlantic salmon returns have been very low for many years and remain extremely low in terms of adult abundance in the wild. Further, the majority of all adults return to a single river, the Penobscot, which accounted for more than 90 percent of all adult returns to the GOM DPS between 2000 and 2016. Of the 3,125 adult returns to the Penobscot River in 2011, the majority are the result of smolt stocking; and only a small portion were naturally-reared. The 2011 return number represents the highest value since 1990; however, the subsequent years reflect a continuing and dramatic multi-decadal decline with only 261 returns to the Penobscot in 2014. The 2014 returns represent the lowest value since the early 1970s. The years 2015 (731) and 2016 (507) saw minor increases in adult returns to the Penobscot River.

Figure 2. Adult Atlantic salmon returns to the GOM DPS rivers between 1967 and 2016 (Fay *et al.* 2006, USASAC 2001-2017).



The term naturally-reared includes fish originating from both natural spawning and from stocked hatchery fry (USASAC 2012). Hatchery fry are included as naturally-reared because hatchery fry are not marked and, therefore, cannot be distinguished from fish produced through natural spawning. Because of the extensive amount of fry stocking that takes place in an effort to recover Atlantic salmon, it is possible that a substantial number of fish counted as naturally reared were actually stocked as hatchery fry. Low abundances of both hatchery-origin and naturally-reared adult Atlantic salmon returns to Maine demonstrate continued poor marine survival. Declines in hatchery-origin adult returns are less sharp because of the ongoing effects of consistent hatchery supplementation of smolts. Nearly all of the hatchery-reared smolts are released into the Penobscot River–554,000 smolts in 2011 (USASAC 2012). In contrast, the number of returning naturally-reared adults continues at low levels due to poor marine survival. In conclusion, the abundance of Atlantic salmon has been low and either stable or declining over the past several decades. The proportion of fish that are of natural origin is very small (approximately 6 percent over the last 10 years) but appears stable. The conservation hatchery program has assisted in slowing the decline and helping to stabilize populations at low levels.

However, stocking of hatchery products has not contributed to an increase in the overall abundance of Atlantic salmon and as yet has not been able to increase the naturally reared component. Continued reliance on the conservation hatchery program could prevent extinction but will not allow recovery of the Atlantic salmon, which must be accomplished through by increases in naturally reared fish.

2.2.3 Critical Habitat Description

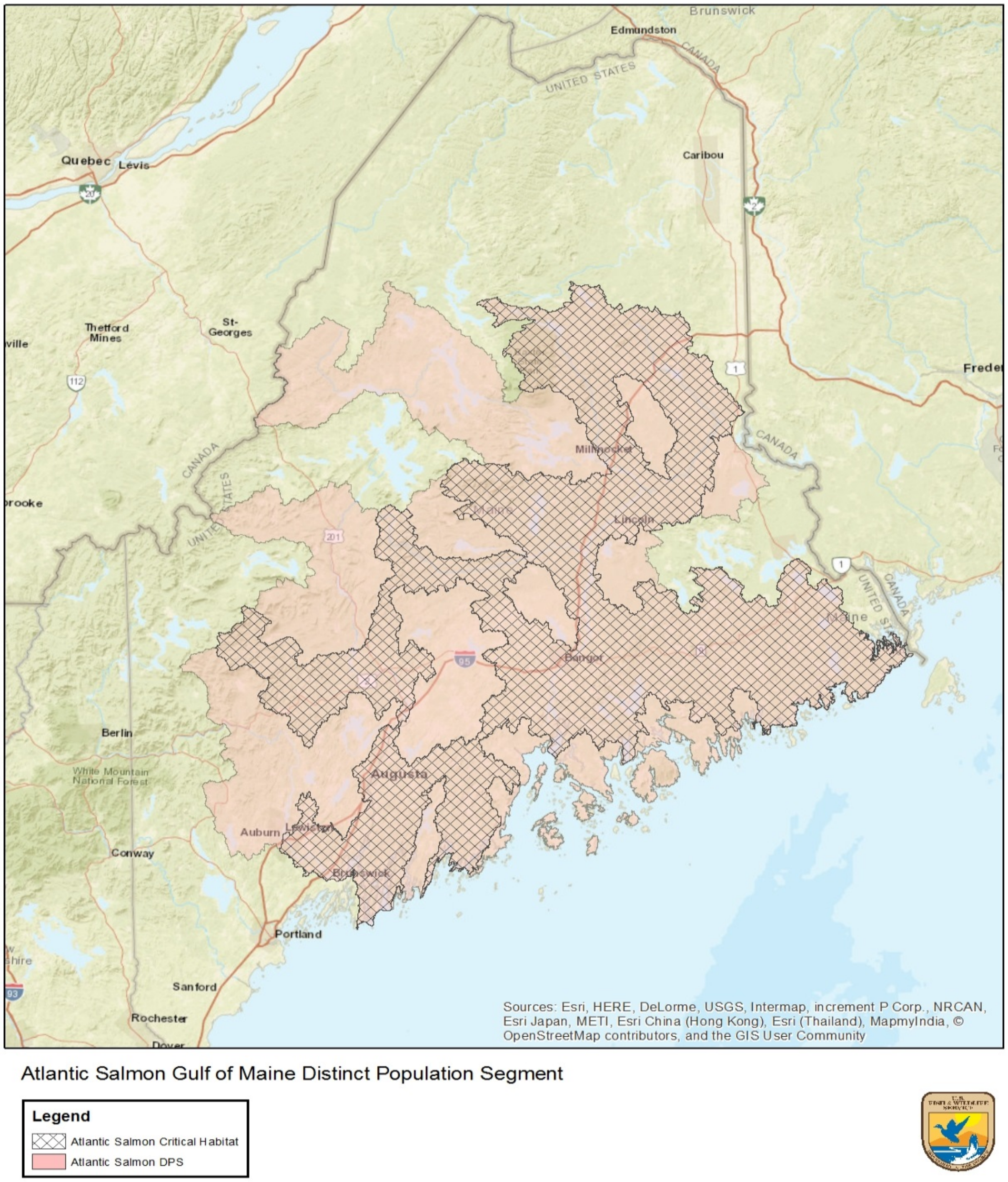
Coincident with the June 19, 2009 endangered listing, the NMFS designated critical habitat for the Atlantic salmon (*Federal Register* 2009b, 29300) (**Figure 3)**. The final rule was revised on August 10, 2009 (*Federal Register* 2009c, 39003). In this revision, designated critical habitat for the expanded Atlantic salmon GOM DPS was reduced to exclude trust and fee holdings of the Penobscot Indian Nation. Critical habitat is designated to include all perennial rivers, streams, estuaries, and lakes connected to the marine environment with the range of the GOM DPS of Atlantic salmon, except for those particular areas within the range that are specifically excluded.

The designation of critical habitat for Atlantic salmon uses both the terms primary constituent element (PCE) and physical and biological features (PBFs). Critical habitat for Atlantic salmon is designated to include two PCEs, sites for spawning and rearing and sites for migration. Within each PCE, a number of essential PBFs are identified. The new critical habitat regulations (*Federal Register* 2016, 7414) eliminate the future use of the term PCE and provide a definition of PBFs to assist in identifying specific areas that can be identified as critical habitat for a species. The shift in terminology does not change the approach used in conducting a 'destruction or adverse modification' analysis, which is the same regardless of whether the original designation identified PCEs or PBFs.

The status of Atlantic salmon critical habitat in the GOM DPS is important for two reasons, 1) because it affects the viability of the listed species within the action area at the time of the consultation and 2) because those habitat areas designated critical provide PBFs essential for the conservation (i.e., recovery) of the species. The complex life cycle exhibited by Atlantic salmon gives rise to complex habitat needs, particularly during the freshwater phase (Fay *et al.* 2006). For example, spawning gravels must be a certain size and free of sediment to allow successful incubation of the eggs. Eggs also require cool, clean, and well-oxygenated waters for proper development. Juveniles need abundant food sources, including insects, crustaceans, and other small fish. They need places to hide from predators (mostly birds and larger fish), such as under logs, root wads, and boulders in the stream or beneath overhanging vegetation. They also need places to seek refuge from periodic high flows (e.g., side channels and off-channel areas) and from warm summer water temperatures (e.g., coldwater springs and deep pools).

Returning adults generally do not feed in fresh water but instead rely on limited energy stores to migrate, mature, and spawn. Like juveniles, adults also require cool water and places to rest and hide from predators. During all life stages, Atlantic salmon require cool water that is free of contaminants. They also need migratory corridors with adequate passage conditions (timing, water quality, and water quantity) to allow access to the various habitats required to complete their life cycle.

Figure 3. Geographic extent of the Atlantic salmon Gulf of Maine Distinct Population Segment and designated critical habitat.



The physical and biological features of the two components of Atlantic salmon critical habitat, sites for spawning and rearing and sites for migration, are as follows:

Physical and biological features of sites for spawning and rearing (SR):

- SR 1.Deep, oxygenated pools and cover (e.g., boulders, woody debris, vegetation, etc.), near freshwater spawning sites, necessary to support adult migrants during the summer while they await spawning in the fall.
- SR 2.Freshwater spawning sites that contain clean, permeable gravel and cobble substrate with oxygenated water and cool water temperatures to support spawning activity, egg incubation, and larval development.
- SR 3.Freshwater spawning and rearing sites with clean, permeable gravel and cobble substrate with oxygenated water and cool water temperatures to support emergence, territorial development and feeding activities of Atlantic salmon fry.
- SR 4.Freshwater rearing sites with space to accommodate growth and survival of Atlantic salmon parr.
- SR 5.Freshwater rearing sites with a combination of river, stream, and lake habitats that accommodate parrs' ability to occupy many niches and maximize parr production.
- SR 6.Freshwater rearing sites with cool, oxygenated water to support growth and survival of Atlantic salmon parr.
- SR 7.Freshwater rearing sites with diverse food resources to support growth and survival of Atlantic salmon parr.

Physical and biological features of sites for migration (M):

- M 1.Freshwater and estuary migratory sites free from physical and biological barriers that delay or prevent access of adult Atlantic salmon seeking spawning grounds needed to support recovered populations.
- M 2.Freshwater and estuary migration sites with pool, lake, and in-stream habitat that provide cool, oxygenated water and cover items (e.g., boulders, woody debris, and vegetation) to serve as temporary holding and resting areas during upstream migration of adult Atlantic salmon.
- M 3.Freshwater and estuary migration sites with abundant, diverse native fish communities to serve as a protective buffer against predation.
- M 4.Freshwater and estuary migration sites free from physical and biological barriers that delay or prevent emigration of smolts to the marine environment.
- M 5.Freshwater and estuary migration sites with sufficiently cool water temperatures and water flows that coincide with diurnal cues to stimulate smolt migration.
- M 6.Freshwater migration sites with water chemistry needed to support sea water adaptation of smolts.

2.2.4 Status of the Critical Habitat

In describing critical habitat for the Atlantic salmon, the NMFS divided the GOM DPS range into Salmon Habitat Recovery Units (SHRU). The three SHRUs include the geographic areas known as Downeast Coastal, Penobscot Bay, and Merrymeeting Bay. The SHRU delineations were designed by the NMFS to ensure that a recovered Atlantic salmon population has widespread geographic distribution to help maintain genetic variability and to provide protection from demographic and environmental variation. A widespread distribution of Atlantic salmon across the three SHRUs will provide a greater probability of population sustainability in the future, as will be needed to achieve species recovery.

The three SHRUs resemble, with some differences, the hydrologic unit code (HUC) 10 basin divisions[8] for the GOM DPS. The Merrymeeting Bay SHRU incorporates two large river basins, the Androscoggin and Kennebec, and extends east to the St. George River watershed. The Penobscot Bay SHRU includes the entire Penobscot River basin and extends west to include the Ducktrap River watershed and east to include the Bagaduce River watershed. The Downeast Coastal SHRU includes all the small- to medium-sized coastal watersheds from the Union River east to include the Dennys River.

Habitat areas designated as critical habitat within each SHRU are described in terms of habitat units (HUs). One HU represents 1,076 square feet (100 square meters) of suitable Atlantic salmon rearing or spawning habitat. The quantity of Atlantic salmon rearing HUs in the GOM DPS was estimated through the use of a GIS-based Atlantic salmon rearing habitat model (Wright *et al.* 2008). **Table 2** presents a summary of the total HUs available in each SHRU (areas designated as critical habitat plus those that are not designated or are excluded), as well as the amount of HUs currently considered suitable and accessible for Atlantic salmon. For each SHRU, the NMFS determined that there were sufficient habitat units available within the currently occupied habitat to achieve recovery objectives in the future; therefore, no unoccupied habitat at the HUC-10 watershed scale was designated as critical habitat. A brief historical description for each SHRU, as well as contemporary critical habitat designations and special management considerations, are provided below.

[8] The U.S. Geological Survey and Water Resource Council developed the Hydrologic Unit Code (HUC) system to facilitate the geographic classification of surface water drainages based on topography and surface flow. The system divides drainages in the United States into six nested levels. Drainages are assigned a numbered code that reflects the level of classification. At level 4 is HUC 8, which represents a sub-basin, and level 5 is HUC 10, which represents a watershed. The numbers 8 and 10 reflect the number of digits in the code. As the drainage becomes smaller, the length of code gets longer.

Table 2. Total estimated habitat units (HUs) in the GOM DPS that are suitable and accessible, 2017[9].

SHRU	Total Estimated HUs	Estimated Suitable and Accessible HUs
Penobscot Bay	397,092	18,600 (5% of total HUs)
Merrymeeting Bay	356,066	9,800 (3% of total HUs)
Downeast Coastal	60,363	28,500 (47% of total HUs)
Total	813,521	56,900 (7% of total HUs)

In summary, the June 19, 2009 final Atlantic salmon critical habitat designation (as revised on August 10, 2009) identifies 45 specific areas occupied by Atlantic salmon that comprise approximately 12,161miles (19,571 kilometers) of perennial river, stream, and estuary habitat and 308 square miles (799 square kilometers) of lake habitat within the range of the Atlantic salmon where the physical and biological features essential to the conservation of the species occur. Within the Atlantic salmon occupied range, approximately 870 miles (1,400 kilometers) of river, stream, and estuary habitat and approximately 49 square miles (127 square kilometers) of lake habitat have been excluded from critical habitat pursuant to section 4(b)(2) of the ESA (*Federal Register* 2009c, 29300; *Federal Register* 2009d, 39903).

2.2.4.1 Downeast Coastal SHRU

The Downeast Coastal SHRU encompasses fourteen HUC-10 watersheds covering approximately 1,852,549 acres of land (749,700 hectares) within Washington, Hancock, and Penobscot counties. Eleven HUC-10 watersheds are designated as critical habitat with approximately 53,400 units of habitat that are currently considered occupied by Atlantic salmon. In this SHRU, critical habitat consists of approximately 3,226 miles (5,192 kilometers) of rivers, streams, and estuaries and approximately 140.7 square miles (364.5 square kilometers) of lakes. The Downeast SHRU has enough HUs available within the occupied range that, in a restored state (e.g., improved habitat connectivity or improved habitat quality), the Downeast SHRU could satisfy recovery objectives as described in the final rule for critical habitat (*Federal Register* 2009c, 29300). Certain Tribal and military lands within the Downeast Coastal SHRU in three HUC-10 watersheds are excluded from critical habitat designation.

The Downeast Coastal SHRU once contained high quality Atlantic salmon habitat in quantities sufficient to support robust Atlantic salmon populations. Impacts to substrate and cover, water quality, water temperature, biological communities, and migratory corridors, among other factors, have impacted the quality and quantity of habitat available to Atlantic salmon. Despite these impacts, this SHRU contains five of the seven remaining locally adapted genetic stocks in the GOM DPS (Narraguagus, Pleasant, Machias, East Machias, and Dennys Rivers).

The Downeast SHRU only contains two hydropower dams, both on the Union River. These dams limit access to approximately 4,200 units of habitat, and the associated impoundments impact PBFs primarily through high water temperatures and abundant non-native smallmouth

[9] Data obtained from the NMFS on June 6, 2017 as an update to the data currently available in the March 31, 2016 draft Atlantic Salmon Recovery Plan at: (*http://atlanticsalmonrestoration.org/resources/documents/atlantic-salmon-recovery-plan-2015/recovery-plan-pages/habitat-requirements*; accessed August 2017.)

bass populations, which compete with and prey on juvenile Atlantic salmon. Efforts are underway to address fish passage issues associated with these two dams. The West Branch Union River has abundant, suitable spawning and rearing habitats for Atlantic salmon; improved access to this critical habitat would contribute to Atlantic salmon recovery. The only other mainstem dam in the Downeast SHRU is the Stillwater Dam on the Narraguagus River in Cherryfield. This dam, which does have a fish ladder, is a partial barrier to upstream migration of adult Atlantic salmon and likely results in migration delays that may increase Atlantic salmon's vulnerability to predation. Generally smaller, non-hydropower dams are ubiquitous through the Downeast SHRU, impeding access to and degrading the quality of critical habitat. Ongoing Atlantic salmon conservation efforts are making progress in removing or providing fish passage at some of these dams, with resulting improvements in several PBFs.

Throughout the Downeast SHRU historic log drives negatively impacted critical habitat in many streams by straightening channels and removing wood and boulders, resulting in less diverse aquatic habitat. Many poorly designed road-stream crossings provide complete or partial barriers to Atlantic salmon movements and also degrade the quality of spawning and rearing habitat. In recent years, however, progress is being made to replace or remove problem road-stream crossings and address the impacts of log drives on stream habitat, which is resulting in improvements to several PBFs in many waterbodies through this SHRU.

2.2.4.2 Penobscot Bay SHRU

The Penobscot Bay SHRU encompasses forty-six HUC-10 watersheds covering approximately 54,919,580 acres (22,225,200 hectares) of land in seven counties. Twenty-eight HUC-10 watersheds are designated as critical habitat, with approximately 211,000 units of habitat that are currently considered occupied by Atlantic salmon. In this SHRU, critical habitat consists of approximately 5,723 miles (9,210 kilometers) of rivers, streams, and estuaries and approximately 118 squares miles (305.5 square kilometers) of lakes. The Penobscot Bay SHRU has enough HUs available within the occupied range that, in a restored state (e.g., improved habitat connectivity or improved habitat quality), the Penobscot Bay SHRU could satisfy recovery objectives as described in the final rule for critical habitat (*Federal Register* 2009c, 29300).

Three HUC-10 watersheds–*Molunkus Stream*, *Passadumkeag River*, and *Belfast Bay*–are excluded from critical habitat designation due to economic impact. Certain Tribal lands within the Penobscot Bay SHRU are also excluded from critical habitat designation.

The Penobscot Bay SHRU once contained high quality Atlantic salmon habitat in quantities sufficient to support upwards of 100,000 returning adult Atlantic salmon when freshwater and marine conditions are favorable. Impacts to substrate and cover, water quality, water temperature, biological communities, and migratory corridors, among other factors, have impacted the quality and quantity of habitat available to Atlantic salmon. Because of the presence of dams throughout the watershed, including hydropower dams on the mainstem of the Penobscot River and some of its major tributaries, all but approximately 8,000 units of critical habitat are above dams currently without fish passage operations that are deemed sufficient to allow for the survival and recovery of the GOM DPS. Efforts are currently underway at many of these dams to ensure that dam operations allow for the survival and recovery of Atlantic salmon.

Despite prevalent issues with dams and road-stream crossings affecting habitat connectivity and quality in many locations, the Penobscot Bay SHRU contains the largest abundance of freshwater spawning and rearing habitats that are currently accessible to Atlantic salmon. While the Penobscot River itself contains limited habitat suitable as spawning and rearing habitat for Atlantic salmon, this river is a crucial migratory corridor providing access to valuable habitat in numerous tributaries.

The presence of smallmouth bass and other non-native fish species significantly degrades critical habitat quality and alters predator/prey relationships throughout the mainstem Penobscot and sub-basins including the Mattawamkeag and Piscataquis Rivers. Throughout the Penobscot Bay SHRU, including the East Branch Penobscot and Sebois Rivers, historic log drives negatively impacted critical habitat in many streams by straightening channels and removing wood and boulders, resulting in less diverse aquatic habitat.

2.2.4.3 Merrymeeting Bay SHRU

The Merrymeeting Bay SHRU encompasses forty-five HUC-10 watersheds covering approximately 6,651,647 acres (2,691,828 hectares) of land in nine counties. Nine HUC-10 watersheds are designated as critical habitat, with approximately 136,000 units of habitat that are currently considered occupied by Atlantic salmon. In this SHRU, critical habitat consists of approximately 3,212 miles (5,169 kilometers) of rivers, streams, and estuaries and approximately 48.2 squares miles (124.8 square kilometers) of lakes. The Merrymeeting Bay SHRU has enough HUs available within the occupied range that, in a restored state (e.g., improved habitat connectivity or improved habitat quality), this SHRU could satisfy recovery objectives as described in the final rule for critical habitat (*Federal Register* 2009c, 29300). Lands controlled by the Department of Defense within the *Little Androscoggin* HUC-10, *Kennebec River Estuary* HUC-10, and the *Sandy River* HUC-10 are excluded as critical habitat.

The Merrymeeting Bay SHRU once contained high quality Atlantic salmon habitat in quantities sufficient to support upwards of 100,000 returning adult Atlantic salmon when freshwater and marine conditions are favorable. Impacts to substrate and cover, water quality, water temperature, biological communities, and migratory corridors, among other factors, have impacted the quality and quantity of habitat available to Atlantic salmon. Because of the presence of dams throughout the watershed, including hydropower dams on the mainstems of the Kennebec and Androscoggin Rivers, approximately 29,000 units of critical habitat are above dams currently without fish passage operations that are deemed sufficient to allow for the survival and recovery of the GOM DPS. Efforts are currently underway at many of these dams to ensure that dam operations allow for the survival and recovery of Atlantic salmon.

Despite prevalent issues with dams and road-stream crossings affecting connectivity and quality of critical habitat in many locations throughout this SHRU, the Kennebec River basin is notable in that it contains the most abundant and most suitable habitats for Atlantic salmon in the GOM DPS. Within the Kennebec River watershed, the Sandy River and its tributaries have the highest biological value for spawning and rearing habitat. All adult Atlantic salmon returning to the Kennebec River are currently stocked into the Sandy River through a trap and truck program around the four lowermost dams on the Kennebec. Atlantic salmon recovery in the Sandy River sub-basin is also being supported by an egg planting program. Critical habitat in the Kennebec River portion of the Merrymeeting Bay SHRU may provide greater resilience to climate change because of its high gradient systems and cool water influences.

The presence of smallmouth bass, brown trout, and other non-native fish species degrades critical habitat quality and alters predator/prey relationships throughout the SHRU. In some portions of the Merrymeeting Bay SHRU, historic log drives negatively impacted critical habitat in many streams by straightening channels and removed wood and boulders, resulting in less diverse aquatic habitat.

2.3 Environmental Baseline

The environmental baseline provides a snapshot of a species health or status at a given time within the action area and is used as a biological basis upon which to analyze the effects of the proposed action. Assessment of the environmental baseline includes an analysis of past and present impacts of all actions in the action area but does not include the effects of the action under review in the consultation (Service and NMFS 1998). An environmental baseline that does not meet the biological requirements of a listed species may increase the likelihood that adverse effects of the proposed action will result in jeopardy to a listed species or in destruction or adverse modification of designated critical habitat.

The action area for this programmatic consultation includes the combined action areas for multiple projects for which an exact location within the geographic range of the GOM DPS is not yet known. Consequently, it is not possible to precisely define 1) the current condition of Atlantic salmon and its critical habitat in the individual project action areas, 2) the factors responsible for those conditions, or 3) the conservation role of the specific action areas.

Therefore, in order to complete the jeopardy analysis in this PBO, the Service is making several assumptions regarding the environmental baseline in each future action area for a covered road-stream crossing project. These assumptions include the following: 1) the overall abundance of Atlantic salmon is very low and is orders of magnitude lower than historic abundance levels in the GOM DPS; 2) the percentage of naturally reared Atlantic salmon versus those from hatchery supplementation efforts is low through the GOM DPS; 3) low marine survival is negatively affecting the entire GOM DPS and contributing to low numbers of adult returns to all rivers; 4) Atlantic salmon occurrence and abundance in each project's action area will vary depending on the location relative to ongoing conservation hatchery stocking locations and natural spawning activity; 5) throughout the GOM DPS access to and quality of Atlantic salmon habitat is affected by dams and poorly designed road-stream crossings, limiting the current function of migration, spawning, and rearing habitats; and 6) at least some of the project-specific action areas, particularly those associated with crossing structure removals and replacements, are currently experiencing some degradation of aquatic habitat function.

As described above in the Status of the Species and Critical Habitat section, the many factors that are influencing the current population of the GOM DPS and the condition of critical habitat are largely ubiquitous throughout the range of Atlantic salmon. Therefore, the Service believes that our analyses and conclusions in this PBO are broadly applicable to the numerous future project-specific action areas that will covered by this programmatic consultation.

2.4 Effects of the Action

The effects of the action refer to the direct and indirect effects of an action on the species or critical habitat, together with the effects of other activities that are interrelated or interdependent with that action, that will be added to the environmental baseline (50 CFR 402.02). Indirect effects are those that are caused by the proposed action and are later in time, but still are reasonably certain to occur.

Chapter 2 section **2.1.1** of the PBO provides an overview of the programmatic activities. Stream connectivity projects in this PBO, implemented under the project design criteria and with the required conservation measures also listed in **Chapter 2** sections **2.1.6, 2.1.7 and 2.1.8**, are considered Likely to Adversely Affect (LAA) Atlantic salmon when the species is likely present in the action area and NLAA Atlantic salmon when the species is not likely present in the action area. LAA projects will include the pursuit, capture and evacuation of Atlantic salmon from the instream work area to minimize construction-related effects to the species. Given the required project design criteria and the required construction-related conservation measures, all projects covered by this programmatic consultation are NLAA Atlantic salmon critical habitat. A more thorough discussion of our effects determinations related to Atlantic salmon and critical habitat is available on page 7 of this document in the programmatic consultation introduction that precedes the PBO.

2.4.1 Effects of the Action on Atlantic Salmon

Despite the diverse range of activities proposed, the effects they generate can be distilled into a limited array of likely or potential effects. The effects that are described include elevated turbidity and sediment transport, temporary migration and movement barrier, fish handling and relocation, impingement and entrainment, water quality impact (e.g., pollutants), and habitat or critical habitat alteration. These effects will be verified during the future Tier 2 review of each project submitted under this programmatic consultation. The extent of each of these effects is described below, based upon the assumptions articulated in **Chapter 2** section **2.1**, which describes the proposed action.

The effects analysis discusses the effects on Atlantic salmon adults and juveniles. Since the action agencies are not proposing activities that will result in effects to eggs, fry and smolts (due to time-of-year restriction for inwater work), the term juvenile used in this section specifically relates to parr.

2.4.1.1 Elevated Turbidity and Sediment Transport

Pulses of elevated suspended sediment will occur episodically for individual projects. The primary activities that contribute to sediment and turbidity increases in Atlantic salmon habitat include clearing and grading near streams and in-water work. Although these effects are temporary and will be minimized through the use of CMs (including but not limited to the implementation of a SEWPCP, revegetating exposed soils, providing “dirty water” treatment, conducting work within a cofferdam, and limiting in-water activities where a clay substrate exists), complete avoidance of sedimentation and turbidity increases is not usually achievable. Generally, activities that are conducted below the OHWM result in less turbidity if work is performed in isolation from the flowing water. All work requiring streambed excavation will occur within a dewatered cofferdam. Demolition of bridge abutments will also occur within a cofferdam. This recognizes that while cofferdams are used to minimize turbidity overall during instream construction work, there are still short-term turbidity increases when cofferdams are installed and removed. Short-term (generally two hours or less) turbidity pulses typically result from placing or removing cofferdams and from reintroducing water into the dewatered work area where exposed soils become suspended in the water column.

It is possible to minimize turbidity effects when conducting work outside of a cofferdam. Examples include work in gravel or bedrock substrate and work that has a very short duration of the in-stream work component, like operating heavy equipment and vegetation or other debris removal at structure inlets. In general for the proposed activities associated with road-stream crossing projects, instream work activities outside of cofferdams will be very limited.

The effects of increased suspended solids on salmonids depend on the extent, duration, timing, and frequency of increased sediment levels at the place where it will occur (Bash *et al.* 2001). Newcombe and Jensen (1996) completed a literature review of 80 publications. Referenced literature assessed impacts from suspended sediment on multiple salmonid and non-salmonid species. They analyzed the findings pertaining to effects of suspended sediment exposure, measured in concentrations (milligrams per liter) on juvenile and adult salmonids and calculated a severity of ill-effects score. The score was then used to predict species response at various concentrations and durations. Depending on the level of these parameters, sedimentation can cause lethal, sublethal, and behavioral effects in juvenile and adult salmonids. The parameters shown below represent their findings and are the thresholds at which the effects can be anticipated.

Behavioral response–The range of turbidity releases expected to result in behavioral reactions ranging from a startle response to avoidance.

- 1to 20 milligrams per liter for one hour
- 1 milligram per liter for 24 hours

Sublethal effects–The ranges of turbidity releases expected to result in sublethal effects including stress, reduction in feeding rates, and increased respiration rates.

- 20 to 22,026 milligrams per liter for one hour
- One milligram per liter for six days

Potential mortality–A higher range of releases has the potential to result in reduced growth rates, increased predation, and fish mortality.

- Greater than 22,026 milligrams per liter for one hour
- Seven milligrams per liter for 30 months

While these thresholds are helpful in predicting effects on Atlantic salmon from the project activities, real-time monitoring during instream construction is typically conducted by measuring turbidity in nephelometric turbidity units (NTU). Laboratory methods are necessary to determine sediment concentration levels in milligrams per liter, as given above. NTU is a measurement of light refraction, and it varies with the size and composition of suspended material. The ratio between NTU and milligrams per liter will vary (typically less than 10 to 1), but turbidity is commonly used as an approximate indicator of suspended sediment (Department of Fisheries and Oceans Canada 2000).

Robertson *et al.* (2006) found adverse effects to juvenile Atlantic salmon from short-term increases in suspended sediment at levels as low as 15 NTU in vitro. Effects on fish from short-term turbidity increases (hours or days) are generally temporary and are reversed when turbidity levels return to background levels (Robertson *et al.* 2006). Increased turbidity associated with activities proposed in this programmatic consultation is not expected to reach concentration levels above 30 NTU above background for more than a few hours at a time and not for more than a total of four hours per day, for a maximum of a three-day period based on the experience of the MDOT with similar projects (Service 2017).

Avoidance of turbid areas is the typical behavioral response, which can mean that Atlantic salmon are displaced from their preferred habitats in order to seek areas with less suspended sediment. The Service expects that adult Atlantic salmon have a greater capacity to avoid turbid waters than juvenile Atlantic salmon, as adults are not trying to maintain and control a territory. Consequently, it is anticipated that effects to adult Atlantic salmon temporarily exposed to elevated turbidity levels will be minimized due to their mobility capabilities. Effects will be limited to a behavioral response of temporary displacement, as adults are likely to avoid sublethal exposure. Because the duration of increased turbidity events will be limited to a few hours per day at most, temporary displacement of adults is not expected to significantly disrupt normal behavioral patterns. Therefore, effects to adult Atlantic salmon from short-term, increased turbidity are considered insignificant.

Rearing juvenile Atlantic salmon may be present at all times within assumed occupied habitat so a timing restriction for instream work will reduce, but not eliminate, the potential for exposure of juvenile Atlantic salmon to increased suspended sediment. Juvenile Atlantic salmon exposed to sediment may seek cover in place or move to less turbid habitat. For those seeking cover in place, they are more likely to be exposed to construction-related turbidity. We expect both behavioral and sublethal effects to juvenile Atlantic salmon from some activities covered in this programmatic consultation. Behavioral effects to juvenile Atlantic salmon will be moderated by the short duration of exposure (maximum of four hours per day based on Maine DOT experience) and the relatively small areas affected.

Displacement from habitat for this duration, depending on the size of the area affected, may flush juvenile Atlantic salmon from preferred cover, resulting in an increased predation risk. Sublethal effects may also occur to juvenile Atlantic salmon that do not avoid the area of elevated turbidity including reduction in feeding rates, stress, elevated blood sugars, gill flaring, and coughing (Berg and Northcote 1985, Servizi and Martens 1991, Spence *et al.* 1996). Turbid water may also affect Atlantic salmon juvenile's ability to avoid predators. The short duration of elevated turbidity will moderate the effect, but juvenile Atlantic salmon may be exposed to increased predation and elevated stress for up to four hours a day and within 1000 feet downstream of cofferdam installation and removal. According to the MDOT, these pulses may range between 3 and 30 NTU above background and will be of short duration (one to two hours per event). Particle size affects how long sediment is suspended in the water column. Turbidity effects to juveniles are discussed in more detail and how it relates to specific project types in the following paragraphs.

For projects constructed in the wet and on coarse substrates (limited to debris removal maintenance projects), the increase in turbidity is expected to be negligible. For short-duration projects constructed in the wet, even on non-coarse substrates, the increase in turbidity is also expected to be negligible. Sheet pile installation and removal (vibratory hammer only), tracked excavator operation on bedrock or cobble, and riprap installation for bridge and bank protection may create pulses of small (4 to 20 NTU) increases in turbidity up to 1,000 feet downstream of the activity for up to four hours per day based on MDOT experience. These small increases in turbidity for short durations and within small areas should limit potential effects to behavioral effects on adult and juvenile Atlantic salmon. The behavioral effect expected is temporary displacement and is not expected to significantly disrupt normal behavioral patterns or to an extent that creates a likelihood of injury (gill abrasion or reduced respiratory function). Therefore, these effects, which will be limited in both duration and spatial scale, will be insignificant.

Isolation of the stream construction area with cofferdams is an important conservation measure intended to minimize construction-related adverse effects to Atlantic salmon and their habitat created by turbid water discharge and sedimentation, which would otherwise be more severe if streambed excavation occurred in a flowing stream. Core activities included in worksite isolation include sandbag and sheet pile cofferdam installation and removal, stream diversion via pump bypass and channel bypass, fish evacuation, and cofferdam dewatering. Most of the programmatic activity categories require cofferdam use for instream construction activities. We anticipate that 22 projects annually will require the use of cofferdams to isolate instream work areas.

Elevated turbidity of up to 30 NTU above background could extend a maximum of 1,000 feet downstream of the work area for up to two hours during each activity-related cofferdam use (i.e., cofferdam installation, stream diversion, dewatering, cofferdam removal, and re-watering) for a maximum of four hours per day over a maximum three-day period (Service 2017). Juvenile Atlantic salmon will be exposed to pulses of increased suspended sediment during construction of cofferdams and when sediment is generated by dewatering and re-watering work areas, resulting in adverse behavioral and sublethal effects to juvenile Atlantic salmon. Juvenile Atlantic salmon may also be briefly exposed to increased turbidity prior to their evacuation from the isolated work area before it is dewatered. Behavioral effects to juvenile Atlantic salmon from increased turbidity may result in potential adverse effects, especially when the affected area could extend up to 1,000 feet downstream of the activity. Behavioral and sub-lethal effects to juvenile Atlantic salmon present within 1,000 feet downstream of cofferdam installation and removal are expected to cause take to juvenile Atlantic salmon in the form of harassment.

We can't precisely determine the number of exposed juvenile Atlantic salmon that will experience adverse effects from suspended sediment, in part because we don't know where specific projects will be located. We can, however, use a reasonable worst-case scenario based on 1) the estimated amount of stream habitat that will be affected and 2) our general knowledge of juvenile Atlantic salmon densities in Maine to quantify the effects of elevated suspended sediment on Atlantic salmon. Below we summarize the anticipated annual impacts to stream habitat from cofferdam installation and dewatering (**Table 3**). Although up to 1,000 feet of stream area downstream of the cofferdam location would be impacted twice by increased turbidity (i.e., once during cofferdam installation and once during cofferdam removal), we equate these two impacts to one exposure event for juvenile Atlantic salmon, even though these two impacts are likely to happen a few days apart. Given that juvenile Atlantic salmon are territorial, the fish exposed to increased turbidity during cofferdam installation are likely the same fish exposed during cofferdam removal.

Table 3. Summary of annual projects, cofferdam dimensions, and downstream turbidity effects from cofferdam installation and removal.

	Direct Impact Area (sq. ft.)				**Downstream Impact Area (sq. ft.)**			
Total No. of Projects Needing Cofferdams Annually	**Average Cofferdam Area (sq. ft.) Per Project[10]**	**Total Estimated Area of Impact (sq. ft.) Annually**	**Total Est. Area of Impact (sq. ft.) with Atlantic Salmon Present Annually[11]**	**Total Est. Area of Impact (sq. ft.) without Atlantic Salmon Present Annually[12]**	**Avg. Per Project[13]**	**Total Annually**	**Total Est. Area of Impact (sq. ft.) with Atlantic Salmon Present Annually[11]**	**Total Est. Area of Impact (sq. ft.) without Atlantic Salmon Present Annually[12]**
22	1,500	33,000	**14,520**	18,480	10,000	220,000	**96,800**	123,200

Stream specific parr densities vary between streams and between habitats within the same streams. Take estimates for section 7 consultations are derived from two possible sources of juvenile density data. First, stream specific parr densities may be calculated from catch per unit effort (CPUE) surveys[14] completed by resource agencies (primarily the MDMR). Data from these survey efforts are processed to produce an estimate of parr density for each HU. Use of this data source is preferred as it relates to stream specific data. When stream specific information is not available and a suitable substitute is also not available (e.g., data from a

[10] Assumption is that the average de-watered area is 10 feet by 150 feet = 1,500 sq. ft.

[11] This number was obtained by multiplying the 'total estimated area of impact annually' by 44 percent (i.e., anticipated proportion of formal consultations).

[12] This number was obtained by multiplying the 'total estimated area of impact annually' by 56 percent (i.e., anticipated proportion of informal consultations).

[13] Elevated turbidity could extend a maximum of 1,000 feet downstream of the work area for up to one hour during cofferdam installation and one hour during cofferdam removal and re-watering (10 feet x 1,000 feet = 10,000 sq. ft.).

[14] Catch per unit effort is the total catch divided by the total amount of effort used to harvest the catch. CPUE is an indirect measure of the abundance of a target species.

nearby tributary stream), we can estimate parr densities using a model that the Service developed to predict the amount of Atlantic salmon rearing habitat in un-surveyed Atlantic salmon streams. The Service has expanded the rearing habitat model to also predict juvenile densities in all perennial streams in the GOM DPS based on a functional relationship between watershed size and juvenile density developed by Sweka and Mackey (2010). These juvenile density estimates range from 0 to 10.7 parr per HU.

For two previous stream crossing projects with high quality Atlantic salmon rearing habitat and stream specific information available, the parr densities were found through surveys to be 3.5 and 5.6 parr per HU (Service 2017). We believe it is reasonable to assume that density for parr in streams containing Atlantic salmon juveniles across the range of GOM DPS is 5 parr per HU.

Twenty-two projects are expected to require work area isolation annually (**Table 3**), of which ten will occur where Atlantic salmon are potentially present. **Table 3** estimates the downstream area of temporary effect from elevated turbidity using the assumed cofferdam dimensions and 1,000-foot downstream distance. **Table 4** presents the total potential Atlantic salmon HUs and number of juvenile Atlantic salmon adversely affected by cofferdam installation and removal. The two separate impacts from an increase in turbidity are considered as one exposure event, resulting in take of juvenile Atlantic salmon. The amount of take is based on the expected density of Atlantic salmon parr in the impacted stream reach.

Table 4. Total potential annual Atlantic salmon HUs and juveniles adversely affected by cofferdam installation and removal and downstream turbidity.

Total Annual Area in sq. ft. **(from Table 3)**	**Total Annual Area in sq. meters**	**Total Annual HUs***	**Total Annual Atlantic salmon Juveniles Adversely Affected****
111,320	10,342	103	515

*HU=1,076 square feet (100 square meters)
**Assumes 5 parr (juveniles) per HU

In summary, activities covered by this programmatic consultation will likely cause elevated turbidity above background levels. Generally, these turbidity “pulses” will last for no more than two hours at a time and are mostly associated with the installation and removal of instream cofferdams. The expected concentrations and durations of sediment exposure will not result in Atlantic salmon exposure that could cause mortality. Effects to adult Atlantic salmon are expected to be limited to a behavioral response of temporary displacement, which is considered an insignificant effect.

Elevated turbidity is expected to cause short-term adverse behavioral and physical effects to juvenile Atlantic salmon. Take in the form of harassment may occur to juvenile Atlantic salmon exposed to turbidity during cofferdam installation and removal or during work area re-watering. These effects are quantified by estimating the total annual area experiencing elevated turbidity and calculating juvenile Atlantic salmon density (**Tables 3** and **4**).

2.4.1.2 Temporary Migration and Movement Barrier

Cofferdam work area isolation will usually cause a temporary barrier to Atlantic salmon migration and movement. Cofferdams are required for all programmatic activities that require instream work except some maintenance or repair activities, primarily removal of accumulated vegetative or anthropogenic debris at a structure inlet. Projects with cofferdams that are not channel-spanning, which mostly involve work on larger streams, will retain fish passage in the open portion of the channel. Projects with partial-spanning cofferdams will result in temporary flow and depth modifications but will not create complete barriers to fish movement. In-channel work outside of a cofferdam such as equipment operation or debris removal at a structure inlet may increase in-water disturbance levels, but not to a degree to create a barrier to fish movement. Behavioral effects, such as avoiding the immediate work area, could result from these activities; but effects to adult and rearing juvenile Atlantic salmon migration and movement will be insignificant.

Cofferdams that are channel-spanning will have a temporary adverse effect on Atlantic salmon movement because as long as they are in place (generally from one to 60 days based on MDOT experience), they will form a complete barrier. Dewatering of a construction site with channel-spanning cofferdams can involve the use of a diversion pipe or channel or a bypass pump to divert the stream flow around the construction site. There is some anecdotal evidence that diversion ditches or channels can provide some measure of fish passage during construction, particularly downstream fish movement (Peets 2016 pers. comm.). For purposes of this analysis, however, we are assuming that all projects that use channel-spanning cofferdams (regardless of how water is bypassed around the construction site) will impose a complete, temporary barrier to all fish movement through the construction site as long as the cofferdams remain in place.

Channel-spanning cofferdams are anticipated for in-water work for most of the covered projects. The proposed July 15 to September 30 work window will avoid the smolt outmigration, the adult Atlantic salmon fall spawning migration when they move from summer holding pools to spawning grounds and the post-spawning migration when adults move back to the ocean either after spawning in the late fall or the following spring. The summer work window, therefore, will limit effects from channel-spanning cofferdams to rearing juvenile Atlantic salmon movements.

Juvenile Atlantic salmon rear in freshwater streams generally, for two to three years before undergoing smoltification and commencing ocean migration. As they grow, parr will move into different stream habitats, seeking out increasing water depth and velocities and larger substrates. Parr will move within streams in search of more suitable micro-climates, utilizing different habitats for seasonal survival. During the winter, for example, parr may need to move out of certain stream habitats as ice and flow conditions change. The required summer instream work window, however, will avoid any effects of cofferdams on winter parr movements.

During the summer low flow period when stream temperatures may become elevated, juvenile Atlantic salmon (particularly 1+ and older parr) need the ability to move to find thermal refuge habitat. Temporarily blocking these movements could have varying effects. During the warmer months that coincide with the July 15 to September 30 standard in-water work window, juvenile Atlantic salmon may seek thermal refugia associated with a variety of stream habitat features including tributaries, shaded areas near streambanks, deep pools, side channels, groundwater springs or seeps, and areas with emergent hyporheic water (Kurylyk *et al.* 2015). Cofferdams may inhibit access to this cooler water, exposing Atlantic salmon to warmer water temperatures and decreased fitness. Loss of the ability to freely move may also make juvenile Atlantic salmon more subject to predation. We anticipate that as many as 22 projects annually will include channel-spanning cofferdams and will result in adverse effects and, therefore, take in the form of harassment to rearing juvenile Atlantic salmon by restricting movement. Most streams where channel-spanning cofferdams will be placed are smaller streams, likely 20 feet wide or less. Parr moving during the work-window for cofferdam installation and removal (July 15 to September 30) are most likely moving to find thermal refugia and could be moving either upstream or downstream of their rearing habitat territory to find a source of cooler water. Research in New Brunswick on the Miramichi River shows that parr can move 6.2 miles in search of cold water (Cunjak *et al.* 2014).

Because of the variability in the density and distribution of juvenile rearing habitat, the general lack of information on locations of thermal refugia, and the variability in Atlantic salmon distribution and densities in Maine Atlantic salmon rivers, we assume that parr could be expected to move through the area with the cofferdam from about 1.25 miles either upstream or downstream during the work-window for cofferdam installation (July 15 to September 30) (**Table 5**).

Table 5. Total annual number of Atlantic salmon parr adversely affected by channel-spanning cofferdams.

Projects with Channel-spanning Cofferdams Per Year (with Atlantic salmon Present)	Total Annual (sq. feet)[15]	Total Annual (sq. meters)	Total Annual HUs*	Total Annual Atlantic salmon Juveniles Adversely Affected**
22	**132,000**	**12,263**	**123**	**615**

*HU=1,076 square feet (100 square meters).
**Assumed five parr (juvenile Atlantic salmon) per unit.

In summary, partial-channel spanning cofferdams and other in-water work activities may result in temporary disturbance, flow and depth alteration, or partial migration pathway obstructions for adult and juvenile Atlantic salmon. These effects will be reduced by the timing and duration of the work and the preservation of a movement corridor through the work area. Effects on movement and migration from these activities, therefore, will be insignificant. Channel-spanning cofferdams will create temporary, but complete, barriers to Atlantic salmon movement. The timing of this work (July 15 to September 30) will avoid critical migration periods for adults and smolts but will prevent juvenile Atlantic salmon from moving between preferred rearing habitats and thermal refugia. This activity may result in take in the form of harassment from

[15] Assumption is that the average stream area within which parr may move to access thermal refugia or other suitable habitat is 13,200 feet (2.5 miles) by 10 feet (average stream width of 10 feet).

potential reduced fitness and increased predation because the ability of juvenile Atlantic salmon to move to more favorable habitat will be temporarily restricted.

2.4.1.3 Fish Handling and Relocation

Most activities conducted under this programmatic consultation will require that instream construction work is done in isolation from stream flows, typically through the installation of cofferdams and the use of pumps or diversion channels to redirect stream flows around the work site. Because the dewatering of a stream inside a cofferdam would have a lethal effect on any fish left inside the cofferdam, fish relocation is used as a conservation measure to minimize the harmful effects of cofferdam installation and dewatering. Fish relocation uses a sequence of actions to exclude and relocate fish from the instream work area associated with the cofferdams.

To minimize dewatering-related fish stranding inside the cofferdam, the applicants (or appropriate agency staff or other approved personnel) will capture and remove as many Atlantic salmon and other fish species as possible from the work area. The applicants will conduct fish evacuation procedures as described in **Chapter 2** section **2.1.7.2** and following the MDMR (2010) and NMFS (2000) electrofishing protocols to minimize the number of Atlantic salmon juveniles subject to stranding inside the cofferdams.

Capturing and handling Atlantic salmon can cause physiological stress and possibly physical injury or death, including cardiac or respiratory failure from electrofishing (Snyder 2003). Studies show all aspects of fish handling, such as electrofishing, dip-netting, time out of water, and data collection (e.g., measuring and weighing), are stressful and can lead to immediate or delayed mortality (Murphy and Willis 1996). Clement and Cunjak (2010) found a low incidence and severity of injuries to juvenile Atlantic salmon from electrofishing in New Brunswick, but injuries were more prevalent in larger juveniles. The sublethal effects associated with electrofishing and relocation, other than physical injury, remain largely unknown, though they likely include disruption and interruption of normal behavior through relocation and decreased predation avoidance due to temporary incapacitation if individuals are not observed and removed from the water.

Direct mortality may occur when fish are handled roughly or kept out of the water for extended periods. Delayed fish mortality is often associated with a disease epizootic, which generally occurs from 24 hours to 14 days after handling. If a fish is injured during handling, disease may develop within a few hours or days. Examples of injuries which can lead to disease problems are loss of mucus, loss of scales, damage to the integument, and internal damage. Internal injuries occur when fish are not properly restrained or not sedated during handling.

When capturing fish as part of evacuation procedures, equipment such as dip nets, minnow traps and seines will be used first, as practicable. Electrofishing equipment will be used as a final option for clearing the construction area. To minimize temperature-related handling stress to Atlantic salmon, electrofishing will not be conducted in water temperatures above 22.0°C (71.6°F, MDMR 2010). Construction and fish evacuation scheduling will need to account for possible high water temperature conditions when work is conducted within the July 15 to September 30 work window. Early morning evacuation, when water temperatures are often at their coolest daily temperature, will be prioritized. In some situations, however, construction may need to be delayed when stream temperatures exceed 22°C (71.6°F).

Despite precautions, some fish mortality can be expected while electrofishing. The MDMR typically handles a few thousand juvenile Atlantic salmon each year while electrofishing. Recorded mortalities are generally about one percent or less of fish captured and are predominately young-of-the-year (YOY) Atlantic salmon (parr during their first year after hatching). This low mortality rate reflects the training and experience of MDMR staff and the careful adherence to an electrofishing protocol designed to avoid mortality of Atlantic salmon.

Handling stress and risk of injury to juvenile Atlantic salmon will be minimized by 1) ensuring minimal handling time (no data will be collected from individual Atlantic salmon other than recording the number of captures), 2) ensuring minimal time that fish are held out of the water and the stream, and 3) using transfer containers with aerated stream water at the ambient temperature. Adverse effects to Atlantic salmon parr from fish relocation activities are summarized in **Table 6.**

Any fish found inside a cofferdam will be captured and relocated prior to the start of excavation and other in-channel work. This temporary displacement can result in significant effects because Atlantic salmon juveniles are highly territorial. If juveniles occur in the cofferdam area footprints, those relocated juveniles will have to establish new territories. This disruption to their normal behavior may put juveniles at increased risk of injury or mortality as it leaves them more vulnerable to predation, they may need to aggressively compete with other juveniles in establishing a new territory, and they may be less able to capture prey. When construction activities are finished and stream flows are returned, juveniles can re-occupy rearing habitat.

Table 6. Total annual cofferdam impact area and Atlantic salmon juveniles affected.

Total Impact Area (sq. ft.) from Table 3	Total (sq. meters)	Total HUs*	Total Juveniles adversely affected**	Expected Juvenile Mortality From Handling***
14,520	**1349**	**13.49**	**68**	**1**

*HU=1,076 square feet (100 square meters).
**Assumed five parr (juvenile Atlantic salmon) per unit.
***Assumed one percent of all fish handled. No adult Atlantic salmon mortality proposed or expected under this programmatic.

Despite best efforts at fish relocation from the instream work site, some mortality may occur if juvenile Atlantic salmon are missed or stranded in stream substrate interstices and subsequently left inside a dewatered cofferdam. Highly territorial salmonids, such as Atlantic salmon, that hold station and establish territories may be more vulnerable to stranding effects owing to their reluctance to abandon territories (Armstrong *et al.* 1998). Furthermore, the relatively low voltages typically used in Maine when electrofishing in the GOM DPS to minimize injury or death of Atlantic salmon makes it possible that some juvenile Atlantic salmon (especially YOY) could be left in the stream substrate when dewatering begins (Dube and Craig 2011 pers. comm.).

During dewatering, stranding does not always lead directly to mortality, as juvenile fish can survive for several hours in the substrate after dewatering because some water always remains. If stranded fish are not quickly identified and removed, however, mortality could result from removal of stream substrate for project construction, exposure to crushing while equipment and crews are operating within the cofferdam, or stranding over a longer period. During a field experiment conducted in cold water (less than 4.5°C/40.1°F), Saltveit *et al.* (2001) found that 60 percent of Atlantic salmon juveniles became stranded during 42 minutes of dewatering. After searching the substrate, about 39 percent of the stranded fish could not be found. YOY Atlantic salmon were affected more severely than older juveniles. Only about 10 percent of 1+ Atlantic salmon juveniles were stranded during daylight in water greater than 9°C (80.2°F). In general, the incidence of Atlantic salmon stranding is much lower during summer, when water temperature is relatively high compared to winter conditions. This is likely attributable to lower fish activity and greater substrate-seeking behavior during the cold season. Stranding is also higher during the day, probably because Atlantic salmon are predominantly active at night and more likely to leave substrate at night.

We are not aware of data or literature that quantifies stranding of juvenile Atlantic salmon in stream substrates after fish removal efforts, including electrofishing. Given the best available scientific information, however, it is assumed that some juvenile Atlantic salmon will be left stranded inside a cofferdam, particularly in streams with coarse gravel and cobble substrate where small fish can be very difficult to detect and remove. When cofferdams are de-watered and construction activities begin to replace or remove the existing stream crossing (e.g., excavation of the substrate), any fish left stranded in the substrate will be killed. Therefore, mortality is expected for any juvenile Atlantic salmon left stranded within the stream substrate within the footprint of a de-watered cofferdam after all fish removal efforts have been completed.

In summary, we estimate that 22 cofferdams will be constructed annually where juvenile Atlantic salmon are likely to occur and would be affected by fish handling and relocation activities. These activities may cause direct take in the form of harassment to at most 68 Atlantic salmon juveniles by pursuing, capturing and relocating fish to adjacent habitat. Of these 68 juvenile Atlantic salmon, take in the form of harm from electrofishing and handling injury and mortality will affect one individual and take in the form of harm from stranding mortality may affect an unknown but likely small number of the 68 Atlantic salmon juveniles.

2.4.1.4 Impingement and Entrainment

Impingement and entrainment is a potential risk for juvenile Atlantic salmon at the pump intake during water pumping for cofferdam dewatering and stream diversions in Atlantic salmon waters. Where cofferdams are utilized, pumping from the stream may be necessary, depending on the method used to divert water around the construction site (i.e., some projects may use a diversion channel or ditch rather than a bypass pump). Approach velocities across the intake screen that are faster than a fish's swimming capability can overcome fish and draw and hold them against the screen surface (i.e., impingement), resulting in suffocation or physical damage to the fish (NMFS 2011). Pump intake hoses without screens or with improper screen designs can result in fish being drawn into the pump (entrainment) and killed.

Additionally, fish can become impinged in block nets that have been positioned to prevent fish from moving into a work area. This could be an additional source of injury or mortality associated with construction site isolation procedures; however, block nets used in a similar manner on projects in Maine have not resulted in fish impingement (Service 2013). Therefore, additional capture or mortality of Atlantic salmon associated with entrainment on block nets is not expected.

The implementation of protective measures for fish screens on pump intakes as described in the **Chapter 2** section **2.1.7.5** and NMFS (2011) will reduce the likelihood of fish injury or mortality from interactions with pumps used to divert stream flows to very unlikely. With application of the required procedures and CMs, effects from impingement and entrainment to juvenile Atlantic salmon are expected to be discountable.

2.4.1.5 Heavy Equipment Operation

Although not routine, a small number of projects may necessitate the operation of heavy equipment in the stream channel but outside of the dewatered cofferdam. Equipment will be limited, however, to that section of the stream that is isolated by the block nets used for fish evacuation. Since Atlantic salmon will be removed from the work area prior to equipment entering the stream, effects to Atlantic salmon (e.g., from crushing) are very unlikely to occur and are therefore discountable.

2.4.1.6 Water Quality Impact (Pollutants)

Petroleum-based materials, such as diesel fuel and oil, contain polycyclic aromatic hydrocarbons (PAHs) which can enter streams from a spill or stormwater runoff and then affect Atlantic salmon individuals. PAHs can be acutely toxic to salmonids and other aquatic organisms at high exposure levels or can cause sublethal effects at lower exposures (Albers 2003, Meador *et al.* 2006). All of the project activities have the potential to result in releases of various pollutants that are related to general construction activities. All in-water excavation, however, will take place inside of a cofferdam.

The proposed activities do not allow intentional pollutant discharges of any sort in association with construction activities. However, the use of heavy equipment in or near a waterbody increases the risk of contaminants (fuel, oil, hydraulic fluid, etc.) being accidentally released into the project site and possibly degrading habitat conditions and threatening aquatic organisms. As a component of the SEWPCP for each project, the applicants (or their contractor) will develop and implement a Spill Prevention, Control and Countermeasures (SPCC) Plan, designed to avoid any stream impacts from hazardous chemicals associated with construction activities, such as diesel fuel, oil, lubricants, and other hazardous materials. The SPCC Plan includes the assurance that necessary BMPs will be on site and employed in the event of a hazardous materials release. Careful adherence to an approved SPCC Plan, as part of an overall SEWPCP, will make it highly unlikely that Atlantic salmon will be exposed to harmful chemicals from a spill or accident.

The applicants will implement the appropriate CMs to prevent spill incidents. All fuel and other hazardous materials will be stored on an impervious surface at least 100 feet from streams. All pumps will be maintained, refueled, and operated at a location consistent with the SPCC Plan and in a manner that avoids chemical or other hazardous materials getting into the stream. Depending on the nature of released material, a spill event could have adverse effects to Atlantic salmon individuals. However, the applicants will implement the specified CMs to help prevent spill incidents and ensure that the consequences of spills are minimized. Applicants will ensure proper implementation of the SPCC Plan, greatly reducing the chance of exposure of Atlantic salmon to harmful chemicals from a spill or release. Equipment operation in flowing water will be very infrequent and only on non-erodible substrates and will also need to be specifically noted in the project description and plans and approved as part of the DRT review process. In summary, effects to Atlantic salmon juveniles and adults from pollutants that may enter the water from spills and equipment leaks will be minimized to insignificant and discountable levels through CMs such as implementation of the SEWPCP and locating refueling and maintenance activities at least 100 feet from streams.

2.4.1.7 Habitat Alteration

The habitat where Atlantic salmon are most likely to occur is generally designated as critical habitat. Some areas where Atlantic salmon could occur, however, were specifically excluded from designation as critical habitat as military, Tribal, or economic exclusions. Additionally, it is possible that small numbers of Atlantic salmon could occur in a few other areas within the GOM DPS that were not designated as critical habitat (e.g., the Sebasticook River watershed).

This section focuses on impacts to Atlantic salmon from temporary and permanent habitat modifications related to in-channel fill placement and dewatering. Effects to critical habitat are discussed below in **Chapter 2** section **2.4.2**. Permanent habitat alteration can result from road-stream crossing structure removal or replacement, installation of new road-stream crossing structures, and riprap placement. Impacted areas that are restored following construction are considered temporarily impacted. Activities that may result in temporary habitat impacts include dewatering and substrate excavation within a cofferdam and operation of heavy equipment in flowing water.

Temporary. Temporary fill placement in the form of cofferdams is not expected to result in permanent habitat degradation, as the affected areas will be minimized to what is necessary for construction and then restored following use. After cofferdams are constructed, the work area within them will be dewatered. This will make the existing habitat temporarily unavailable to Atlantic salmon. The affected area will generally be about 1,500 square feet for 22 projects annually in waters occupied by Atlantic salmon. Where excavation occurs within dewatered areas, the streambed will be re-contoured and natural streambed material will be added as necessary to restore the impacted area to match the adjacent habitat. Temporary impacts to Atlantic salmon spawning habitat will not occur during spawning or egg incubation. Based on the relatively small area affected compared to the available surrounding habitat and the fact that the habitat will be restored following construction, these temporary habitat impacts will have insignificant effects on juvenile Atlantic salmon.

Permanent. Stable rock material is placed to protect and stabilize structure banklines, inlets, and outlets. For inlet and outlet treatments, rock material placement is primarily limited to the interface of the structure with the road embankment, as well as to connect structure banklines with the upstream and downstream stream banks. In some cases this rock material will be serving the function of riparian vegetation, which would normally provide bank stabilization in the absence of the structure. The permanent impact to stream habitat from placement of stable rock materials is limited in spatial scope and confined to only the stream margins along banklines.

All structure installations and permanent structure removals are designed to support long-term natural stream functions including aquatic habitat, aquatic connectivity, and movement of wood and streambed materials. Most, if not all, replacement projects will result in net permanent improvements in stream habitat and function, given 1) the project design criteria based on Stream Simulation principles that emphasize natural stream dimensions, profiles, and dynamics and 2) the requirement that structures be at least 1.2 times bankfull width. Overall, projects will avoid permanent, adverse effects to stream habitat and instead often result in long-term (permanent) improvements to Atlantic salmon habitat for all life stages.

In summary, temporary habitat impacts associated with placement of and dewatering within a cofferdam will have insignificant effects on Atlantic salmon based on the small area of habitat affected compared to the surrounding habitat available and that the affected areas will be restored after construction is completed. Permanent habitat impacts from placement of small amounts of stable rock materials, which will limited in spatial extent and confined to stream banklines, will be insignificant. Replacements or removals of existing poorly designed crossing structures, which are expected to be the majority of projects constructed under this programmatic consultation, will result in long-term beneficial effects to Atlantic salmon habitat.

2.4.1.8 Summary of Effects to Atlantic salmon

The **Table 7** provides an overview of anticipated effects to Atlantic salmon generated by the categories of core construction activities that are common to some or all of the programmatic activity categories.

Table 7. Summary of Programmatic Core Activities and Anticipated Effects

Core Activity	Stressors/Impacts to Atlantic salmon Associated with Core Activities*	
	Insignificant or Discountable	**Adverse Effect**
1–Cofferdam Work Area Isolation	F, G	A, B, C
2–Fish Evacuation From Work Area		C
3–Streamflow Bypass Installation, Removal, and Re-watering	D, F	A, B
4 – Debris removal	A, B, F	
5 - Streambed Excavation	A,F,G	
6 - Minor Fill Placement	A,F,G	
7 - Heavy Equipment Operation	A,E,F	

Stressors/Impacts:

- **A.** Elevated turbidity/sediment transport
- **B.** Temporary migration/movement barrier
- **C.** Fish handling and relocation
- **D.** Impingement/entrainment
- **E.** Heavy equipment operation
- **F.** Water quality impact (pollutants)
- **G.** Habitat alteration

2.4.2 Effects of the Action on Atlantic Salmon Critical Habitat

The NMFS designated critical habitat necessary for the recovery of the Atlantic salmon GOM DPS and defined PBFs to protect the different freshwater and estuarine habitats that are important for the complex life cycle of Atlantic salmon. All of the proposed activities, when located in a waterway designated as critical habitat, will affect Atlantic salmon critical habitat to some degree. Effects to critical habitat can be either temporary or permanent. Most activities, such as culvert replacements and permanent removals, will restore critical habitat acreage and function by improving fish access and supporting natural stream processes. Therefore, the overall program is expected to result in a net long-term benefit for Atlantic salmon critical habitat and for recovery of the species.

Habitat effects as they directly relate to species effects are discussed above in **Chapter 2** section **2.4.1.7**. This section analyzes the effects on the PBFs of critical habitat, as previously described in **Chapter 2** section **2.2.3**. These effects, described by PBF, include water quality impacts, turbidity and sedimentation, habitat alteration, and migration and movement barrier (temporary only). At the end of this section, **Table 8** summarizes the anticipated effects to PBFs from the four programmatic activities.

Our assumption is that all programmatic activities, which will have only temporary impacts to critical habitat during construction, are not likely to adversely affect critical habitat. This is based on these temporary effects not diminishing the ability of critical habitat to support the conservation and recovery of the species, regardless of whether Atlantic salmon currently occupy the habitat or might in the future as recovery progresses, since all of the PBFs will be restored to full function after completion of the project. Immediately below we describe the temporary effects associated with turbidity and sedimentation that are relevant to several PBFs to avoid redundancy. These temporary effects will result in small areas of impact within each of the SHRUs over the course of program implementation, but where the habitat function is restored once each project is completed.

Turbidity and Sedimentation. The intensity and duration of the effects associated with turbidity and sedimentation result in measured changes of habitat use by Atlantic salmon and sublethal effects to juvenile Atlantic salmon, but they do not have residual effects on the function of critical habitat. Turbidity releases associated with construction activities will be temporary and within the scope of natural seasonal sediment fluctuations in streams. These releases are not expected to affect Atlantic salmon redds and spawning areas or reduce the quality of rearing habitat. PBFs that are likely to be most affected by increased turbidity and sedimentation include SR 2, SR 3, and SR 7.

The Service concludes that effects from sedimentation on critical habitat are insignificant and discountable. Although turbidity may be elevated above background levels for short durations and within 100 to 1000 feet of the project area, no short-term or residual adverse effects to Atlantic salmon critical habitat are expected. Critical habitat conditions will return to pre-project levels within hours of the proposed activities. Additionally, only a small fraction of the total HUs within critical habitat in each SHRU will experience the temporary effects from elevated turbidity and sedimentation each year. This scale of effects provides further support that temporary effects associated with turbidity and sedimentation on critical habitat are insignificant, in relation to the habitat's ability to support the conservation and recovery of Atlantic salmon.

2.4.2.1 Effects to the Physical and Biological Features of Spawning and Rearing (SR)

SR 1: Deep, oxygenated pools and cover (e.g., boulders, woody debris, vegetation, etc.), near freshwater spawning sites, necessary to support adult migrants during the summer while they await spawning in the fall.

This physical and biological feature is most likely to be permanently affected at existing road-stream crossing locations where outlet scour pools large enough to serve as holding areas for adult Atlantic salmon were artificially created by a structure's inadequate design (e.g., an undersized culvert). Culvert replacements can potentially result in the loss of these artificial holding pools. Undersized structures can create these pools downstream of the structure outlet due to increased flow velocities and stream energy. A properly designed replacement structure may result in filling a portion of the pool to recreate the stream's natural profile. Over time, natural stream material may fill the pool as the stream restriction is relieved and the stream is again subject to natural sediment transportation processes.

Atlantic salmon use of these artificially created pools is currently unknown. Replacing or removing poorly designed structures within critical habitat is expected to return stream function to more natural conditions, including facilitating movement of boulders, wood and gravel and creation of pools within the natural form of the stream channel. Natural pools located downstream of construction sites may be affected by short-term turbidity effects associated with cofferdam installation and removal. This temporary input of minor amounts of finer sediments into the water column is not expected to change the function of downstream pools as holding habitat for adult Atlantic salmon. Overall, program activities will result in insignificant or beneficial effects to SR 1.

SR 2: Freshwater spawning sites that contain clean, permeable gravel and cobble substrate with oxygenated water and cool water temperatures to support spawning activity, egg incubation, and larval development.

SR 3: Freshwater spawning and rearing sites with clean, permeable gravel and cobble substrate with oxygenated water and cool water temperatures to support emergence, territorial development and feeding activities of Atlantic salmon fry.

SR 2 and SR 3 are combined for this analysis, as they are similar habitat features that provide different important functions for Atlantic salmon. These PBFs represent stream areas that can be used for spawning, egg incubation, and alevin and fry development. These sites are likely to be rare around existing road-stream crossings. For example, according to the MDOT, based on past experience over the seven years of consulting on effects to critical habitat since 2009, only one project has affected known spawning areas.

The required instream work window of July 15 to September 30 is designed, in part, to avoid effects to SR 2 and SR 3 during the sensitive periods of spawning, egg incubation, and alevin and fry development. Avoiding construction-related effects during these sensitive periods will allow these PBFs to continue their important role in species recovery by supporting wild reproduction of Atlantic salmon. If any areas of spawning habitat are temporarily disturbed during construction activities, such as by de-watering or excavation, these areas will be restored upon completion of the project and will continue to function as SR 2 and SR 3.

For road-stream crossing replacement and permanent removal projects, access to upstream spawning habitat by adults will often be improved compared to the existing situation. Therefore, the ability of SR 2 and SR 3 to function as spawning habitat and contribute to the recovery of Atlantic salmon may be improved by the proposed action through enhancement of upstream fish passage, depending on the individual project locations. Given the proposed project design criteria and CMs, the proposed action and all activities discussed herein will result in either insignificant or discountable effects to SR 2 and SR 3.

SR 4: Freshwater rearing sites with space to accommodate growth and survival of Atlantic salmon parr.

SR 5: Freshwater rearing sites with a combination of river, stream, and lake habitats that accommodate parrs' ability to occupy many niches and maximize parr production.

SR 6: Freshwater rearing sites with cool, oxygenated water to support growth and survival of Atlantic salmon parr.

SR 7: Freshwater rearing sites with diverse food resources to support growth and survival of Atlantic salmon parr.

SR 4 through SR 7 are combined when considering potential effects, as they represent different aspects of rearing habitat that are all important for parr (juvenile) survival and growth. All of the activities proposed as part of the action may result in temporary or permanent effects to these habitats.

Most activities proposed as part of the action will result in the loss of critical habitat due to the placement of small amounts of fill materials and from dewatering the instream work area. Most of these fill placements are temporary and will be removed after use, allowing critical habitat to return to pre-project condition and function. Temporary fill consists of cofferdams used to isolate the instream work area and allow for dewatering a small section of the stream channel. Dewatering will result in the loss of aquatic invertebrates and small fish (particularly in circumstances where fish evacuation is not done) that are food resources for juvenile Atlantic salmon. Once stream flows are reestablished, however, aquatic organisms should recolonize the stream and once again be available as food for juvenile Atlantic salmon. Some projects will result in an improvement in local habitat conditions for aquatic invertebrates and small fish, such as where an undersized and perched culvert with no streambed material inside is replaced with a bottomless arch culvert supporting a natural stream channel under the structure.

Previously we assumed that the average stream area impacted by fill for cofferdams and dewatering is about 1,500 square feet, but these dimensions can vary depending on the width of the stream and other project specifics. Although this area of critical habitat would be temporarily unavailable to juvenile Atlantic salmon during construction (generally no more than a few days), this type of temporary effect is not expected to measurably reduce the ability of critical habitat to contribute to the survival and recovery of Atlantic salmon. Effects associated with temporary fill and dewatering are insignificant to SR 4 through 7.

Since all projects will be designed using Stream Simulation techniques that strive to mimic natural stream conditions including hydrology, sediment and debris transport, and channel shape and dimensions, they will maintain or improve the baseline condition of juvenile rearing habitat and facilitate the movement of Atlantic salmon to meet their needs to survive and grow. Overall, the proposed action should result in long-term benefits to critical habitat that supports juvenile Atlantic salmon.

2.4.2.2 Effects to the Physical and Biological Features of Migration (M)

M 1: Freshwater and estuary migratory sites free from physical and biological barriers that delay or prevent access of adult Atlantic salmon seeking spawning grounds needed to support recovered populations.

The structure design requirements of this programmatic consultation will ensure that all projects will support the upstream migration of adult Atlantic salmon in freshwater habitats. Some projects are expected to improve the ability of adult Atlantic salmon to move upstream to spawning habitat in situations where existing road-stream crossing structures present an impediment to migration. This PBO does not cover projects located in estuarine migratory sites for adult Atlantic salmon seeking spawning grounds.

Temporary effects to this PBF may result from channel-spanning cofferdam placement. The required instream work window will ensure that the primary migratory windows for Atlantic salmon adults are avoided. Furthermore, the relatively short time that cofferdams will be in place (generally a few days) will minimize the likelihood that upstream migration of an adult will be affected. Currently, the very low number of adult spawners present in the GOM DPS will also reduce the chance that a temporary cofferdam would impact an adult Atlantic salmon during its upstream migration. Therefore, temporary effects to M 1 in areas that may contain Atlantic salmon adults are insignificant or discountable.

M 2: Freshwater and estuary migration sites with pool, lake, and in-stream habitat that provide cool, oxygenated water and cover items (e.g., boulders, woody debris, and vegetation) to serve as temporary holding and resting areas during upstream migration of adult Atlantic salmon.

Lake and estuarine migration sites will not be affected given the nature of the proposed action. This PBF is most likely to be permanently affected at existing road-stream crossing locations where outlet scour pools large enough to serve as holding areas for adult Atlantic salmon were artificially created by a structure's inadequate design (e.g., an undersized culvert). Culvert replacements can potentially result in the loss of these artificial holding pools. Undersized structures can create these pools downstream of the structure outlet due to increased flow velocities and stream energy. A properly designed replacement structure may result in filling a portion of the pool to recreate the stream's natural profile. Over time, natural stream material may fill the pool as the stream restriction is relieved and the stream is again subject to natural sediment transportation processes.

Atlantic salmon use of these artificially created pools is currently unknown. Replacing or removing poorly designed structures within critical habitat is expected to return stream function to more natural conditions, including facilitating movement of boulders, wood and gravel and creation of pools within the natural form of the stream channel. Natural pools located downstream of construction sites may be affected by short-term turbidity effects associated with cofferdam installation and removal. This temporary input of minor amounts of finer sediments into the water column is not expected to change the function of downstream pools as holding habitat for adult Atlantic salmon. Overall, program activities will result in insignificant or beneficial effects to M 2.

M 3: Freshwater and estuary migration sites with abundant, diverse native fish communities to serve as a protective buffer against predation.

The proposed action also has the ability to affect native fish species that serve as a predation buffer for Atlantic salmon adults and smolts. A predation buffer occurs when other species of fish that act as forage for predators relieve predation pressure on Atlantic salmon. Alewife (*Alosa pseudoharengus*), blueback herring (*Alosa aestivalis*), and American shad (*Alosa sapidissima*) are examples of anadromous species that undergo migrations when Atlantic salmon smolts and adults are moving through estuaries and would provide an alternative prey source for seals, porpoises, otters, striped bass, double-crested cormorants, and ospreys. Restoration and maintenance of other native fish species can relieve predation pressures on Atlantic salmon. Therefore, projects that restore fish passage and natural stream habitats will have a beneficial effect to Atlantic salmon CH.

The proposed action includes many measures to minimize short-term effects to Atlantic salmon and their habitat during construction and to provide an overall long-term benefit to Atlantic salmon and stream habitat. In turn, those same measures minimize effects to these buffer species. The fish passage and stream function improvements in Atlantic salmon habitat are also restoration activities for these species. Stream restoration efforts in Maine, including projects to improve habitat connectivity at road stream crossings, are already having a positive impact on alewife populations, which in turn should provide a benefit to Atlantic salmon as a native species prey buffer. Due to the nature of the proposed activities and the associated CMs, none of the proposed actions will impair the ability of the native fish species to act as a prey buffer for Atlantic salmon. Therefore, the proposed activities will result in either insignificant or beneficial effects to M 3.

M 4: Freshwater and estuary migration sites free from physical and biological barriers that delay or prevent emigration of smolts to the marine environment.

Smolt out-migration occurs downstream (with the stream flows) toward the ocean. The impact of poorly designed road-stream crossings on downstream migration of smolts is not specifically known but is suspected to be far less than the known negative impacts on upstream movements of juvenile and adult Atlantic salmon. The activities proposed in this action should fully support the timely downstream migration of smolts through properly designed road-stream crossing structures. Furthermore, the required instream work window will avoid all temporary, construction-related effects (e.g., installation of a cofferdam across the stream) during the smolt out-migration period. The proposed activities will not have any effects on estuarine migration sites. Overall, the proposed activities will result in either discountable or long-term beneficial effects to M 4.

M 5: Freshwater and estuary migration sites with sufficiently cool water temperatures and water flows that coincide with diurnal cues to stimulate smolt migration

The activities covered by this PBO will have long-term positive effects on water flow and habitat complexity through the project design requirements that promote natural stream processes, such as large wood and boulder transport and the formation of pools. While reduced habitat complexity can lead to altered width-to-depth ratios and increase temperature fluctuations (*Federal Register* 2009b, 29300), all covered activities will either restore or maintain natural stream functions that support habitat complexity and cooler water temperatures. Since all instream construction activities must take place between July 15 and September 30, all direct effects to migrating smolts will be avoided. Therefore, the proposed activities will result in either discountable or long-term beneficial effects to M 5.

M 6: Freshwater migration sites with water chemistry needed to support sea water adaptation of smolts.

Activities proposed under this action are not expected to have any effect on water chemistry, specifically water pH, and will also not occur at a time when sea water adaptation of smolts is occurring in the spring. Therefore, the proposed activities will result in discountable effects to M 6.

Table 8. Summary of critical habitat PBFs and anticipated impacts.

PBF Element	Stressors with insignificant or discountable affects
SR 1	TS,WQ, THA, PHA, TM
SR 2,3	TS, WQ, THA, PHA,TM
SR 4,5,6,7	TS, WQ, THA,PHA, TM
M1	TS, WQ, THA, PHA, TM
M2	TS, WQ, THA, PHA, TM
M3	TS,WQ, THA, PHA
M4	TS,WQ, THA, PHA
M5	TS,WQ, THA, PHA
M6	TS,WQ, THA, PHA

TS=elevated turbidity/sediment transport, **WQ**=water quality impact (pollutants), **THA**=temporary habitat/critical habitat alteration, **PHA**=permanent habitat/critical habitat alteration, **TM**=temporary migration/movement barrier

2.5 Cumulative Effects

Cumulative effects include the effects of future State, Tribal, local, and private actions that are reasonably certain to occur in the action area. Future Federal actions that are unrelated to the proposed action are not considered in this section because they require separate consultation pursuant to section 7 (a)(2) of the ESA.

The programmatic action area encompasses the entire geographic range of the GOM DPS of Atlantic salmon and an extensive area of land (17,753 square miles) associated with many rivers, stream, ponds, and lakes. Therefore, an array of future State, Tribal, local, and private actions are likely to occur in each of the three SHRUs.

The GOM DPS contains very little Federal land. Reasonably foreseeable non-Federal activities will include (but are not limited to) agriculture, forestry, municipal infrastructure maintenance, residential and commercial development, energy projects, and recreational fishing. Within each of these broad categories, a variety of actions that could affect Atlantic salmon and their habitat include water withdrawal to irrigate crops, logging roads and stream crossings, non-point source pollution from residential and commercial development, and loss of forest and other natural habitats within a watershed from development.

Many areas around road crossings are subject to recreational angling activities. Atlantic salmon juveniles can be caught while fishing for other sport fish, such as brook trout. Angling also has the potential to affect adult Atlantic salmon in certain locations where anglers and adult Atlantic salmon are expected to interface.

Many activities that impact streams, ponds, and wetlands require Federal permits from the Corps under the CWA and RHA. Therefore, those potential future actions (State, Tribal, local, and private) that require Federal permits and that will affect Atlantic salmon and critical habitat will be subject to ESA section 7 (a)(2) consultation.

Maine's total population as of July 2016 was 1,331,479 compared to 1,125,043 in 1980 (18.3 percent growth over 36 years). Maine has seen its population growth dwindle in recent years and by 2034 is expected to experience a 1.8% decline compared to 2014. Patterns and types of land use and development, however, are not expected to dramatically change relative to trends seen over recent decades. Activities that have affected Atlantic salmon and their habitat in recent years are expected to continue relatively unchanged, although various efforts at Atlantic salmon conservation have and will continue to benefit Atlantic salmon (e.g., dam removals and riparian conservation easements). In recent years, substantial progress has been made in Maine to address the fish passage and habitat connectivity issues associated with road-stream crossings and dams. This trend is expected to continue into the future, bolstered by various efforts to streamline regulatory reviews including this programmatic consultation.

Most projects completed as part of this action are not expected to increase either residential or commercial development in the general project area. New roads and their road-stream crossings, however, will likely come with some sort of associated residential or commercial development where there could be additional effects to Atlantic salmon or critical habitat. It is difficult to predict the scope of scale of such impacts, and those actions most apt to affect Atlantic salmon and critical habitat will likely require a permit from the Corps and trigger ESA section 7 consultation.

2.6 Conclusion

After reviewing the current status of the endangered Atlantic salmon and its designated critical habitat, the environmental baseline for the action area, the effects of the proposed action and cumulative effects, it is the Service's biological opinion that the action, as proposed, is not likely to jeopardize the continued existence of the Atlantic salmon and will result in a net conservation benefit to the species.

The Service reached these conclusions because:

> **A.** The primary purpose of the proposed action is to conserve the Atlantic salmon and its critical habitat;
>
> **B.** The proposed action was developed in coordination with the Service for that purpose;
>
> **C.** The proposed action gives full consideration to, and is consistent with, the survival and recovery needs of the Atlantic salmon and the role of the action area in providing for those needs;

D. The proposed action gives full consideration to, and is consistent with, the recovery support function of critical habitat for the Atlantic salmon and the role of the action area in providing for that function;

E. There is a proven track record for successful implementation of the proposed action, and there is a high level of certainty that the proposed action is likely to produce a beneficial impact for Atlantic salmon and the recovery support function of its critical habitat. The Service and the Federal Action Agencies have collaborated on a number of road-stream crossing improvement projects throughout the GOM DPS over the last few years.

F. Adverse effects (including those that conform to incidental take) are likely to be small in magnitude, temporary (meaning not continuous, recurring, or chronic), short-term and geographically local with respect to the entire GOM DPS and within each of the three SHRUs.

G. The amount or extent of incidental take of Atlantic salmon will be low, and is not likely to have adverse population-level impacts to this species. All take is limited to juvenile Atlantic salmon and will be mostly non-lethal take associated with construction activities and fish evacuation from the instream work area.

H. The proposed action will not cause a permanent net loss of habitat, net loss of habitat function, net loss of critical habitat or a net loss of functional value of critical habitat.

CHAPTER 3 INCIDENTAL TAKE STATEMENT

Section 9 of the ESA prohibits the take of endangered species without special exemption. The term take is defined to include harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect, or to attempt to engage in any such conduct. Harm is further defined by the Service to include an act that actually kills or injures wildlife. Such acts may include significant habitat modification or degradation that results in death or injury to a listed species by significantly impairing essential behavioral patterns, including breeding, feeding, or sheltering. The term harass is further defined by the Service as intentional or negligent actions that create the likelihood of injury to listed species by annoying it to such an extent as to significantly disrupt normal behavior patterns which include, but are not limited to, breeding, feeding or sheltering.

Incidental take is defined as take that is incidental to, and not the purpose of, the carrying out of an otherwise lawful activity. Under the terms of section 7(b)(4) and section 7(o)(2), taking that is incidental to and not intended as part of the agency action is not considered to be prohibited taking under the ESA, provided that such taking is in compliance with the terms and conditions of this Incidental Take Statement.

3.1 Amount or Extent of Take

Stream-specific parr densities vary between individual streams and between habitats within the same streams. In past consultations for similar road-stream crossing projects, take estimates were derived using two different approaches. One approach applies stream-specific parr densities derived from CPUE surveys completed by resource agencies (primarily the MDMR). These surveys result in an estimate of parr density for each sampled HU. Stream-specific data is preferred when calculating parr density. When stream specific information is not available, the GIS-based model for predicting the amount of juvenile rearing habitat in a stream is used (Wright *et al.* 2008). This model also predicts parr density based on a functional relationship between watershed size and known parr densities in perennial streams throughout the GOM DPS. These juvenile density estimates range from 0 to 10.7 parr per HU (Sweka and Makey 2010).

In two MDOT projects where high quality Atlantic salmon rearing habitat was present in the action area and stream-specific parr density information was available, the parr densities were 3.5 and 5.6 parr per habitat unit. The Service believes it is reasonable to assume that the average parr density in streams containing Atlantic salmon juveniles across the range of this PBO is 5 parr per HU. Based on this assumption, the annual incidental take estimate for the proposed action is summarized below in **Table 9**.

Table 9. Annual Atlantic salmon juvenile take estimate for the proposed action.

A. Stressor	B. No. of projects	C. Total area/extent of impact (sq. ft.)	D. Total annual HUs* (C. in sq. meters) Divided by 100	E. Annual Juvenile Atlantic salmon Affected** (D. times 5)	F. Type of Take
Elevated Turbidity/Sediment	22 cofferdams	111,320	103	515	Harassment
Temporary Migration or Movement Barrier	22 projects w/channel-spanning cofferdams	132,000	123	615	Harassment
Fish Handling and Relocation	22 cofferdams	14,520	13.49	68	Harassment, Harm, and Lethal Harm

*HU=1,076 square feet (100 square meters).
**Assumed 5 parr (juvenile Atlantic salmon) per unit.

3.2 Reasonable and Prudent Measures

Due to the broad inclusion of CMs in the project description, the only required reasonable and prudent measure is that all CMs, as identified in the Description of the Proposed Action in **Chapter 2** section **2.1**of this PBO and in Corps' permit conditions, must be followed.

Conservation measures designed to avoid and minimize effects on listed species and critical habitat are integral components of the proposed action (see **Chapter 2** section **2.1.6, 2.1.7, and**

2.1.8 for conservation measures), and this proposed action is expected to be completed consistent with these measures and all project design criteria. We have completed our effects analysis accordingly. The Service believes that due to the inclusion of the detailed project design criteria and CMs, no additional reasonable and prudent measures are necessary. The CMs and project design criteria included in this PBO are nondiscretionary and must be implemented by the FEMA, the Corps, or the Service (and the Applicants and their contractors) in order for the exemption in section 7(o)(2) to apply. The Federal action agencies have a continuing duty to regulate the activities covered by this Incidental Take Statement. The protective coverage of section 7(o)(2) will lapse if either the FEMA, the Corps, or the Service fails to require adherence to all the terms and conditions of the Incidental Take Statement or fails to exercise that discretion as necessary to retain the oversight to ensure compliance with these terms and conditions. Further consultation may be required to determine what effect any modified action may have on listed species or designated critical habitat.

The Service considers the full application of the CMs included as part of the proposed action description to be necessary and appropriate to minimize the amount or extent of incidental take of the Atlantic salmon associated with the proposed action. Any deviation from the CMs or the project descriptions stated in this PBO will be beyond the scope of this consultation and will not be exempted from the prohibition against take as described in this Incidental Take Statement.

3.3 Terms and Conditions

In order to be exempt from the prohibitions of section 9 of the ESA, the FEMA, the Corps, the Service, the Applicants, and all contractors must comply with the following terms and conditions, which implement the reasonable and prudent measure described above and outline the required monitoring and reporting requirements. These terms and conditions are nondiscretionary.

1. All applicable CMs described in this PBO will be fully implemented.
2. The Federal action agencies will generate an annual report for submittal to the Service. This report will summarize program use and incidental take for the reporting year (for the sake of this PBO, "year" refers to the calendar year of January 1 to December 31), as well as monitoring information that may inform potential assumptions about the effects of the program activities.

CHAPTER 4 REINITATION NOTICE

This concludes formal consultation on the action outlined in the request. As provided in 50 CFR 402.16 (*Federal Register* 2008, 76286), reinitiation of formal consultation is required where discretionary Federal agency involvement or control over the action has been retained (or is authorized by law) and if any of the following occurs: 1) the amount or extent of incidental take is exceeded; 2) new information reveals effects of the agency action that may affect listed species or critical habitat in a manner or to an extent not considered in this opinion; 3) the agency action is subsequently modified in a manner that causes an effect to the listed species or critical habitat not considered in this opinion; or 4) a new species is listed or critical habitat designated that may be affected by the action. In instances where the amount or extent of incidental take is exceeded, any operations causing such take must cease pending reinitiation.

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