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ECONOMIC ANALYSIS OF CRITICAL HABITAT DESIGNATION FOR THE GULF OF MAINE DISTINCT POPULATION SEGMENT OF ATLANTIC SALMON

Final Report | May 2009

prepared for:

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EXECUTIVE SUMMARY

INTRODUCTION

1. This report identifies and analyzes the potential economic impacts associated with the designation of critical habitat for the Gulf of Maine Distinct Population Segment (DPS) of Atlantic salmon. Pursuant to the Endangered Species Act (ESA), the National Marine Fisheries Service (NMFS) proposed to list this DPS as an endangered species on September 3, 2008.[1] NMFS subsequently proposed to designate critical habitat for the DPS on September 5, 2008.[2] NMFS is now finalizing these actions, with revisions that take into account public comment on the proposed rules.

2. Section 4(b)(2) of the ESA requires NMFS to consider the economic, national security, and other impacts of designating a particular area as critical habitat. NMFS may exclude an area from critical habitat if it determines that the benefits of exclusion outweigh the benefits of specifying the area as part of the critical habitat, unless it also determines that the failure to designate the area as critical habitat will result in the extinction of the species concerned.

3. This report employs the best data available to analyze the economic impacts of designating particular areas as critical habitat; these impacts represent the "benefits of exclusion".[3] NMFS presents its formal consideration of the benefits of including particular areas (the "benefits of inclusion") within the designation in a separate report.[4] Together, these two reports support NMFS in determining whether the benefits of excluding any particular area outweigh the benefits of designating that

[1] National Oceanic and Atmospheric Administration, *Endangered and Threatened Species; Proposed Endangered Status for the Gulf of Maine Distinct Population Segment of Atlantic Salmon: Proposed Rule*, 73 Federal Register 51415, September 3, 2008.

[2] National Oceanic and Atmospheric Administration, *Endangered and Threatened Species; Proposed Critical Habitat for the Gulf of Maine Distinct Population Segment of Atlantic Salmon: Proposed Rule*, 73 Federal Register 51747, September 5, 2008.

[3] A draft of this report was made available to the public for review and comment in September, 2008, when NMFS published its proposed critical habitat rule. This final report incorporates revisions, as appropriate, to respond to comments on the draft. For a detailed discussion of public comments on the draft economic analysis and associated responses, see the responses to public comment section of the Final Rule.

[4] National Marine Fisheries Service, *Biological valuation of Atlantic salmon (*Salmo salar*) habitat in the Gulf of Maine Distinct Population Segment*, 2009.

area. These determinations are required under Section 4(b)(2) before any exclusion can be made. Such determinations are documented in NMFS' 4(b)(2) report.[5]

DEFINITION OF THE GULF OF MAINE DPS OF ATLANTIC SALMON

4. NMFS' September 2008 proposal defined the Gulf of Maine DPS as comprising all Atlantic salmon whose freshwater range occurs in watersheds from the Androscoggin River northward along the Maine coast to the Dennys River. In response to public comment on the proposed listing rule, as well as further analysis of the historic range of Atlantic salmon, NMFS has revised this definition in the final listing rule. As specified in that rule, the Gulf of Maine DPS includes all anadromous Atlantic salmon whose freshwater range occurs in the watersheds from the Androscoggin River northward along the Maine coast to the Dennys River, and wherever these fish occur in the estuarine and marine environment. The following impassable falls delimit the upstream extent of the freshwater range:

- Rumford Falls in the town of Rumford on the Androscoggin River;
- Snow Falls in the town of West Paris on the Little Androscoggin River;
- Grand Falls in Township 3 Range 4 BKP WKR, on the Dead River in the Kennebec Basin;
- the un-named falls (impounded by Indian Pond Dam) immediately above the Kennebec River Gorge in Indian Stream Township;
- Big Niagara Falls in Township 3 Range 10 WELS, on Nesowadnehunk Stream in the Penobscot Basin;
- Grand Pitch in Trout Brook Township, on Webster Brook in the Penobscot Basin; and
- Grand Falls in Grand Falls Township, on the Passadumkeag River in the Penobscot Basin.

The marine range of the DPS extends from the Gulf of Maine, throughout the Northwest Atlantic Ocean, to the coast of Greenland. Included in the DPS are all conservation hatchery populations used to supplement the natural population; currently, such conservation hatchery populations are maintained at Green Lake National Fish Hatchery (GLNFH) and Craig Brook National Fish Hatchery (CBNFH). Excluded are landlocked salmon and those salmon raised in commercial hatcheries for aquaculture. The DPS as defined in the final rule has been listed as endangered under the ESA.

CONSISTENCY OF THE ECONOMIC ANALYSIS WITH THE FINAL LISTING RULE

[5] National Marine Fisheries Service, *Designation of critical habitat for Atlantic salmon (*Salmo salar*) in the Gulf of Maine Distinct Population Segment*, ESA Section 4(b)2 Report, 2009.

5. The geographic scope of the economic analysis was established based upon the definition of the Gulf of Maine DPS set forth in the proposed listing rule. As a result, the analysis examines the potential economic impact of designating critical habitat in areas that extend beyond the historic range of the Gulf of Maine DPS, as defined in the final listing rule. The final critical habitat rule, however, limits the designation to areas that are currently occupied by the salmon and contain the physical and biological features essential to the conservation of the species. While this report estimates the economic impacts attributable to the designation of critical habitat throughout the study area, it specifically highlights the impacts of designating critical habitat in currently occupied areas. The specification of these areas is consistent with the delineation of the DPS set forth in the final listing rule.

ANALYTIC METHODS

6. Once critical habitat is designated, section 7 of the ESA requires Federal agencies to consult with NMFS to ensure that any action they authorize, fund, or carry out *will not likely result in the destruction or adverse modification of critical habitat.* NMFS may, through the consultation process, recommend changes to these activities (termed "activities with a Federal nexus") that would avoid destruction or adverse modification of critical habitat. The economic impacts of critical habitat designation stem from this process and any modifications to activities implemented as a result of consultation.

7. To derive a measure of the economic impacts associated with designating a particular area as critical habitat, this analysis: (1) characterizes existing or potential threats to the salmon's habitat within these areas; (2) links these threats with particular human activities; (3) identifies the modifications to these activities that would avoid or minimize the threats; and (4) to the extent feasible, quantifies and monetizes the economic impact of the modifications.

8. Based on discussions with biologists at NMFS and a review of relevant background documents – including NMFS' proposal to list the Gulf of Maine DPS of Atlantic salmon as endangered (the Listing Rule), the Recovery Plan developed for the DPS, the Status Review underlying the proposed Listing Rule, the ESA section 7 consultation history for the Gulf of Maine DPS of Atlantic salmon as delineated when originally listed in 2000 (65 FR 69459), and consultations conducted for listed species of Pacific salmon and steelhead – the analysis considers the potential for the following land use activities to have an adverse impact on the physical and biological features of critical habitat for the Gulf of Maine DPS of Atlantic salmon:

   - **Hydropower** - operation and maintenance of dams and fish passage projects, or installation and operation of tidal energy projects.
   - **Agriculture** - land clearing and use of pesticides, fertilizers, and herbicides.
   - **Changing land use patterns/development** - residential, commercial, and industrial development; and discharge of industrial and municipal wastewater.

- **Transportation and other in-stream construction projects** - construction and maintenance of roads, bridges, or culverts; dredging; bank stabilization; installation and maintenance of vegetation, pilings, moorings, and bulkheads; boat ramp construction or maintenance; and construction or repair of pipelines and electric transmission lines.
- **Silviculture** - land clearing; use of pesticides, fertilizers, and herbicides; and harvest practices.
- **Aquaculture, hatcheries, and fisheries research** - fish and shellfish stocking and cultivation activities, and biological research on fisheries.
- **Mining** - peat, sand and gravel, or metals mining.

9. This analysis focuses on the impact of critical habitat designation on these land use activities, examining the state of the world with and without the designation of critical habitat for the Gulf of Maine DPS of Atlantic salmon. The "without critical habitat" scenario represents the baseline for the analysis, considering habitat protections already afforded the DPS either as a result of its listing or as a result of other Federal, State, and local regulations. The "with critical habitat" scenario describes the incremental impacts associated specifically with the designation of critical habitat for the species. The incremental impacts quantified in this analysis are those not expected to occur absent the designation of critical habitat for the salmon.

10. To quantify the economic impacts of modifications to land uses, the analysis involves the following general steps:

    1. Identify the baseline of economic activity and the statutes and regulations that constrain that activity in the absence of the critical habitat designation;
    2. Identify the types of activities that are likely to be affected by critical habitat designation;
    3. Estimate the costs of modifications needed to comply with the ESA's critical habitat provisions (incremental impacts);
    4. Project over space and time the occurrence of the activities and the likelihood they will in fact need to be modified; and
    5. Aggregate the costs up to the watershed level. The analysis reports impacts at the watershed level both for individual activities (e.g., dam operations) and across activities (e.g., hydropower operations, agriculture, development, and transportation activities).

    These steps and other aspects of the analysis are described in greater detail below.

11. Incremental impacts may include the direct costs associated with additional effort for consultations (including new consultations that otherwise would have been limited to jeopardy issues, reinitiated consultations, or new consultations occurring specifically because of the designation) as well as the direct costs associated with project modifications that would not have been required to avoid jeopardizing the continued

existence of the species. Incremental impacts may also include indirect impacts resulting from reaction to the potential designation of critical habitat (e.g., developing habitat conservation plans (HCPs) in an effort to avoid designation of critical habitat). Additional requirements under State or local laws intended to protect sensitive habitat may also be triggered, and uncertainty and perceptional effects on markets may result.

12. The analysis estimates impacts based on activities that are reasonably foreseeable, including activities that are currently authorized, permitted, or funded, or for which proposed plans are currently available to the public. In general, the time frame over which data are available to project land uses in the study area is 20 years. In the case of hydropower dams, however, consultations are assumed to occur concurrent with the relicensing of projects by the Federal Energy Regulatory Commission. Relicensing schedules are typically on a 30- to 50-year cycle. Analysis of impacts associated with hydropower projects are therefore forecast over a 50-year time frame to capture all potential impacts associated with consultation on critical habitat issues.

13. To calculate present value and annualized impacts, guidance provided by OMB specifies the use of a real annual discount rate of seven percent. In addition, OMB recommends sensitivity analysis using other discount rates, such as three percent, which some economists believe better reflects the social rate of time preference (i.e., the willingness of society to exchange the consumption of goods and services now for the consumption of goods and services in the future).[6] Accordingly, the analysis presents impacts at seven percent and provides a sensitivity analysis that presents impacts assuming a discount rate of three percent.

STUDY AREA

14. The area that NMFS considered in developing its proposed critical habitat designation for the Gulf of Maine DPS of Atlantic salmon (the "study area") includes the bankfull width or high water mark of approximately 19,200 miles of rivers and perennial streams located in Maine and northeastern New Hampshire. These rivers and streams include the main stems of the Androscoggin, Kennebec, and Penobscot Rivers, as well as their associated tributaries, which extend into 15 of Maine's 16 counties.[7]

15. While NMFS proposes to designate critical habitat only within the bankfull width or high water mark of a river or stream, the economic analysis considers all land use activities that may affect the essential features of the species' habitat, regardless of whether those activities occur within areas that NMFS may formally designate as critical habitat. This includes land use activities in watersheds that feed the rivers and

[6] U.S. Office of Management and Budget, Circular A-4, September 17, 2003 and U.S. Office of Management and Budget, "Draft 2003 Report to Congress on the Costs and Benefits of Federal Regulations; Notice," 68 Federal Register 5492, February 3, 2003.

[7] As noted previously, the study area is broader than the area inhabited by the species.

streams of interest. Specifically, the analysis examines 105 ten-digit hydrological units, each defined by a unique Hydrologic Unit Code and generally referred to as "HUCs". The associated watershed area is approximately 14.2 million acres. Within this area, NMFS has identified 48 HUCs that are currently occupied by the salmon and contain the physical and biological features essential to conservation of the species. The 48 occupied HUCs encompass approximately 6.5 million acres.[8] To be consistent with NMFS' recovery planning efforts for the salmon, the analysis also considers impacts by Salmon Habitat Recovery Unit (SHRU), large areas that encompass numerous HUCs. The study area is comprised of three SHRUs, as described in Exhibit ES-1. Results of the analysis are aggregated and presented at both the SHRU level and the HUC level, allowing NMFS to make 4(b)(2) exclusion decisions at a more refined geographic scale. Exhibit ES-2 presents a map of the study area.

EXHIBIT ES-1. SALMON HABITAT RECOVERY UNITS

SHRU NAME	NUMBER OF HUCS WITHIN SHRU	RIVER MILES IN SHRU	AREA OF SHRU (ACRES)
Downeast Coastal	14	2,587	1,786,503
Merrymeeting Bay	45	8,661	6,712,008
Penobscot Basin	46	7,966	5,707,724
Total	**105**	**19,214**	**14,206,235**

RESULTS AND KEY FINDINGS

16. Exhibit ES-3 summarizes the report's estimates of the potential economic impacts associated with designation of critical habitat across the 105-HUC study area. As the exhibit indicates, the present value of estimated impacts ranges from approximately $340 million to $377 million. On an annualized basis, this is equivalent to impacts of from $29.1 million to $30.4 million per year. These figures reflect estimates of impacts associated with hydropower, agriculture, development, and transportation activities. No impacts associated with silviculture, aquaculture, or mining activities are forecast.

Exhibit ES-4 summarizes the report's estimates of the potential economic impacts of critical habitat designation within the 48 HUCs that are currently occupied by the salmon and contain the physical and biological features essential to the conservation of the species. The present value of estimated impacts in these HUCs ranges from approximately $128 million to $152 million. On an annualized basis, this is equivalent to impacts of from $12.3 million to $13.2 million per year. As these figures indicate, the estimated present value of impacts within occupied HUCs is approximately 38 to 40 percent of the total for the entire study area.

[8] Acreage estimates are derived from GIS data on the boundaries of the 105 HUCs that comprise the study area.

17. Exhibits ES-3 and ES-4 also provide a breakdown of estimated impacts by SHRU. As the exhibits show, the estimated impacts are highest within the Merrymeeting Bay SHRU. Exhibit ES-5 further illustrates the geographic distribution of impacts, providing a map of impacts by HUC. Again, the highest impacts are forecast for HUCs within the Merrymeeting Bay SHRU, the largest of the three salmon habitat recovery units.

18. Exhibit ES-6 describes the distribution of quantified impacts by land use activity for the 105-HUC study area (high cost scenario). Approximately 63 percent of the total is attributable to impacts on hydropower projects. Another 34 percent is associated with impacts on development activity. Impacts on agricultural activities account for approximately two percent of the total, and impacts on transportation and in-stream construction activities account for the remaining one percent. Exhibit ES-7 provides additional detail on the nature of these impacts, notes activities for which significant impacts are not anticipated, and describes the potential impact of critical habitat designation on Tribal lands.

19. Exhibit ES-8 provides a detailed summary of estimated impacts by HUC. The area forecast to generate the greatest share of total impacts upon designation is HUC 0104000210, an occupied HUC located in the Merrymeeting Bay SHRU. The impacts associated with designation of critical habitat within this HUC account for approximately seven percent of the total impacts estimated.

EXHIBIT ES-2. MAP OF STUDY AREA FOR ECONOMIC ANALYSIS OF CRITICAL HABITAT DESIGNATION FOR THE ATLANTIC SALMON

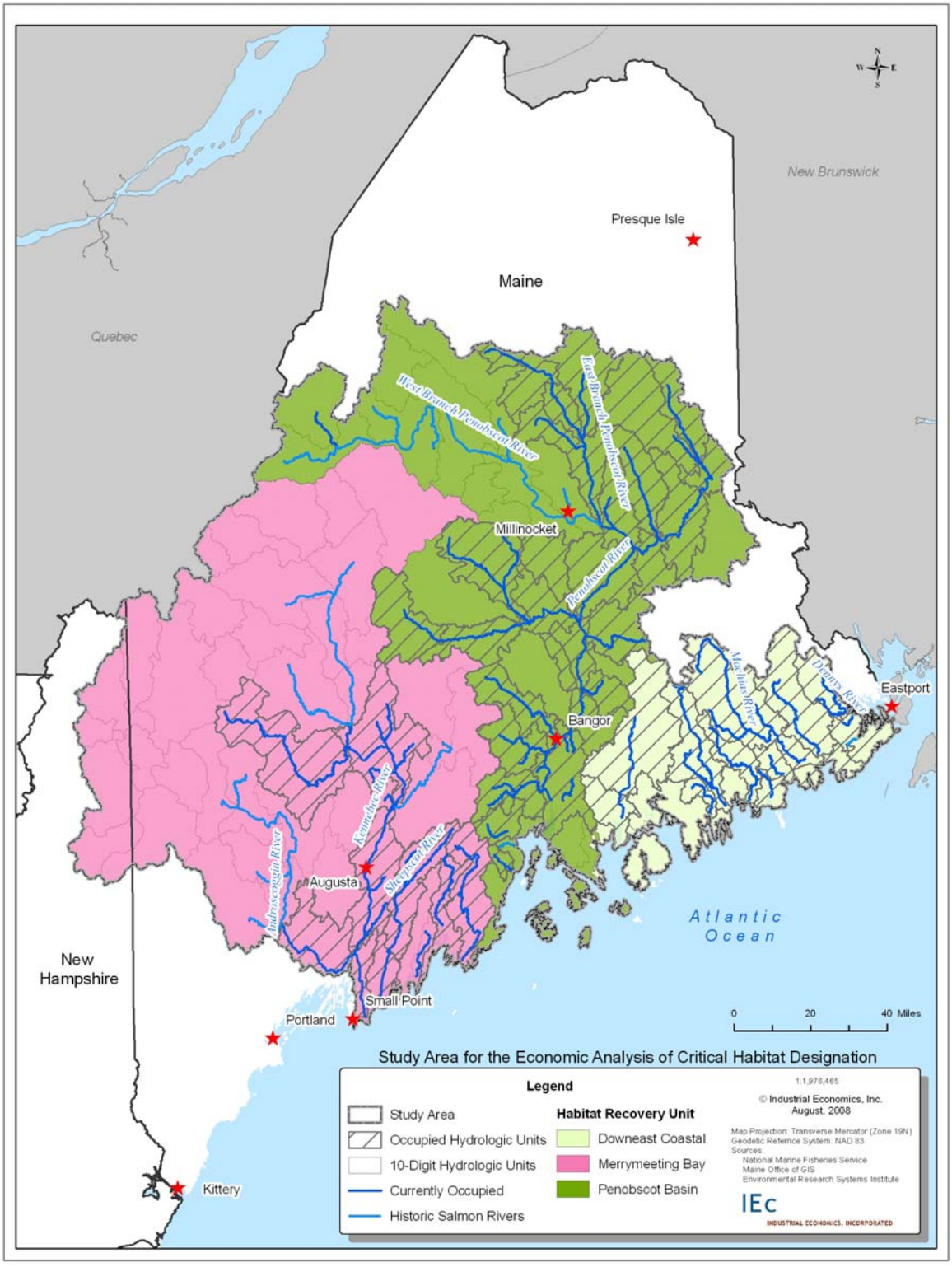


EXHIBIT ES-3. ESTIMATED IMPACTS OF CRITICAL HABITAT DESIGNATION: ALL HUCS

SPECIES HABITAT RECOVERY UNIT	TOTAL PRESENT VALUE IMPACTS		ANNUALIZED IMPACTS	
	LOW	HIGH	LOW	HIGH
Downeast Coastal	$10,600,000	$14,400,000	$1,180,000	$1,250,000
Merrymeeting Bay	$248,000,000	$272,000,000	$21,100,000	$22,000,000
Penobscot Basin	$81,500,000	$91,000,000	$6,840,000	$7,180,000
Total Impacts	**$340,000,000**	**$377,000,000**	**$29,100,000**	**$30,400,000**

1. Impact estimates reflect a 20-year time frame for agriculture, development, and transportation impacts, and a 50-year time horizon for hydropower impacts. Impacts are discounted at an annual rate of 7 percent.
2. Entries may not sum to totals reported due to rounding.

EXHIBIT ES-4. ESTIMATED IMPACTS OF CRITICAL HABITAT DESIGNATION: 48 OCCUPIED HUCS

SPECIES HABITAT RECOVERY UNIT	TOTAL PRESENT VALUE IMPACTS		ANNUALIZED IMPACTS	
	LOW	HIGH	LOW	HIGH
Downeast Coastal	$9,710,000	$12,700,000	$1,040,000	$1,090,000
Merrymeeting Bay	$83,300,000	$98,100,000	$8,130,000	$8,810,000
Penobscot Basin	$35,200,000	$41,000,000	$3,140,000	$3,320,000
Total Impacts	**$128,000,000**	**$152,000,000**	**$12,300,000**	**$13,200,000**

1. Impact estimates reflect a 20-year time frame for agriculture, development, and transportation impacts, and a 50-year time horizon for hydropower impacts. Impacts are discounted at an annual rate of 7 percent.
2. Entries may not sum to totals reported due to rounding.

EXHIBIT ES-5. RELATIVE DISTRIBUTION OF TOTAL IMPACTS AMONG HUCS IN THE STUDY AREA

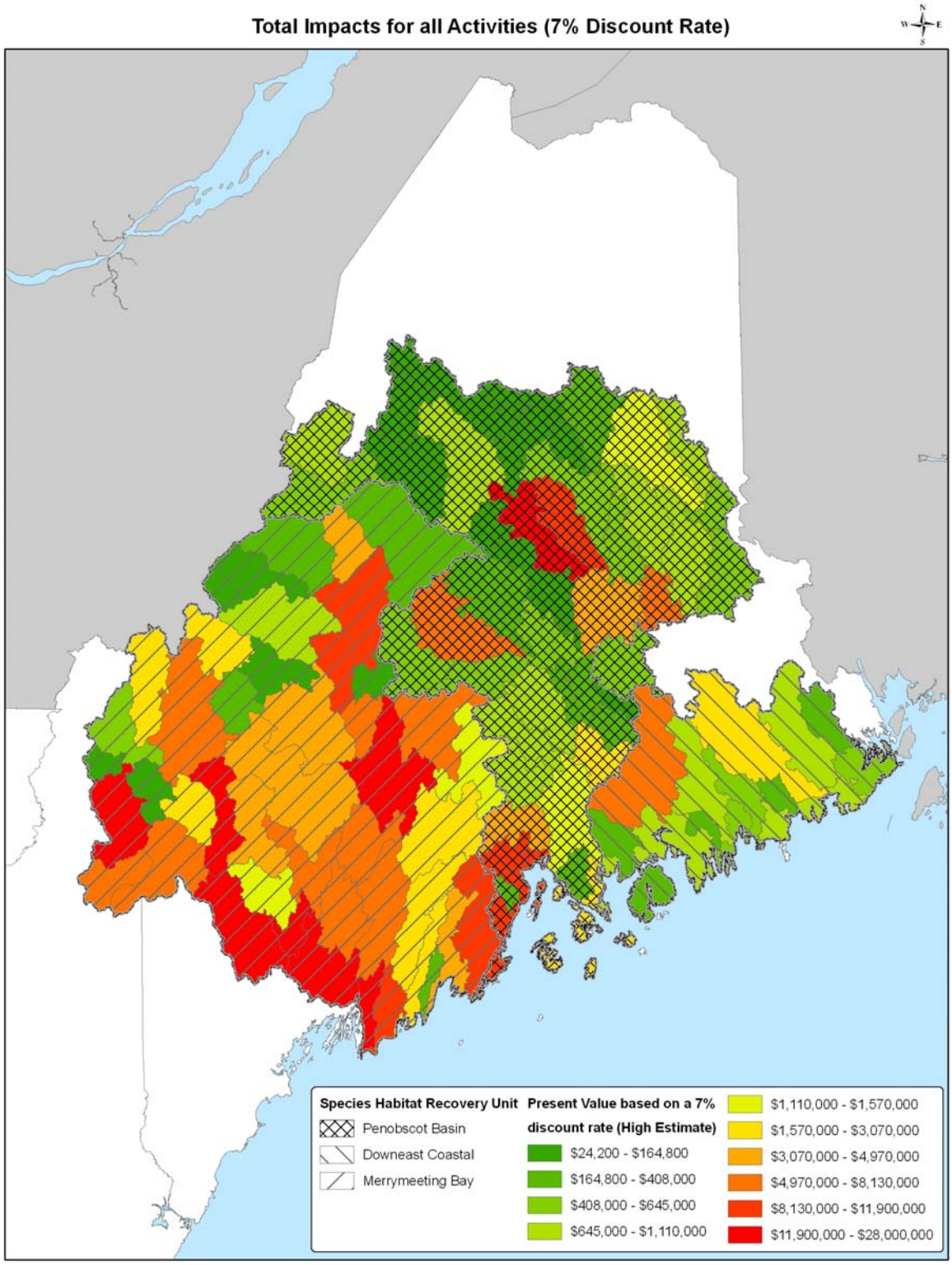


EXHIBIT ES-6. DISTRIBUTION OF IMPACTS BY ACTIVITY (105 HUCS, HIGH COST SCENARIO)

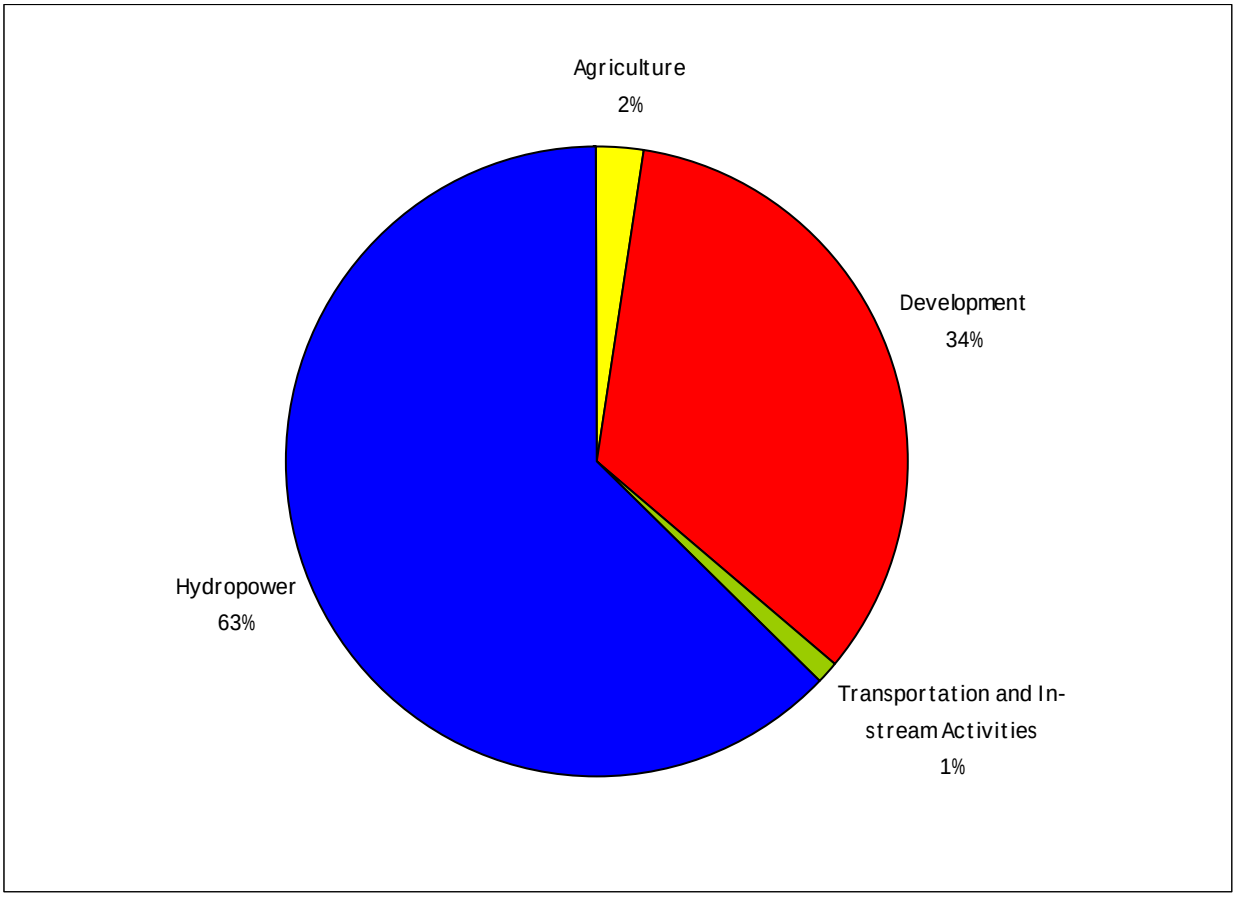


EXHIBIT ES-7. SUMMARY OF FINDINGS FOR THE 105 HUCS ANALYZED

- *Hydropower:* Consultation costs and potential modifications to FERC-licensed or exempt hydropower projects within the study area account for approximately $237 million in estimated impacts. As described in Chapter 3, these potential modifications include construction of fish passage facilities and monitoring of water quality and fish survival. Potential impacts of changes to flow regimes are not quantified, but are described qualitatively in Chapter 3.

- *Agriculture:* Impacts of $8.08 million to $8.98 million are associated with section 7 consultation and potential modification of agricultural activities on 434,307 acres of farmland in Maine and 1,594 acres of farmland in New Hampshire (see Chapter 4). These modifications include the establishment of 30-meter riparian setbacks from perennial streams and development of alternative water supplies to avoid direct withdrawal of water from designated critical habitat.

- *Development:* Roughly 38 percent of the land within the study area is considered developable, as described in Chapter 5. Forecast impacts of $94.4 million to $127 million are attributable to section 7 consultation and the loss in development value that would result from precluding development along a 30-meter riparian setback from perennial streams.

- *Transportation and In-Stream Construction:* As described in Chapter 6, the administrative costs of consultation on Federally permitted road and bridge projects and other in-steam construction activities are estimated to range from $709,000 to $4.25 million. Modification of these projects is not forecast, as many transportation and in-stream construction projects are already likely to be managed in a manner consistent with the requirements of salmon habitat conservation.

- *Silviculture:* While silviculture is a pervasive land use within the study area, the use of Best Management Practices (BMPs) and compliance with State forest management regulations generally ensure that silviculture operations are managed in a manner consistent with salmon habitat conservation. This fact, combined with the lack of a Federal nexus for much silviculture activity in the region, suggests that the incremental effect of critical habitat designation on silviculture operations will be minor (see Chapter 7).

- *Aquaculture:* As described in Chapter 8, the designation of critical habitat will likely have little impact on aquaculture activities, which are already subject to permitting requirements that are designed to protect Atlantic salmon.

- *Mining:* Designation of critical habitat for salmon will likely have little impact on mining activities in the study area. The sector is dominated by small stone and gravel extraction operations located on private land. Extraction does not occur in-stream and is governed by performance standards that already seek to reduce impacts on surface water (see Chapter 9).

- *Tribal Lands:* Approximately 1.3 percent of the land within the study area is owned by the Passamaquoddy Tribe or Penobscot Indian Nation. Chapter 10 of this report describes the extent to which impacts quantified in Chapters 3 through 9 of the report may occur on Tribal lands. Approximately $377,000 of the quantified total impacts are associated with agricultural, development, and transportation activities on Tribal lands.

EXHIBIT ES-8. SUMMARY OF TOTAL IMPACTS BY HUC

DOWNEAST COASTAL			MERRYMEETING BAY			PENOBSCOT BASIN		
	PRESENT VALUE			PRESENT VALUE			PRESENT VALUE	
10 DIGIT HUC	LOW	HIGH	10 DIGIT HUC	LOW	HIGH	10 DIGIT HUC	LOW	HIGH
0105000212	$5,390,000	$6,200,000	0104000210	$23,200,000	$27,900,000	0102000109	$15,200,000	$15,300,000
0105000205	$1,030,000	$1,570,000	0104000106	$19,200,000	$19,400,000	0105000218	$10,600,000	$10,800,000
0105000209	$596,000	$956,000	0105000307	$15,400,000	$16,900,000	0102000110	$10,500,000	$10,700,000
0105000214	$401,000	$831,000	0104000204	$15,800,000	$15,900,000	0105000220	$8,920,000	$10,300,000
0105000204	$446,000	$817,000	0104000208	$15,400,000	$15,700,000	0102000403	$6,620,000	$7,000,000
0105000206	$667,000	$809,000	0103000306	$14,900,000	$15,200,000	0102000307	$6,300,000	$6,430,000
0105000203	$390,000	$555,000	0104000209	$12,600,000	$14,500,000	0102000502	$4,430,000	$4,720,000
0105000208	$369,000	$507,000	0103000106	$11,800,000	$11,900,000	0102000512	$3,640,000	$3,970,000
0105000211	$405,000	$474,000	0105000301	$7,190,000	$11,100,000	0105000217	$1,720,000	$2,400,000
0105000213	$177,000	$389,000	0103000301	$10,900,000	$11,000,000	0102000509	$2,140,000	$2,320,000
0105000201	$257,000	$388,000	0105000306	$8,700,000	$8,980,000	0102000301	$888,000	$1,500,000
0105000215	$122,000	$342,000	0104000206	$7,530,000	$8,130,000	0102000513	$922,000	$1,370,000
0105000207	$240,000	$303,000	0104000201	$7,950,000	$8,050,000	0102000510	$856,000	$1,090,000
0105000210	$153,000	$225,000	0103000312	$6,640,000	$7,470,000	0102000306	$506,000	$881,000
			0103000307	$7,120,000	$7,330,000	0102000101	$805,000	$878,000
			0103000310	$6,400,000	$6,930,000	0102000105	$804,000	$877,000
			0104000202	$6,240,000	$6,430,000	0102000511	$543,000	$801,000
			0104000101	$6,110,000	$6,410,000	0102000508	$598,000	$799,000
			0103000311	$5,510,000	$6,160,000	0102000302	$442,000	$768,000
			0103000303	$5,840,000	$5,910,000	0102000305	$312,000	$646,000
			0103000104	$4,920,000	$4,970,000	0102000102	$553,000	$633,000
			0105000302	$3,140,000	$4,930,000	0102000401	$465,000	$626,000
			0103000304	$3,640,000	$3,980,000	0102000402	$435,000	$583,000
			0104000205	$3,310,000	$3,570,000	0102000503	$305,000	$550,000
			0103000305	$2,690,000	$3,420,000	0102000205	$346,000	$544,000
			0104000203	$2,980,000	$3,070,000	0102000303	$283,000	$476,000
			0104000103	$2,720,000	$2,820,000	0102000304	$203,000	$465,000
			0103000309	$1,490,000	$2,260,000	0102000501	$271,000	$455,000
			0105000305	$1,500,000	$2,220,000	0102000406	$309,000	$408,000
			0105000304	$1,700,000	$2,080,000	0102000506	$272,000	$376,000
			0103000201	$1,810,000	$1,950,000	0105000219	$231,000	$341,000
			0104000207	$934,000	$1,250,000	0105000216	$174,000	$311,000
			0103000308	$803,000	$1,110,000	0102000204	$113,000	$309,000

DOWNEAST COASTAL			MERRYMEETING BAY			PENOBSCOT BASIN		
	PRESENT VALUE			PRESENT VALUE			PRESENT VALUE	
10 DIGIT HUC	LOW	HIGH	10 DIGIT HUC	LOW	HIGH	10 DIGIT HUC	LOW	HIGH
			0103000204	$925,000	$1,050,000	0102000404	$192,000	$278,000
			0104000104	$310,000	$432,000	0102000505	$150,000	$245,000
			0105000303	$209,000	$348,000	0102000507	$123,000	$165,000
			0103000202	$115,000	$221,000	0102000405	$57,100	$154,000
			0103000105	$73,200	$215,000	0102000504	$53,000	$101,000
			0103000103	$93,800	$204,000	0102000103	$34,500	$98,900
			0103000203	$59,300	$149,000	0102000203	$34,600	$96,000
			0103000102	$36,800	$106,000	0102000201	$28,000	$80,400
			0104000102	$41,500	$91,700	0102000202	$25,600	$71,000
			0104000105	$27,400	$69,800	0102000104	$18,400	$52,000
			0103000101	$23,200	$67,000	0102000108	$11,400	$32,600
			0103000302	$32,500	$64,500	0102000107	$10,100	$28,700
						0102000106	$7,730	$24,200
Subtotal: All HUCs	**$10,600,000**	**$14,400,000**	**Subtotal: All HUCs**	**$248,000,000**	**$272,000,000**	**Subtotal: All HUCs**	**$81,500,000**	**$91,000,000**
Subtotal: Occupied HUCs	**$9,710,000**	**$12,700,000**	**Subtotal: Occupied HUCs**	**$83,300,000**	**$98,100,000**	**Subtotal: Occupied HUCs**	**$35,200,000**	**$41,000,000**

	LOW	HIGH
TOTAL PRESENT VALUE: ALL HUCs	**$340,000,000**	**$378,000,000**
TOTAL ANNUALIZED IMPACT: ALL HUCs	**$29,100,000**	**$30,400,000**
TOTAL PRESENT VALUE: OCCUPIED HUCs	**$128,000,000**	**$152,000,000**
TOTAL ANNUALIZED IMPACT: OCCUPIED HUCs	**$12,300,000**	**$13,200,000**

Notes:

1. Figures are rounded to three significant digits and may not sum due to rounding.
2. Estimates reflect present value of quantified impacts assuming a 7 percent discount rate.
3. Highlighting denotes HUCs that Atlantic salmon currently occupy.

CHAPTER 1 | INTRODUCTION AND BACKGROUND

1.1 INTRODUCTION

1. Under the provisions of the Endangered Species Act (ESA), the National Marine Fisheries Service (NMFS) proposes to designate critical habitat for the Gulf of Maine Distinct Population Segment (DPS) of Atlantic salmon (*Salmo salar*). This DPS is comprised of all Atlantic salmon whose freshwater range occurs in the watersheds from the Androscoggin River northward along the Maine coast to the Dennys River, and wherever these fish occur in the estuarine and marine environment. NMFS proposed to list the DPS as an endangered species on September 3, 2008.[1] NMFS subsequently proposed to designate critical habitat for the DPS on September 5, 2008.[2] NMFS is now finalizing these actions.

2. Section 4(b)(2) of the ESA requires NMFS to consider the economic, national security, and other impacts of designating a particular area as critical habitat. NMFS may exclude an area from critical habitat if it determines that the benefits of exclusion outweigh the benefits of specifying the area as part of the critical habitat, unless it also determines that the failure to designate the area as critical habitat will result in the extinction of the species concerned.

3. This report employs the best data available to analyze the economic impacts of designating particular areas as critical habitat; these impacts represent the "benefits of exclusion".[3] NMFS presents its formal consideration of the benefits of including particular areas (the "benefits of inclusion") within the designation in a separate report.[4] Together, these two reports support NMFS in determining whether the benefits of excluding any particular area outweigh the benefits of designating that area. These

[1] National Oceanic and Atmospheric Administration, *Endangered and Threatened Species; Proposed Endangered Status for the Gulf of Maine Distinct Population Segment of Atlantic Salmon: Proposed Rule*, 73 Federal Register 51415, September 3, 2008.

[2] National Oceanic and Atmospheric Administration, *Endangered and Threatened Species; Proposed Critical Habitat for the Gulf of Maine Distinct Population Segment of Atlantic Salmon: Proposed Rule*, 73 Federal Register 51747, September 5, 2008.

[3] A draft of this report was made available to the public for review and comment in September, 2008, when NMFS published its proposed critical habitat rule. This final report incorporates revisions, as appropriate, to respond to comments on the draft. For a detailed discussion of public comments on the draft economic analysis and associated responses, see the responses to public comment section of the Final Rule.

[4] National Marine Fisheries Service, *Biological valuation of Atlantic salmon (*Salmo salar*) habitat in the Gulf of Maine Distinct Population Segment*, 2009.

determinations are required under Section 4(b)(2) before any exclusion can be made. Such determinations are documented in NMFS' 4(b)(2) report.[5]

4. This chapter begins with a summary of relevant statutory and regulatory information concerning the ESA and critical habitat designation. It then provides an overview of the biological requirements, species threats, and proposed critical habitat designation for Atlantic salmon. The chapter finishes with an overview of the rest of the report.

1.2 BACKGROUND

5. A Status Review published in 2006 concluded that the Gulf of Maine DPS should be comprised of all Atlantic salmon whose freshwater range occurs in the watersheds from the Androscoggin River northward along the Maine coast to the Dennys River, including all associated hatchery populations used to supplement natural populations.[6] In September, 2008, NMFS proposed to list this DPS as an endangered species. In response to public comments and additional analysis, the final listing rule modifies the definition of the DPS to include all anadromous Atlantic salmon whose freshwater range occurs in the watersheds from the Androscoggin River northward along the Maine coast to the Dennys River, and wherever these fish occur in the estuarine and marine environment. It continues to include all associated hatchery populations used to supplement these natural populations. It excludes landlocked salmon and salmon raised in commercial aquaculture hatcheries. It also identifies a number of impassable falls that delimit the upstream extent of the salmon's freshwater range.

6. In accordance with the ESA, NMFS also proposes to designate critical habitat for the Gulf of Maine DPS of Atlantic salmon. Section 4(b)(2) of the ESA requires NMFS to designate critical habitat for threatened and endangered species "on the basis of the best scientific data available and after taking into consideration the economic impact, the impact on national security and any other relevant impact, of specifying any particular area as critical habitat." This section grants the Secretary of Commerce discretion to exclude any area from critical habitat if (s)he determines "the benefits of such exclusion outweigh the benefits of specifying such area as part of the critical habitat." The Secretary may not exclude any particular area if exclusion "will result in the extinction of the species."

7. The ESA defines critical habitat under section 3(5)(A) as:

> (i) the specific areas within the geographical area occupied by the species, at the time it is listed…, on which are found those physical or biological features (I) essential to the conservation of the species, and (II) which may require special management considerations or protection; and

[5] National Marine Fisheries Service, *Designation of critical habitat for Atlantic salmon (*Salmo salar*) in the Gulf of Maine Distinct Population Segment*, ESA Section 4(b)2 Report, 2009.

[6] National Marine Fisheries Service and Fish and Wildlife Service, July 2006, *Status Review for Anadromous Atlantic Salmon (*Salmo salar*) in the United States.*

(ii) specific areas outside the geographical area occupied by the species at the time it is listed… upon a determination by the Secretary that such areas are essential for the conservation of the species.

8. Once critical habitat is designated, section 7 of the ESA requires Federal agencies to consult with NMFS to ensure that any action they authorize, fund, or carry out *will not likely result in the destruction or adverse modification of critical habitat.* NMFS may, through the consultation process, recommend changes to these activities (termed "activities with a Federal nexus") that would avoid destruction or adverse modification of critical habitat. The economic impacts of critical habitat designation stem from this process and any modifications to activities implemented as a result of consultation.

9. Section 7 of the ESA also requires Federal agencies to consult with NMFS to ensure that any action they authorize, fund, or carry out *will not likely jeopardize the continued existence of any endangered or threatened species.* Through the consultation process, NMFS may, within its statutory authority, recommend modifications to these activities to avoid jeopardizing the continued existence of the species. Thus, a species listing determination and related jeopardy considerations alone may impose economic impacts, even absent critical habitat designation.

10. In some instances, it is difficult to distinguish between impacts stemming exclusively from critical habitat designation (or, more specifically, impacts related to adverse modification) and impacts resulting from other species conservation measures. For example, a specific modification to a particular Federal action may address both jeopardy and critical habitat concerns. Thus, some impacts related to critical habitat could be considered to occur coextensively with other causes. This difficulty can complicate assessment of the incremental impacts of critical habitat designation.

11. In 2001, the U.S. Tenth Circuit Court of Appeals instructed the U.S. Fish and Wildlife Service (FWS) to conduct a full analysis of all of the economic impacts of proposed critical habitat, regardless of whether those impacts are attributable coextensively to other causes.[7] The court's decision was based on FWS' reliance on a regulatory definition of adverse modification that has since been invalidated. Subsequently, other courts have held that an incremental analysis of impacts stemming solely from the critical habitat rulemaking is proper.[8]

12. As described more fully in Chapter 2, this analysis relies on the best available data to estimate the incremental impacts of critical habitat designation. This approach is consistent with recent judicial rulings and with the U.S. Office of Management and Budget's (OMB) guidelines for conducting economic analysis of regulations. OMB's guidelines direct Federal agencies to measure the costs of a regulatory action against a

[7] New Mexico Cattle Growers Assn v. United States Fish and Wildlife Service, 248 F.3d 1277 (10th Cir. 2001).

[8] See, for example: *Cape Hatteras Access Preservation Alliance v. Department of Interior,* 344 F. Supp. 2d 108 (D.D.C.); CBD v. BLM, 422 F. Supp/. 2d 1115 (N.D. Cal. 2006); Center for Biological Diversity et al., Plaintiffs, v. Bureau of Land Management et al., Defendants and American Sand Association, et al., Defendant Intervenors. Order re: Cross Motions for Summary Judgment. Case 3:03-cv-02509 Document 174 Filed 03/14/2006. Pages 44-45.

baseline, which it defines as the "best assessment of the way the world would look absent the proposed action."[9] In other words, the baseline includes the existing regulatory and socio-economic burden imposed on landowners, managers, or other resource users potentially affected by the designation of critical habitat. Impacts that are incremental to that baseline (i.e., occurring over and above existing constraints) are attributable to the proposed critical habitat regulation.

1.3 OVERVIEW OF SPECIES AND HABITAT

13. As indicated by the ESA's definition of critical habitat, important factors in delineating a critical habitat designation include the species' life history, historical distribution and abundance, and habitat requirements. To derive a measure of economic impacts occurring within discrete areas of critical habitat, this analysis: (1) characterizes existing or potential threats to the species and its habitat occurring within these areas; (2) links these threats to particular human activities; (3) identifies the modifications to these activities that would avoid or minimize the threats; and (4) to the extent feasible, quantifies and monetizes the economic impact of the modifications.

1.3.1 ATLANTIC SALMON BIOLOGY AND HABITAT REQUIREMENTS

14. The Atlantic salmon is an anadromous fish that typically spends two to three years in freshwater before migrating to the ocean, where it typically spends one to two years before returning to its natal river to spawn.[10] The known historic range of Atlantic salmon in U.S. rivers was from the Housatonic River in the south to the St. Croix River in the north. The distribution of the fish in the U.S. by the mid-20th century, however, was primarily limited to Maine.[11] Exhibit 1-1 summarizes, at a general level, the physical and biological features of habitat essential to the conservation of the Gulf of Maine DPS of Atlantic salmon.[12]

[9] OMB, "Circular A-4," September 17, 2003.

[10] For a detailed review of biological information, see: National Marine Fisheries Service, November 2005, Final Recovery Plan for the Gulf of Maine Distinct Population Segment of Atlantic Salmon (*Salmo salar*).

[11] National Marine Fisheries Service and Fish and Wildlife Service, July 2006, *Status Review for Anadromous Atlantic Salmon (*Salmo salar*) in the United States.*

[12] More specific information regarding these elements of critical habitat for each life stage of the salmon is provided in: National Marine Fisheries Service, May 2007, Draft Habitat Requirements and Management Considerations for Atlantic Salmon (Salmo salar) in the Gulf of Maine Distinct Population Segment (DPS).

EXHIBIT 1-1. PHYSICAL AND BIOLOGICAL FEATURES OF CRITICAL HABITAT

SPAWNING AND REARING HABITAT
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.
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.
3. Freshwater spawning and rearing sites with clean gravel in the presence of cool, oxygenated water and diverse substrate to support emergence, territorial development and feeding activities of Atlantic salmon fry.
4. Freshwater rearing sites with space to accommodate growth and survival of Atlantic salmon parr, and population densities needed to support sustainable populations.
5. Freshwater rearing sites with a combination of river, stream, and lake habitats that accommodate parr's ability to occupy many niches and to maximize parr production.
6. Freshwater rearing sites with cool, oxygenated water to support growth and survival of Atlantic salmon parr.
7. Freshwater rearing sites with diverse food resources to support growth and survival of Atlantic salmon parr.
ADULT MIGRATION HABITAT
1. Freshwater and estuary migratory sites free from physical and biological barriers that delay or prevent access to spawning grounds needed to support a recovered population.
2. Freshwater and estuary migration sites with pool, lake, and instream 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.
3. Freshwater and estuary migration sites with abundant, diverse native fish communities to serve as a protective buffer against predation.
SMOLT MIGRATION HABITAT
1. Freshwater and estuary migration sites free from physical and biological barriers that delay or prevent emigration of smolts to the marine environment.
2. Freshwater and estuary migration sites with sufficiently cool water temperatures and water flows that coincide with diurnal cues to stimulate smolt migration.
3. Freshwater migration sites with water chemistry needed to support sea water adaptation of smolts.
4. Freshwater and marine sites with diverse, abundant assemblages of native fish communities to enhance survivorship as Atlantic salmon smolts emigrating through the estuary.
Source: National Marine Fisheries Service, *Biological valuation of Atlantic salmon (*Salmo salar*) habitat in the Gulf of Maine Distinct Population Segment*, 2009.

1.3.2 THREATS AND HUMAN ACTIVITIES

15. Threats to the physical and biological features of the salmon's habitat within the DPS' current and historical range may affect the potential for recovery of the species. Based on a review of potential impacts, NMFS has identified the following land use activities that may adversely affect the physical or biological features of critical habitat for the salmon:

- **Hydropower** - operation and maintenance of dams and fish passage projects, or installation and operation of tidal energy projects.
- **Agriculture** - land clearing and use of pesticides, fertilizers, and herbicides.
- **Changing land use patterns/development** - residential, commercial, and industrial development; and discharge of industrial and municipal wastewater.
- **Transportation and other in-stream construction projects** - construction and maintenance of roads, bridges, or culverts; dredging; bank stabilization; installation and maintenance of vegetation, pilings, moorings, and bulkheads; boat ramp construction or maintenance; and construction or repair of pipelines and electric transmission lines.
- **Silviculture** - land clearing; use of pesticides, fertilizers, and herbicides; and harvest practices.
- **Aquaculture, hatcheries, and fisheries research** - fish and shellfish stocking and cultivation activities, and biological research on fisheries.
- **Mining** - peat, sand and gravel, or metals mining.

Determining how these land use activities may be modified as a result of critical habitat designation, and estimating the costs of these potential modifications, is the crux of this analysis. In addition, to support the Section 4(b)(2) decision-making process, the analysis identifies the spatial distribution of these activities and, where possible, disaggregates impacts to particular geographic areas. Thus, a clear description of the study area is important.

1.3.3 DESCRIPTION OF STUDY AREA

16. The area that NMFS considered in developing its proposed critical habitat designation for the Gulf of Maine DPS of Atlantic salmon (the "study area") includes the bankfull width or high water mark of approximately 19,200 miles of rivers and perennial streams located in Maine and northeastern New Hampshire. These rivers and streams include the main stems of the Androscoggin, Kennebec, and Penobscot Rivers, as well as their associated tributaries, which extend into 15 of Maine's 16 counties.[13]

17. While NMFS proposes to designate critical habitat only within the bankfull width or high water mark of a river or stream, the economic analysis considers all land use activities

[13] NMFS determined the study area based upon the definition of the DPS recommended in the 2006 Status Review. As a result, it incorporates areas upstream of the falls that delimit the historic range of the DPS, as defined in the final listing rule.

that may affect the essential features of the species' habitat, regardless of whether those activities occur within areas that NMFS may formally designate as critical habitat. This includes land use activities in watersheds that feed the rivers and streams of interest. Specifically, the analysis examines 105 ten-digit hydrological units, each defined by a unique Hydrologic Unit Code and generally referred to as "HUCs". The associated watershed area is approximately 14.2 million acres. Within this area, NMFS has identified 48 HUCs that are currently occupied by the salmon and contain the physical and biological features essential to conservation of the species. The 48 occupied HUCs encompass approximately 6.5 million acres.[14] Exhibit 1-2 presents a map of the study area.

1.4 ORGANIZATION OF REPORT

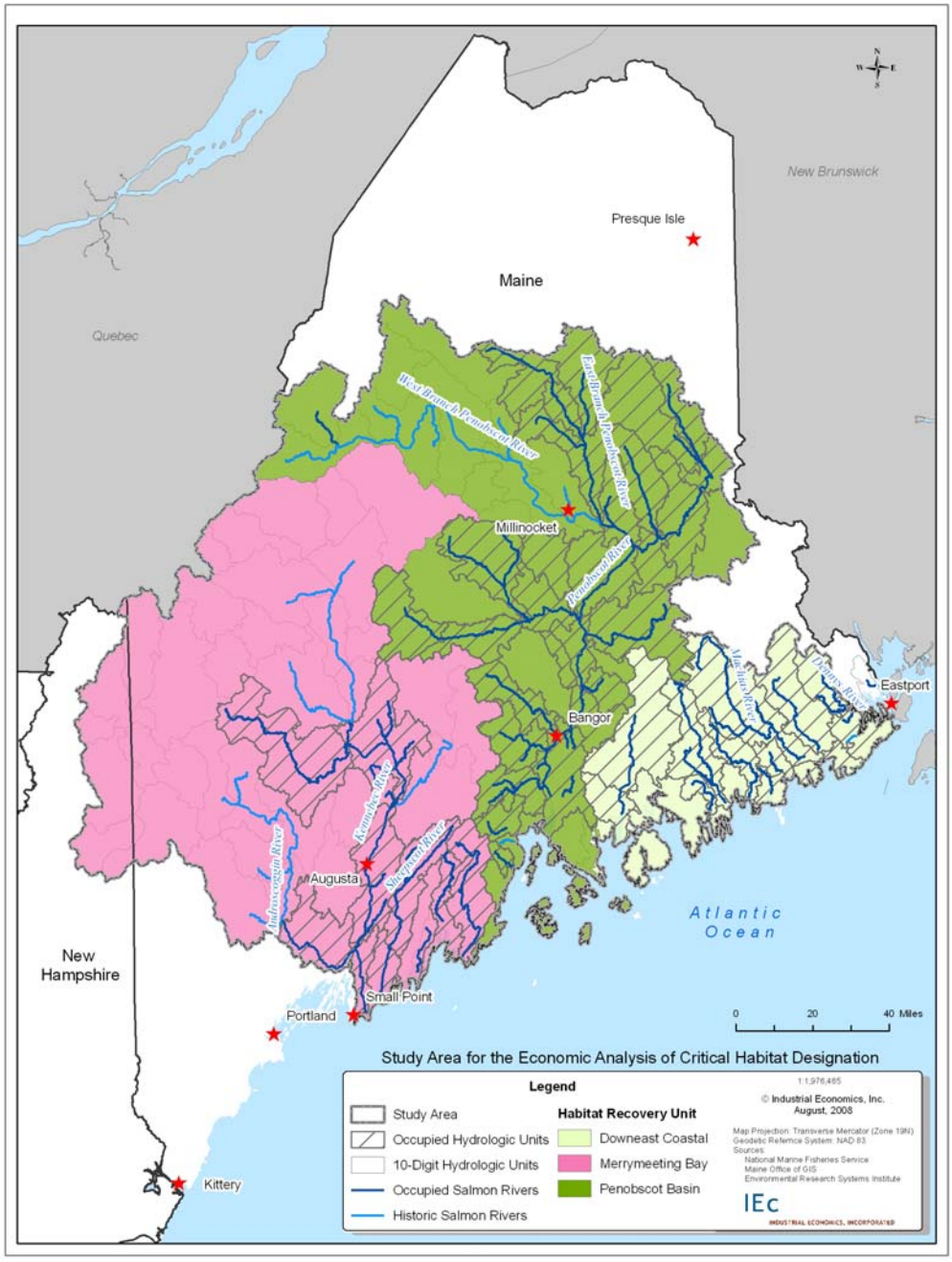
18. The remainder of this report proceeds through nine additional chapters. Chapter 2 discusses the framework and methods employed in the analysis. Chapters 3 through 10 then cover the assessment of potential economic impacts, organized by economic activity:

- Chapter 3 - operation of hydropower facilities;
- Chapter 4 - agriculture operations;
- Chapter 5 - development activities;
- Chapter 6 - transportation and in-stream construction projects;
- Chapter 7 - silviculture activities;
- Chapter 8 - aquaculture activities;
- Chapter 9 - mining operations; and
- Chapter 10 - impacts on tribal land use.

19. In addition, the report includes two appendices: Appendix A, which provides information on the sensitivity of the economic impact estimates to alternative discount rates; and Appendix B, which discusses potential impacts on water bottling operations.

[14] Acreage estimates are derived from GIS data on the boundaries of the HUCs included in the study area.

EXHIBIT 1-2. MAP OF STUDY AREA FOR ECONOMIC ANALYSIS



CHAPTER 2 | FRAMEWORK FOR THE ANALYSIS

2.1 INTRODUCTION

1. The purpose of this report is to identify and analyze the potential economic impacts associated with the designation of critical habitat for the Gulf of Maine Distinct Population Segment (DPS) of Atlantic salmon (*Salmo salar*). The analysis examines the impacts of restricting or modifying specific land uses or activities to avoid destruction or adverse modification of critical habitat. This chapter presents the framework applied to analyze the economic impacts of critical habitat designation, including an outline of the broader 4(b)(2) process and a specific framework for the economic analysis.

2.2 GENERAL ANALYTIC FRAMEWORK FOR THE 4(b)(2) PROCESS

2. Consistent with its analysis of critical habitat designation for West Coast salmon and steelhead, NMFS uses a modified cost-effectiveness analysis to support the designation of critical habitat for the Gulf of Maine DPS of Atlantic salmon. This framework informs the section 4(b)(2) decision-making process by allowing NMFS to compare a monetized estimate of the "benefits of exclusion" against an indicator of the biological "benefits of inclusion" for any particular area.[1] This section first discusses the selection of the modified cost-effectiveness analysis framework and then describes the 4(b)(2) exclusion process.

2.2.1 BENEFIT-COST ANALYSIS AND COST-EFFECTIVENESS ANALYSIS

3. When economic activities have biological effects or other consequences for conservation, analyses of the impacts of regulating those activities can take a number of approaches. Two possible approaches are benefit-cost analysis and cost-effectiveness analysis. Each of these approaches has strong scientific support as well as support from the Office of Management and Budget (OMB) through its guidelines on regulatory analysis.[2] Each also has well known drawbacks, both theoretical and practical, as discussed in the following section in the context of critical habitat designation.

4. Benefit-cost analysis (BCA) is the first choice for analyzing the consequences of a regulatory action such as critical habitat designation.[3] BCA is a well-established

[1] National Marine Fisheries Service, Northwest Fisheries Science Center. August 2005. Final Economic Analysis of Critical Habitat Designation for 12 West Coast Salmon and Steelhead ESUs. Section 2.2 of this report is an abbreviated form of the framework discussion provided in the West Coast salmon critical habitat analysis by the Northwest Fisheries Science Center.

[2] U.S. Office of Management and Budget, "Circular A-4," September 17, 2003, available at http://www.whitehouse.gov/omb/circulars/a004/a-4.pdf.

[3] *Ibid*.

procedure for assessing the "best" course or scale of action, where "best" is that course which maximizes net benefits.[4] Because BCA assesses the value of an activity in net benefit terms, it requires that a single metric, most commonly dollars, be used to gauge both benefits and costs. The data and economic models necessary to estimate costs may be difficult or costly to gather and develop, and a comprehensive analysis of the costs associated with a regulatory action is not always feasible. Nonetheless, the principle is straightforward, and it is generally possible in practice to develop a monetary estimate of at least some portion of regulatory costs. This is the case for critical habitat designation, which has direct impacts on activities carried out, funded, or permitted by the Federal government. (Conceptually, the "benefits of exclusion," which is the language used in section 4(b)(2) of the Endangered Species Act (ESA), are identical to the "costs of inclusion," and so estimates of these costs could be used in a benefit-cost framework.)

5. Assessing the benefits of critical habitat designation in a BCA framework is also straightforward in principle but much more difficult in practice. To the extent that the critical habitat provisions of the ESA increase the protections afforded the salmon and its habitat, they produce real benefits to the species. In principle, these benefits can be measured first by a biological metric, and then by a dollar metric. A biological metric could take the form of the expected decrease in extinction risk, increase in number of spawners, increase in the annual population growth rate, and so forth. A BCA would then value these quantified biological benefits in terms of willingness-to-pay, the standard economic measure of economic value recommended by OMB.[5] This would produce a dollar estimate of the benefits of critical habitat designation, which could then be compared directly to the costs. In the case of Atlantic salmon, however, the data required to complete such an analysis are not available.

6. Recognizing the difficulty of estimating economic values in cases like this one, OMB has recently acknowledged cost-effectiveness analysis (CEA) as an appropriate alternative to BCA:

> Cost-effectiveness analysis can provide a rigorous way to identify options that achieve the most effective use of the resources available without requiring monetization of all of [the] relevant benefits or costs. Generally, cost-effectiveness analysis is designed to compare a set of regulatory actions with the same primary outcome (e.g., an increase in the acres of wetlands protected) or multiple outcomes that can be integrated into a single numerical index (e.g., units of health improvement).[6]

7. Ideally, CEA quantifies both the benefits and costs of a regulatory action but uses different metrics for each. A common application of this method is to health care

[4] Zerbe, R., and D. Dively, 1994. Benefit Cost Analysis in Theory and Practice, New York: HarperCollins.

[5] OMB, 2003.

[6] *Ibid*.

strategies, where the benefits of a strategy are quantified in terms of lives saved, additional years of survival, or some other quantitative, health-related measure.

8. In principle, conducting a CEA of critical habitat designation proceeds along the same lines identified above for BCA, except that the last step of assigning economic (dollar) values to biological benefits is not taken. Different configurations of critical habitat could be gauged by both metrics, with the cost-effectiveness (ratio of units of biological benefits to monetized cost) evaluated in each case. If alternatives have the same level of biological benefits, the most cost-effective is the one with the lowest cost.

9. Standard CEA presumes that benefits can be measured with a cardinal or even continuous measure. For critical habitat designation, however, constructing such a measure for biological benefits is problematic. Although critical habitat designation for the Atlantic salmon is expected to have benefits, it is not yet feasible, given the state of the science, to quantify benefits reliably with a single biological metric. Thus, applying CEA in its standard form is not possible.

10. The alternative form of CEA used in designating critical habitat for the Gulf of Maine DPS of Atlantic salmon is one that develops an ordinal measure of the biological benefits of critical habitat designation.[7] Although it is difficult to monetize or quantify the benefits of critical habitat designation, it is possible to differentiate among habitat areas based on their relative contribution to conservation. For example, habitat areas can be rated as having a high, medium, or low conservation value based on habitat characteristics and professional judgment. The output (a qualitative ordinal ranking) may better reflect the state of the science for the geographic scale considered here than a quantified output, and can be done with available information.

11. Qualitative ordinal evaluations are then combined with estimates of the monetized economic costs of critical habitat designation in a framework that essentially adopts that of CEA. Individual habitat areas are assessed using both their biological evaluation and economic cost, so that areas with high conservation value and lower economic cost have a higher priority for designation, and areas with a low conservation value and higher economic cost have a higher priority for exclusion.[8] By proceeding in order of these priorities (either in terms of inclusion or exclusion), the proposed critical habitat designation can be expected to minimize or at least reduce the overall economic cost of achieving any given level of conservation.

12. This form of CEA has two limitations, one of which it shares with the standard form of CEA. First, all CEAs have an important limitation when the level of benefits varies across alternatives. Because CEA does not evaluate benefits and costs in the same metric, the analysis cannot assess whether a given change has benefits that, in monetary terms, are greater than costs. Thus, while CEA is a way of minimizing the cost of

[7] For additional information, see National Marine Fisheries Service, *Biological valuation of Atlantic salmon (*Salmo salar*) habitat in the Gulf of Maine Distinct Population Segment*, 2009.

[8] For additional information, see National Marine Fisheries Service, *Designation of critical habitat for Atlantic salmon (*Salmo salar*) in the Gulf of Maine Distinct Population Segment*, ESA Section 4(b)2 Report, 2009.

achieving any given level of benefits, the analysis alone cannot specify which among a set of possible levels of benefits is the "best" choice.

13. A second limitation of the modified form of CEA is the inability to discern variation in benefits among those areas assigned the same conservation value (i.e., the same ordinal ranking). As a result, the modified CEA may lead to an outcome with higher expected costs of achieving any given level of conservation than one produced with standard CEA or BCA.

2.2.2 PROCESS FOR 4(B)(2) EXCLUSION DECISIONS

14. Specific areas that satisfy the definition of critical habitat are not automatically designated as critical habitat. Section 4(b)(2) (16 U.S.C. 1533(b)(1)(A)) requires the Secretary to first consider the impact of designation and permits the Secretary to exclude areas from designation under certain circumstances.

> "The Secretary shall designate critical habitat, and make revisions thereto, under subsection (a)(3) of this section on the basis of the best scientific data available and after taking into consideration the economic impact, the impact on national security and any other relevant impact, of specifying any particular area as critical habitat. The Secretary may exclude any area from critical habitat if he determines that the benefits of such exclusion outweigh the benefits of specifying such area as part of the critical habitat, unless he determines, based on the best scientific and commercial data available, that the failure to designate such area as critical habitat will result in the extinction of the species concerned."

15. To this end, NMFS undertakes the following steps to implement section 4(b)(2):

    1. Identify particular areas for possible exclusion from critical habitat designation;
    2. Determine the benefit of designation (biological benefits) of each particular area;
    3. Determine the benefit of exclusion (economic costs) of each particular area;
    4. Determine whether the benefits of exclusion outweigh the benefits of designation; and
    5. Determine whether the exclusions (if any) will result in extinction of the species.

16. This analysis focuses primarily on the third step, quantifying the benefits of excluding particular areas from critical habitat. The following section details the framework of this economic analysis.

2.3 FRAMEWORK FOR THE ECONOMIC ANALYSIS

17. This analysis examines the state of the world with and without the designation of critical habitat for the salmon. The "without critical habitat" scenario represents the baseline for the analysis, considering protections already afforded the habitat of the Gulf of Maine DPS of Atlantic salmon under other Federal, State, and local regulations. The "with

critical habitat" scenario describes the incremental impacts associated specifically with the designation of critical habitat for the species. The incremental impacts quantified in this analysis are those not expected to occur absent the designation of critical habitat for the salmon.

18. The impacts of critical habitat designation generally reflect "opportunity costs" associated with the commitment of resources required to accomplish species and habitat conservation. For example, if the set of activities that may take place on a parcel of land is limited as a result of critical habitat designation, and thus the market value of the land is reduced, this reduction in value represents one measure of opportunity cost. Similarly, the costs incurred by a Federal action agency to consult with NMFS under section 7 represent opportunity costs of salmon conservation, as the time and effort associated with those consultations may have been spent on other endeavors absent the critical habitat designation.

19. At the guidance of the Office of Management and Budget (OMB) and in compliance with Executive Order 12866, "Regulatory Planning and Review," Federal agencies measure changes in economic efficiency to understand how society, as a whole, will be affected by a regulatory action. Economists generally characterize opportunity costs in terms of changes in producer and consumer surpluses in affected markets.[9]

20. To quantify the economic impacts of modifications to land uses, the analysis involves the following general steps:

    1. Identify the baseline of economic activity and the statutes and regulations that constrain that activity in the absence of the critical habitat designation;
    2. Identify the types of activities that are likely to be affected by critical habitat designation;
    3. Estimate the costs of modifications needed for the activity to comply with the ESA's critical habitat provisions;
    4. Project over space and time the occurrence of the activities and the likelihood they will in fact need to be modified; and
    5. Aggregate the costs up to the watershed level. The analysis reports impacts at the watershed level both for individual activities (e.g., dam operations) and across activities (e.g., dam operations, agriculture, development, and miscellaneous in-stream activities).

    These steps and other aspects of the analysis are described in greater detail below.

[9] For additional information on the definition of "surplus" and an explanation of consumer and producer surplus in the context of regulatory analysis, see: Gramlich, Edward M., A Guide to Benefit-Cost Analysis (2nd Ed.), Prospect Heights, Illinois: Waveland Press, Inc., 1990; and U.S. Environmental Protection Agency, Guidelines for Preparing Economic Analyses, EPA 240-R-00-003, September 2000, available at http://yosemite.epa.gov/ee/epa/eed.nsf/webpages/Guidelines.html.

2.3.1 BASELINE FOR THE ECONOMIC ANALYSIS

21. The first step in the economic analysis is to identify the baseline level of protection already afforded the salmon's habitat. This section provides a description of the methodology used to identify baseline conditions and incremental impacts stemming from the proposed designation of critical habitat for the salmon.

22. The baseline for this analysis is the existing state of regulation, prior to the designation of critical habitat, that provides protection to the species under the ESA, as well as under other Federal, State and local laws and guidelines. The baseline includes sections 7, 9, and 10 of the ESA, and economic impacts resulting from these protections to the extent that they are expected to occur absent the designation of critical habitat for the species.

- Section 7 of the Act, absent critical habitat designation, requires Federal agencies to consult with NMFS to ensure that any action authorized, funded, or carried out will not likely jeopardize the continued existence of any endangered or threatened species. The portion of the administrative costs of consultations under the jeopardy standard, along with the impacts of project modifications resulting from consideration of this standard, are considered baseline impacts.
- Section 9 defines the actions that are prohibited by the Act. In particular, it prohibits the "take" of endangered wildlife, where "take" means to "harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct."[10] The economic impacts associated with this section manifest themselves in sections 7 and 10.
- Under section 10(a)(1)(B) of the Act, an entity (e.g., a landowner or local government) may develop a Habitat Conservation Plan (HCP) for a listed species of fish or wildlife to meet the conditions for issuance of an incidental take permit in connection with the development and management of a property.[11] The requirements of the HCP may have economic impacts associated with the goal of ensuring that the effects of incidental take are adequately minimized and mitigated. The development and implementation of HCPs is considered a baseline protection for the species and habitat unless the HCP is determined to be precipitated by the designation of critical habitat, or the designation influences stipulated conservation efforts under HCPs.

23. The protection of listed species and habitat is not limited to the ESA. Other Federal agencies, as well as State and local governments, may also seek to protect the natural resources under their jurisdiction. If compliance with the Clean Water Act or State environmental quality laws, for example, protects habitat for the species, such protective efforts are considered to be baseline protections and costs associated with these efforts are not quantified as impacts of critical habitat designation.

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[10] 16 U.S.C. 1532.

[11] U.S. Fish and Wildlife Service, "Endangered Species and Habitat Conservation Planning," August 6, 2002, accessed at http://endangered.fws.gov/hcp/.

2.3.2 IDENTIFYING INCREMENTAL IMPACTS OF CRITICAL HABITAT DESIGNATION

24. This analysis focuses on the incremental impacts of critical habitat designation. The purpose of the incremental analysis is to determine the impacts on land uses and activities from the designation of critical habitat beyond those impacts due to existing required or voluntary conservation efforts being undertaken due to other Federal, State, and local regulations or guidelines.

25. When critical habitat is designated, section 7 requires Federal agencies to ensure that their actions will not result in the destruction or adverse modification of critical habitat (in addition to ensuring that the actions are not likely to jeopardize the continued existence of the species). The added administrative costs of including consideration of critical habitat in section 7 consultations and the additional impacts of implementing project modifications to protect critical habitat are the direct result of the designation of critical habitat. These costs are not in the baseline, and are considered incremental impacts of the rulemaking.

26. Incremental impacts may include the direct costs associated with additional effort for consultations (including new consultations that otherwise would have been limited to jeopardy issues, reinitiated consultations, or new consultations occurring specifically because of the designation) as well as the direct costs associated with project modifications that would not have been required under the jeopardy standard. Additionally, incremental impacts may include indirect impacts resulting from reaction to the potential designation of critical habitat (e.g., developing habitat conservation plans (HCPs) in an effort to avoid designation of critical habitat), and triggering of additional requirements under State or local laws intended to protect sensitive habitat. Uncertainty and perceptional effects on markets may also result. The nature of these impacts is described in greater detail below.

2.3.2.1 Direct Impacts

27. The direct, incremental impacts of critical habitat designation stem from the consideration of the potential for destruction or adverse modification of critical habitat during section 7 consultations. The two categories of direct, incremental impacts of critical habitat designation are: 1) the administrative costs of conducting section 7 consultation; and 2) implementation of any project modifications requested by NMFS through section 7 consultation to avoid or minimize potential destruction or adverse modification of critical habitat.

Administrative Section 7 Consultation Costs

28. Parties involved in section 7 consultations include NMFS or the U.S. Fish and Wildlife Service (FWS), a Federal action agency, and in some cases, a private entity involved in the project or land use activity. The Federal action agency is the liaison with NMFS. While consultations are required for activities that are authorized, funded, or carried out by a Federal agency (termed activities with a "Federal nexus") and may affect the species regardless of whether critical habitat is designated, the designation may increase the effort for consultations if the project or activity in question may affect critical habitat.

29. In general, three different scenarios associated with the designation of critical habitat may trigger incremental administrative consultation costs:

    1. **Additional effort to address adverse modification in a new consultation -** New consultations taking place after critical habitat designation may require additional effort to address critical habitat issues above and beyond those raised by the listing of the species. In this case, only the additional administrative effort required to consider critical habitat is considered an incremental impact of the designation.

    2. **Re-initiation of consultation to address adverse modification -** Consultations that have already been completed on a project or activity may require re-initiation to address critical habitat. In this case, the costs of re-initiating the consultation, including all associated administrative and project modification costs, are considered incremental impacts of the designation.

    3. **Incremental consultation resulting entirely from critical habitat designation -** Critical habitat designation may trigger additional consultations that would not occur absent the designation (e.g., for an activity that may affect the critical habitat but not the species). All administrative and project modification costs associated with incremental consultations are considered incremental impacts of the designation.

30. The administrative costs of these consultations vary depending on the specifics of the project, and it may not be possible to predict the level of effort required for each future consultation. One way to address this uncertainty is to show a range of possible consultation costs. A review of consultation records and discussions with FWS field offices provided the range of administrative costs employed in this analysis. Exhibit 2-1 presents the midpoints of these ranges. Subsequent chapters provide additional information on the specific values employed to estimate the cost of consultations associated with particular activities.

EXHIBIT 2-1. MEDIAN VALUES FOR ADMINISTRATIVE CONSULTATION COSTS (2007 DOLLARS)

INCREMENTAL ADMINISTRATIVE COSTS OF CONSULTATION ($2007)					
CONSULTATION TYPE	NMFS	FEDERAL AGENCY	THIRD PARTY	BIOLOGICAL ASSESSMENT	TOTAL COSTS
INCREMENTAL CONSULTATION RESULTING ENTIRELY FROM CRITICAL HABITAT DESGINATION					
Technical Assistance	$530	n/a	$1,050	n/a	$1,500
Informal	$2,300	$2,900	$2,050	$2,000	$9,500
Formal	$5,150	$5,800	$3,500	$4,800	$19,500
Programmatic	$15,500	$13,000	n/a	$5,600	$34,100
RE-INITIATION OF CONSULTATION TO ADDRESS ADVERSE MODIFICATION					
Technical Assistance	$265	n/a	$525	n/a	$750
Informal	$1,150	$1,450	$1,030	$1,000	$4,750
Formal	$2,580	$2,900	$1,750	$2,400	$9,750
Programmatic	$7,750	$6,480	n/a	$2,800	$17,000
ADDITIONAL EFFORT TO ADDRESS ADVERSE MODIFICATION IN A NEW CONSULTATION					
Technical Assistance	$133	n/a	$263	n/a	$375
Informal	$575	$725	$513	$500	$2,380
Formal	$1,290	$1,450	$875	$1,200	$4,880
Programmatic	$3,880	$3,240	n/a	$1,400	$8,510

Source: IEc analysis of full administrative costs is based on data from the Federal Government Schedule Rates, Office of Personnel Management, 2007, and a review of consultation records from several FWS field offices across the country conducted in 2002.
Notes:
1. Totals may not sum due to rounding.
2. Estimates reflect average hourly time required by staff.

Section 7 Project Modification Impacts

31. Section 7 consultation considering critical habitat may also result in project modification recommendations specifically addressing potential destruction or adverse modification of critical habitat. For new consultations that otherwise would have been limited to jeopardy issues and for re-initiations of past consultations to consider critical habitat, the economic impacts of project modifications undertaken to avoid or minimize adverse modification are considered incremental impacts of critical habitat designation. For consultations that are forecast to occur specifically because of the designation (incremental consultations), impacts of all associated project modifications are assumed to be incremental impacts of the designation.

32. Specific analytic methods employed to project the likelihood of consultation and the likelihood of modification, as well as the methods employed to quantify the economic impacts of project modifications, vary by land use activity and modification type. These

methods are discussed in detail later in this report as part of each activity-specific analysis.

2.3.2.2 Indirect Impacts

33. The designation of critical habitat may, under certain circumstances, affect actions that do not have a Federal nexus and thus are not subject to the provisions of section 7 of the Act. Indirect impacts are those unintended changes in economic behavior that may occur outside of the Act, through other Federal, State, or local actions, that are caused by the designation of critical habitat. This section identifies common types of indirect impacts that may be associated with the designation of critical habitat. When these types of conservation efforts and economic effects occur as a result of critical habitat designation, they are appropriately considered incremental impacts.

Habitat Conservation Plans

34. Under section 10 of the Act, landowners seeking an incidental take permit must develop an HCP to counterbalance the potential harmful effects that an otherwise lawful activity may have on a species. The purpose of the habitat conservation planning process is to ensure that the effects of incidental take are adequately minimized and mitigated. Thus, HCPs are developed to ensure compliance with section 9 of the Act and to meet the requirements of section 10 of the Act.

35. Application for an incidental take permit and completion of an HCP are not required or necessarily recommended by NMFS as a result of critical habitat designation. In certain situations, however, the new information provided by the proposed critical habitat rule may prompt a landowner to apply for an incidental take permit. For example, a landowner may have been previously unaware of the potential presence of the species on his or her property, and expeditious completion of an HCP may offer the landowner regulatory relief in the form of exclusion from the final critical habitat designation. In this case, the effort involved in creating the HCP and undertaking associated conservation actions is considered an incremental effect of designation.

Other State and Local Laws

36. Under certain circumstances, critical habitat designation may provide new information to a State or local government about the sensitive ecological nature of a geographic region, potentially triggering additional economic impacts under State or local laws. In cases where these impacts would not have been triggered absent critical habitat designation, they are considered indirect, incremental impacts of the designation.

Additional Indirect Impacts

37. In addition to the indirect effects noted above, project proponents, land managers and landowners may face additional indirect impacts, including the following:

- **Time Delays -** Both public and private entities may experience incremental delays for projects and other activities due to requirements associated with the need to reinitiate the section 7 consultation process and/or compliance with other laws triggered by the designation. To the extent that delays result from the

designation, they are considered indirect, incremental impacts of the designation.

- **Regulatory Uncertainty** - NMFS conducts each section 7 consultation on a case-by-case basis and issues a biological opinion on formal consultations based on species-specific and site-specific information. As a result, government agencies and affiliated private parties who consult with NMFS under section 7 may face uncertainty concerning whether project modifications will be recommended by NMFS and what the nature of these modifications will be. This uncertainty may diminish as consultations are completed and additional information becomes available on the effects of critical habitat on specific activities. Where information suggests that regulatory uncertainty stemming from the designation may affect a project or economic behavior, associated impacts are considered indirect, incremental impacts of the designation.
- **Stigma -** In some cases, the public may perceive that critical habitat designation may result in limitations on private property uses above and beyond those associated with anticipated project modifications or regulatory uncertainty. Public attitudes about the limits or restrictions that critical habitat may impose can cause real economic effects, regardless of whether such limits are actually imposed. All else equal, a property that is designated as critical habitat may have a lower market value than an identical property that is not within the boundaries of critical habitat due to perceived limitations or restrictions. As the public becomes aware of the true regulatory burden imposed by critical habitat, the impact of the designation on property markets may decrease. To the extent that potential stigma effects on markets are probable and identifiable, these impacts are considered indirect, incremental impacts of the designation.

2.4 PRESENTATION OF RESULTS

2.4.1 GEOGRAPHIC SCOPE

38. The 4(b)(2) exclusion process is conducted for a "particular area," not for the critical habitat as a whole. This analysis is therefore conducted at a geographic scale that divides the area under consideration into smaller subareas. The statute does not specify the exact geographic scale of these "particular areas." For the purposes of this analysis, a "particular area" is defined as a standard watershed unit, as mapped by the U.S. Geological Service and described by ten-digit, fifth-field hydrologic unit codes (referred to in this report as HUC 10s, HUCs, or simply watersheds). The study area comprises 105 HUCs, ranging in size from 21,000 to 379,000 acres.

39. To be consistent with NMFS' recovery planning efforts for the salmon, the analysis also considers impacts by Salmon Habitat Recovery Unit (SHRU). The study area is comprised of three SHRUs, as described in Exhibit 2-2. Results of the analysis are aggregated and presented at both the SHRU level and the HUC level, allowing NMFS to make 4(b)(2) exclusion decisions at a more refined geographic scale.

EXHIBIT 2-2. SALMON HABITAT RECOVERY UNITS

SHRU NAME	NUMBER OF HUCS WITHIN SHRU	RIVER MILES IN SHRU	AREA OF SHRU (ACRES)
Downeast Coastal	14	2,587	1,786,503
Merrymeeting Bay	45	8,661	6,712,008
Penobscot Basin	46	7,966	5,707,724
Total	**105**	**19,214**	**14,206,235**

2.4.2 ANALYTIC TIME FRAME

40. The analysis estimates impacts based on activities that are reasonably foreseeable, including activities that are currently authorized, permitted, or funded, or for which proposed plans are currently available to the public. In general, the time frame over which data are available to project land uses in the study area is 20 years. In most cases, therefore, the analysis estimates economic impacts from 2008 (the year in which NMFS first proposed critical habitat designation for the Gulf of Maine DPS of Atlantic salmon) through 2027 (20 years later). In the case of hydropower dams, however, section 7 consultations presumably would occur concurrent with the relicensing of projects by the Federal Energy Regulatory Commission. Relicensing schedules are typically on a 30- to 50-year rotation. The analysis of the effect of critical habitat designation on hydropower projects therefore considers impacts over a 50-year time frame.

2.4.3 DISCOUNTING IMPACTS OVER TIME

41. The analysis employs standard discounting techniques to calculate the present value of economic impacts that are projected to occur in the future. The present value (PV_c) of impacts projected to occur from year t to T is measured in 2007 dollars according to the following standard formula:

$$PV_c = \sum_{t=t_0}^{t=T} \frac{C_t}{(1+r)^{t-2007}}$$

C_t = cost of species conservation efforts in year t

r = discount rate

42. To calculate present values, guidance provided by OMB specifies the use of a real discount rate of seven percent. In addition, OMB recommends sensitivity analysis using other discount rates, such as three percent, which some economists believe better reflects the social rate of time preference.[12] Accordingly, the analysis presents impacts at seven

[12] U.S. Office of Management and Budget, Circular A-4, September 17, 2003 and U.S. Office of Management and Budget, "Draft 2003 Report to Congress on the Costs and Benefits of Federal Regulations; Notice," 68 Federal Register 5492, February 3, 2003.

percent and provides a sensitivity analysis in Appendix A, summarizing impacts by particular area assuming a discount rate of three percent.

2.5 SUMMARY

43. The economic framework applied in this report sums project-level impacts to estimate the total impact of designating particular areas as critical habitat. This framework provides NMFS meaningful information for the 4(b)(2) exclusion process to distinguish between areas that have a relatively high or low benefit of exclusion. This information supports the use of a modified cost-effectiveness approach in designating critical habitat.

CHAPTER 3 | HYDROPOWER

3.1 INTRODUCTION

1. This chapter assesses the potential impacts of designating critical habitat for the Gulf of Maine DPS of Atlantic Salmon on hydropower projects in the study area. The primary focus of the analysis is the impact of critical habitat designation on conventional hydropower facilities, i.e., facilities that employ dams to impound and/or divert a river's natural flow for the purpose of producing power. The study area includes a large number of these facilities. In addition, the analysis considers the potential impact of critical habitat designation on tidal energy projects, which exploit the natural ebb and flow of ocean tides to produce power. At present, no tidal energy facilities are located within the study area; however, a tidal energy firm has received two preliminary permits to explore the feasibility of developing such projects. In light of the interest in this emerging technology, the analysis considers potential impacts on tidal facilities as well as conventional hydropower operations.

2. The impact of tidal energy projects on the Atlantic salmon and its habitat has not been extensively studied. In comparison, the impacts of conventional hydropower operations on the species and its habitat are much better understood. The dams associated with these facilities can impede or prevent the natural migration of the species and affect the physical and biological features of salmon habitat, disrupting stream connectivity and altering natural hydrologic, geomorphic, and thermal regimes. Alterations to stream flows associated with dams impede the salmon's access to spawning and rearing habitats and prevent downstream migration for smolts. Even at dams where fish passage exists, impoundments behind the dams can confuse smolts during downstream emigration, which can slow the migration process and increase predation. In addition to their impact on connectivity, dams may negatively alter salmon habitat by obstructing downstream sediment transport and causing fluctuations in water temperature, stream flows, and water levels.[1]

[1] Atlantic Salmon Biological Review Team, *Status Review for Anadromous Atlantic Salmon (Salmo salar) in the United States*, July 2006.

3. Both tidal energy projects and conventional hydropower projects within the study area are subject to licensing by the Federal Energy Regulatory Commission (FERC), providing a nexus for section 7 consultation.[2] For conventional hydropower projects, the analysis assumes that NMFS will consult in conjunction with FERC's relicensing review.[3] For tidal energy projects, the analysis assumes that NMFS will engage with FERC in a formal consultation considering the salmon and its habitat before FERC issues a license for construction and operation. The analysis incorporates the administrative costs of these consultations in its overall estimate of the potential impacts of critical habitat designation.

4. The design and location of tidal energy projects that may be developed within the study area is highly uncertain. Without this information, NMFS cannot specify the project modifications (if any) that it might request, and the potential costs of such modifications are excluded from the analysis. In contrast, NMFS is able to identify a number of potential project modifications for conventional hydropower facilities. The changes that NMFS may request include:

   - Provision of upstream and downstream fish passage;
   - Addition of fish screens to diversions and intake structures;
   - Analysis of the dam's impact on fish passage and survival;
   - Implementation of water quality and temperature studies and controls;
   - Changes in flow regimes, including seasonal restrictions, flow augmentation, or spill requirements; or
   - Dam removal.[4]

   The projected impact of critical habitat designation on conventional hydropower facilities is based upon the costs associated with several of these modifications.

[2] As described in Section 3.2, FERC is the primary Federal agency responsible for issuing licenses for all non-federal hydroelectric projects within its jurisdiction. Hydropower dams within the study area are either licensed by FERC or must apply for an exemption from FERC licensing. The procedures for applying for exemptions are the same as those described for a license application (Federal Energy Regulatory Commission, April 2001, Hydroelectric Project Licensing Handbook). FERC also issues preliminary permits (for feasibility studies) and licenses (for construction and operation) for tidal energy projects.

[3] While NMFS has played a role in ensuring that dam operations consider salmon conservation, NMFS' Northeast Region has not previously participated in section 7 consultations specifically regarding hydropower activities and Atlantic salmon. Consultations have occurred, however, on hydropower activities considering other species of salmon. For example, consultations on West Coast salmon and steelhead have addressed a number of hydropower actions, including licensing/relicensing of projects; review of operations plans; construction of new projects; modifications to dam structures (e.g., installation of fish passage facilities); changes in operations (e.g., changes in flow regimes); and removal of dams.

[4] The list of potential project modifications was derived from review of existing management documents and personal communications with NMFS.

5. Exhibit 3-1 summarizes the estimated economic impacts of critical habitat designation on conventional hydropower operations and tidal energy projects. The remainder of this chapter provides additional detail on the generation of these estimates. Specifically:

- Section 3.2 presents a profile of conventional hydropower operations within the region, including a discussion of existing Federal and State regulations that apply to such operations;
- Section 3.3 identifies hydropower dams in the study area;
- Section 3.4 details the analysis of potential impacts on conventional hydropower projects;
- Section 3.5 describes the potential for development of tidal energy projects within the study area, and the potential effect of salmon conservation measures on these projects;
- Section 3.6 summarizes the results of the analysis; and
- Section 3.7 notes key caveats and assumptions.

EXHIBIT 3-1. IMPACTS OF ATLANTIC SALMON CRITICAL HABITAT DESIGNATION ON HYDROPOWER ACTIVITIES

SALMON HABITAT RECOVERY UNIT	TOTAL PRESENT VALUE IMPACTS	ANNUALIZED IMPACTS
Downeast Coastal	$4,920,000	$357,000
Merrymeeting Bay	$168,000,000	$12,200,000
Penobscot Basin	$64,300,000	$4,660,000
Total	**$237,000,000**	**$17,200,000**

1. Impact estimates reflect a 50-year time horizon (2008-2057) over which impacts are discounted at an annual rate of 7 percent. The 50-year horizon reflects the time frame over which the existing dams are scheduled for relicensing.
2. Entries may not sum to totals reported due to rounding.

3.2 PROFILE OF REGIONAL HYDROPOWER OPERATIONS

3.2.1 REGIONAL HYDROPOWER PRODUCTION

6. Hydropower is a significant energy source in Maine. The Energy Information Administration (EIA) reports that Maine generated 16.8 million Megawatt-hours of electricity in 2006, approximately 25 percent of which was generated from hydroelectric facilities.[5] Exhibit 3-2 provides a summary of net electricity generation in Maine by

[5] U.S. Department of Energy, Energy Information Administration, Table 5. Electric Power Industry Generation by Primary Energy Source, 1990 Through 2006, accessed at http://www.eia.doe.gov/cneaf/electricity/st_profiles/maine.html on January 31, 2008.

energy source in 2006. Hydropower ranked second in net electricity generation, behind only natural gas.

EXHIBIT 3-2. NET ELECTRICITY GENERATION IN MAINE BY PRIMARY ENERGY SOURCE (2006)

ENERGY SOURCE	2006 ELECTRICTY GENERATION (MILLION MEGAWATT-HOURS)	PERCENT OF TOTAL 2006 ELECTRICITY GENERATION
NATURAL GAS	7.3	43.4%
HYDROELECTRIC	4.3	25.4%
WOODCHIPS, BIOMASS, AND OTHER RENEWABLES	3.9	23.6%
PETROLEUM	0.6	3.5%
COAL	0.3	1.9%
OTHER	0.4	2.1%
TOTAL	16.8	100%

Source: U.S. Department of Energy, Energy Information Administration, Table 5. Electric Power Industry Generation by Primary Energy Source, 1990 Through 2006, accessed at http://www.eia.doe.gov/cneaf/electricity/st_profiles/maine.html on January 31, 2008.

7. Exhibit 3-3 compares net generation from hydroelectric facilities to total electricity generation in Maine from 1996 to 2006. During this period, the percentage of electricity generated from hydroelectric operations ranged from a high of approximately 35 percent (1997) to a low of approximately 12 percent (2002). Since 2002, the percentage of net electricity generation attributed to hydropower has increased to approximately 25 percent. Over the same period, net generation from hydropower increased from 2.7 million Megawatt-hours (MW hours) to 4.3 million MW hours.

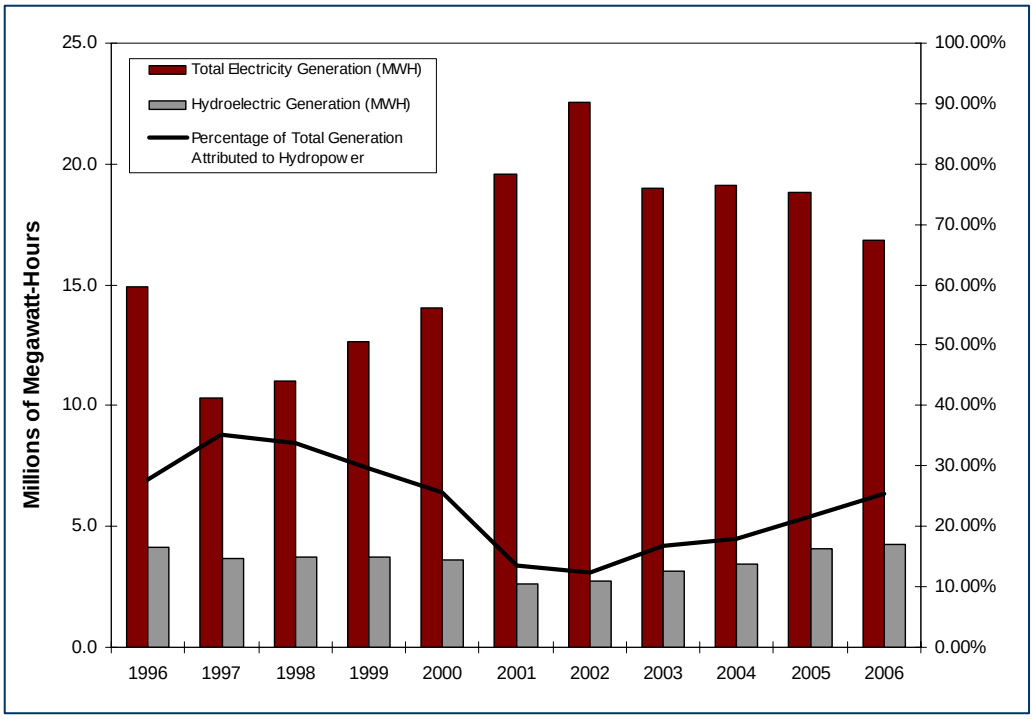
8. Hydropower is a less significant energy source in New Hampshire, accounting for approximately 1.5 million MW hours in 2006, approximately 14 percent of the total electricity generation in the State. In total, New Hampshire generated approximately 22.0 million MW hours of electricity in 2006, with nuclear (43 percent) and natural gas (27 percent) facilities accounting for approximately 70 percent of the power generated.

9. As of January 1, 2007, the Maine Department of Environmental Protection (MEDEP) reports that Maine hosts 103 active hydropower projects, involving 134 Federal Energy Regulatory Commission (FERC) licensed or exempt dams. In addition, the State reports 23 hydropower projects that do not fall under FERC's jurisdiction.[6,7] The total installed capacity for all Maine hydropower projects is approximately 766 Megawatts, with 97 percent of available capacity derived from FERC licensed or exempt projects.

[6] Maine Department of Environmental Protection, *Hydropower Projects in Maine*, January 1, 2007.

[7] Non-jurisdictional projects are those that fall outside FERC's jurisdiction under the terms of the Federal Power Act.

EXHIBIT 3-3. NET HYDROELECTRIC GENERATION IN COMPARISON TO TOTAL NET GENERATION IN MAINE FROM 1996 TO 2006.



Source: U.S. Department of Energy, Energy Information Administration, Table 5. Electric Power Industry Generation by Primary Energy Source, 1990 Through 2006, accessed at http://www.eia.doe.gov/cneaf/electricity/st_profiles/maine.html on January 31, 2008.

10. Maine hydropower projects are concentrated in three major watersheds, all of which are within the study area for this analysis: the Androscoggin River watershed; the Kennebec River watershed; and the Penobscot River watershed. Over 90 hydroelectric facilities are located within these watersheds.[8] Additional hydroelectric facilities are scattered throughout Maine, including concentrations in the Saco River and St. Croix River watersheds, which are outside the study area.

11. According to the U.S. Census Bureau, the hydropower industry in Maine employed 139 people in 2005.[9] To the extent that this information does not include employees at industrial hydropower facilities (i.e., those facilities such as paper mills that use hydropower to run industrial processes) or those employees that work out-of-State (e.g.,

[8] Atlantic Salmon Biological Review Team, Status Review for Anadromous Atlantic Salmon (Salmo salar) in the United States, July 2006.

[9] U.S. Bureau of the Census, 2005 County Business Patterns, accessed at http://www.census.gov/epcd/cbp/view/cbpview.html on January 31, 2008.

administrative jobs located at corporate headquarters), these estimates may underestimate the employment related to Maine hydropower projects.

12. Similar to other electricity producers in New England, hydropower generators sell their electricity through wholesale electricity markets or contracts with utilities and suppliers. Power is then distributed through transmission lines, where it is stepped down for local transmission.[10] Consumers of electric power include residential, industrial, and commercial interests. In 2000, Maine consumed approximately 4.1 million MW hours of electricity generated from hydropower.[11]

3.2.2 REGULATION OF HYDROPOWER PROJECTS

13. Multiple Federal and State regulations affect the operation of hydropower projects and provide protection to the salmon. This section describes current regulation of hydropower activities as it relates to salmon conservation.

3.2.2.1 Federal Regulation of Hydropower Projects

Federal Power Act[12]

14. The Federal Power Act (FPA) requires all non-Federal hydropower projects located on navigable waters of the United States to be licensed. FERC has responsibility for national energy regulatory issues, including the exclusive authority under the FPA to license the construction of new hydropower projects; issue licenses for the continuance of existing projects (relicensing); and oversee ongoing operations, including dam safety inspections and environmental monitoring.[13] FERC is responsible for dam safety at over 2,600 licensed and exempted dams and related water retention structures in the United States.[14] Presently, FERC has issued 71 active licenses and 24 exemptions in Maine, along with 41 active licenses and 42 exemptions in the State of New Hampshire.[15,16]

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[10] Iso New England, *Reliable Energy*, undated, accessed at http://www.iso-ne.com/nwsiss/grid_mkts/elec_works/oview_brochure.pdf on February 11, 2008.

[11] U.S. Department of Energy, Energy Information Administration, Table F14: Hydroelectric Power and Geothermal Energy Consumption Estimates by Sector, 2005, accessed at http://www.eia.doe.gov/emeu/states/sep_fuel/html/fuel_hy_ge.html on February 12, 2008.

[12] 16 U.S.C. § 791-828c, as amended.

[13] U.S. Department of Energy, Federal Energy Regulatory Commission, "Industries: Hydropower," accessed at http://www.ferc.gov/industries/hydropower.asp on January 31, 2008.

[14] U.S. Department of Energy, Federal Energy Regulatory Commission, "Industries: Hydropower," accessed at http://www.ferc.gov/industries/hydropower/gen-info/regulation/origin.asp on January 31, 2008.

[15] U.S. Department of Energy, Federal Energy Regulatory Commission, "Issued Licenses as of 1/16/08" and "Issued Exemptions as of 1/16/08," accessed at http://www.ferc.gov/industries/hydropower/gen-info/licensing.asp on January 31, 2008.

[16] Note that hydroelectric projects of less than 5 Megawatts installed capacity may apply for exemption to FERC licensing if the site and owners meet certain conditions. In addition, small conduit hydroelectric projects, up to 15 Megawatts, may apply for a Conduit Exemption. See Federal Energy Regulatory Commission, *Handbook for Hydroelectric Project Licensing and 5 MW Exemptions from Licensing*, April 2004, for more information on the exemption process.

15. FERC hydropower licenses are issued for a period of up to 50 years, although discussions with MEDEP indicate that, recently, licenses have been approved for 30 year periods.[17] The relicensing process often involves bringing dams into compliance with regulatory standards developed since issuance of the previous license, such as the Clean Water Act (CWA) and Endangered Species Act (ESA).[18,19] As required by the FPA, FERC hydropower relicensing must be conducted in light of laws and regulations that are in effect at the time of license renewal. Specifically, section 10(j) of the Federal Power Act was promulgated to ensure that FERC consider both power and non-power resources during the relicensing process. Thus, FERC may require operators to modify stream flow, water levels, or make other modifications to accommodate human health, wildlife, and aquatic habitat needs.

16. Particularly relevant to this analysis, section 18 of the FPA states that FERC shall require the construction, operation, and maintenance by a licensee at its own expense of fish passage if prescribed by the Secretary of the Interior (delegated to the U.S. Fish and Wildlife Service (FWS)) or the Secretary of Commerce (delegated to NMFS).[20] The recommendation to install or improve fish passage may be brought about through consultation under section 7 of the ESA or through section 18 of the FPA. Past consultations under section 18 of the FPA have resulted in the installation of fish passage at Maine hydropower projects. Recent examples of NMFS and/or FWS requiring fish passage under section 18 include requiring dam operators at the Orono Dam (Stillwater River) to design and implement upstream fish passage for diadromous species within three years of the issuance of a new license (2005), and requiring the gradual installation of fish passage for anadromous species at the Lockwood Dam on the Kennebec River.[21,22]

Clean Water Act[23]

17. The CWA provides the EPA and States a variety of regulatory and non-regulatory tools to reduce direct pollutant discharges into waterways, finance municipal wastewater treatment facilities, and manage polluted runoff in order to support "the protection and propagation of fish, shellfish, and wildlife and recreation in and on the water." Key water quality protections of the CWA related to hydropower operations include the NPDES permit program, which is administered by the State of Maine and ensures that point

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[17] Margerum, Mark, Maine Department of Environmental Protection, Personal Communication, January 17, 2008.

[18] United States Environmental Protection Agency, *National Management Measures to Control Nonpoint Source Pollution from Hydromodification*, July 2007, EPA 841-B-07-002.

[19] U.S. Department of Energy, Federal Energy Regulatory Commission, Division of Hydropower Administration and Compliance, *Compliance Handbook,* March 2004.

[20] Federal Power Act, 16 U.S.C. § 803(j) (1986).

[21] U.S. Department of Energy, Federal Energy Regulatory Commission, *Order On Offer of Settlement and Issuing New License,* 113 FERC ¶62,181, December 8, 2005.

[22] U.S. Department of Energy, Federal Energy Regulatory Commission, *Order Issuing New License,* 110 FERC ¶ 61,240, March 4, 2005.

[23] 33 U.S.C. 1251 et seq. 1987.

sources of pollution meet State water quality standards. In addition, to avoid exceeding water quality standards, Section 401 of the CWA requires Federal agencies to obtain certification from the State before issuing permits that would result in increased pollutant loads.[24] These water quality maintenance tools may benefit Atlantic salmon regardless of critical habitat designation.

Rivers and Harbors Act[25]

18. The Rivers and Harbors Act (RHA) places Federal investigations and improvements of rivers, harbors and other waterways under the jurisdiction of the USACE and requires that all investigations and improvements include due regard for wildlife conservation. This Act may provide protection to Atlantic salmon from in-stream construction activities, such as construction of a dam or tidal energy project. Under sections 9 and 10 of the RHA, the USACE is authorized to regulate the construction of any structure or work within navigable waters.

National Environmental Policy Act[26]

19. The National Environmental Policy Act (NEPA) requires that all Federal agencies conduct a detailed environmental impact statement (EIS) in every recommendation or report on proposals for legislation and other major Federal actions significantly affecting the quality of the human environment. Through its requirement to consider alternatives, the NEPA process may provide protection to Atlantic salmon for hydropower-related activities that have Federal involvement.

Other Federal Statutes and Regulations that Apply to Land Use Activities

20. The following statutes and regulations may also directly or indirectly affect hydropower operations and their impacts on Atlantic salmon habitat in the study area.

- **Fish and Wildlife Conservation Act (FWCA):** The FWCA encourages States to develop, revise, and implement, in consultation with Federal, State, local and regional agencies, a plan for the conservation of fish and wildlife, particularly species indigenous to the state.[27]
- **Magnuson-Stevens Fishery Conservation and Management Act:** This Act requires identification of essential fish habitat in fishery management plans and consideration of actions to ensure the conservation and enhancement of habitat.[28]

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[24] U.S. Environmental Protection Agency. Introduction to the Clean Water Act. Accessed at: http://www.epa.gov/r5water/cwa.htm on February 14, 2008.

[25] 33 USC §§ 401 et seq. 1938.

[26] 42 USC §§ 4321-4345 1969.

[27] 16 USC §§ 2901-2911 1980, as amended.

[28] 16 USC §§ 1801-1882 1976, as amended.

- **Water Resources Development Act (WRDA):** WRDA authorizes the construction or study of USACE projects and outlines environmental assessment and mitigation requirements.[29]
- **Anadromous Fish Conservation Act (AFCA):** The AFCA authorizes the Secretary of the Interior to enter into agreements with States and other non-Federal interests to conserve, develop and enhance the anadromous fish resources of the U.S.

3.2.2.2 State of Maine Regulation of Hydropower Projects

21. To ensure that Maine hydropower projects meet environmental and water quality standards, the State regulates hydropower development through the permitting of hydroelectric projects; the prohibition of the construction of new dams on specified river segments; and the certification of water quality standards for all FERC licensed activity. The Maine Waterway Development and Conservation Act (MWDCA) requires operators to apply for a single hydropower permit for the following:[30]

- Construction of hydropower projects;
- Structural alteration of a hydropower project in ways that change water levels or stream flows above or below a dam; and
- Maintenance and repair of existing hydropower projects involving dredging or filling of specified water bodies (e.g., great ponds, coastal wetlands), or dredging or filling on land adjacent to those waters.[31]

22. MEDEP reviews MWDCA permit applications for hydropower projects located in organized municipalities, while the Land Use Regulation Commission (LURC) administers permits in unorganized townships and plantations.[32] During the review process, the permit application is circulated for review and comment among various Maine executive agencies, including the Departments of Conservation, Inland Fisheries and Wildlife, Transportation, and Marine Resources; the Maine Historic Preservation Commission; the State Planning Office; the Public Utilities Commission; and relevant municipal offices. The MEDEP or LURC may subject the approval of the permit to conditions, including the establishment of water levels, stream flows, and the construction and maintenance of fish passage. Permit approval requires the demonstration of eight

[29] 33 USC §§ 2201-2330 1986, as amended.

[30] 38 M.R.S.A. Sections 630-640.

[31] In general, MWDCA permits are not required for normal maintenance and repair of existing hydropower facilities, provided that no dredging or filling is involved. State of Maine, Department of Environmental Protection, *A Guide to the Maine Rivers Policy and Water Development and Conservation Act*, September 2007.

[32] State of Maine, Department of Environmental Protection, *A Guide to the Maine Rivers Policy and Water Development and Conservation Act*, September 2007.

specific criteria, including demonstration of economic benefits, dam safety, technical and financial feasibility, and efforts to mitigate adverse environmental impacts.[33]

23. The Maine Rivers Policy prohibits the construction of dams on certain "outstanding" river segments, as specified in 12 M.R.S.A. Section 403.[34] Outstanding rivers are those deemed by the legislature to have "unparalleled natural and recreational values, [and] provide irreplaceable social and economic benefits to the people in their existing state."[35] The Policy protects a total of 1,051 miles of 18 rivers and streams. Within the study area, parts of 13 rivers have been designated as outstanding river reaches by the legislature.[36]

24. Pursuant to section 401 of the CWA, all applicants for any activity that results in a discharge to navigable waters must obtain State certification that the activity will not violate water quality standards. The MEDEP is the certifying agency for all (FERC and FERC-exempted) licensing and relicensing hydropower projects in the State. The water quality certification procedures state, "[MEDEP] shall issue or deny certification at the same time it approves or disapproves the proposed project [under MWDCA]. If issued, the certification must state that there is a reasonable assurance that the project will not violate applicable water quality standards."[37]

3.2.2.3 State of New Hampshire Regulation of Hydropower Projects

25. The New Hampshire Department of Environmental Services (NHDES) is the principal entity charged with regulation of hydropower dams in the State. Operators applying for FERC licensing or re-licensing must concurrently apply for a New Hampshire Water Quality Permit from NHDES, pursuant to section 401 of the Clean Water Act and State statute 485-A:17, regulations Env-WS 451-455.[38] The permit requires applicants to characterize general operations at the dam and identify activities that would affect water quality and/or the physical aquatic habitat. NHDES approves permits if the operators demonstrate:

> "The surface waters shall support and maintain a balanced, integrated, and adaptive community of organisms having a species composition, diversity, and functional organization comparable to that of similar natural habitats of a region.

[33] State of Maine, Department of Environmental Protection, *A Guide to the Maine Rivers Policy and Water Development and Conservation Act*, September 2007.

[34] The Maine Rivers Policy, including the list of river reaches protected by the Act, can be found at 12 M.R.S.A Sections 401-406. State of Maine, Department of Environmental Protection, *A Guide to the Maine Rivers Policy and Water Development and Conservation Act*, September 2007.

[35] 12 M.R.S.A Section 403.

[36] All or parts of the following rivers located within the study area have been designated as outstanding rivers by the State of Maine: Dead River; Dennys River; East Machias River; Kennebec River; Machias River; Mattawamkeag River; Moose River; Narraguagus River; Penobscot River; Pleasant River; Rapid River; Sheepscot River; and West Branch Pleasant River. 12 M.R.S.A Section 403.

[37] 38 M.R.S.A Section 635-B.

[38] Piszczek, Paul, New Hampshire Department of Environmental Services, Watershed Management Division, Personal Communication, January 31, 2008.

> Differences from naturally occurring conditions shall be limited to non-detrimental differences in community structure and function." [39]

NHDES typically approves permits contingent upon the applicant meeting a series of conditions specific to the project, which may include increased sampling of dissolved oxygen levels upstream and downstream of the dam, fish passage measures (pursuant to biological and aquatic integrity statutes), and/or site-specific flow requirements. Upon permit approval, NHDES sends the full application to FERC, where the special conditions are incorporated into the FERC license. NHDES has issued three permits for hydropower projects since 2000.[40]

26. In addition to Water Quality Permits, any new construction or modification to an existing facility must file an application for dam construction or reconstruction. The permit requires operators to prepare a site operation plan that details maintenance schedules, safety features, and emergency procedures. Within NHDES, the Bureau of Dams is responsible for granting these permits.[41] Finally, all new dams must also apply for a wetlands permit through NHDES.[42]

3.3 HYDROELECTRIC DAMS IN THE STUDY AREA

27. The National Inventory of Dams (NID) catalogs dams across the country and provides information on key attributes of each dam, such as its purpose, height, and width. The NID identifies more than 400 dams within the study area, including major hydroelectric projects in the Penobscot, Kennebec, and Androscoggin River watersheds. The NID data, however, include information on decommissioned dams and dams that are too small to be subject to Federal permitting and oversight. When considering salmon conservation needs, NMFS therefore relies on the database of dams managed by MEDEP, which maintains data on the location of dams, levees, and impoundments in the State.[43,44]

28. Exhibits 3-4 and 3-5 summarize the distribution of FERC licensed and exempt dams within the study area. Two types of small hydropower projects are eligible for exemptions: small conduit hydroelectric facilities; and projects of five megawatts (MW) or less of installed capacity. The procedures for applying for exemptions are the same, however, as those described for a license, including consideration of species and habitat

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[39] Env-Ws 1703.19 accessed at http://www.des.state.nh.us/rulemaking/adopted2007/Env-Ws1700Interim.pdf on January 31, 2008.

[40] Piszczek, Paul, New Hampshire Department of Environmental Services, Watershed Management Division, Personal Communication, January 31, 2008.

[41] State Of New Hampshire, Department of Environmental Services, Water Division, Dam Bureau, Application to Construct or Reconstruct a Dam, accessed at http://www.des.state.nh.us/Dam/damapp.pdf on January 31, 2008.

[42] Degler, Jocelyn, New Hampshire Department of Environmental Services, Wetlands Bureau, Personal Communication, on January 31, 2008.

[43] Kircheis, Dan and Jeff Murphy, National Marine Fisheries Service, Personal Communication, January 8, 2008.

[44] In the absence of better information, this analysis employs the NID data to locate FERC dams in New Hampshire.

conservation.[45] FERC exempt dams are therefore considered in this analysis along with the licensed projects. In total, 109 dams within the study area are FERC licensed or exempt. The total installed capacity of these dams in Maine is approximately 665 Megawatts, which represents approximately 87 percent of the total hydropower capacity in Maine.[46,47] The dams in New Hampshire represent an additional 57 Megawatts of installed capacity.

29. The largest hydroelectric dams and storage projects within the study area are primarily located in the Penobscot, Kennebec, and Androscoggin watersheds. Most of the larger FERC dams in these basins, which are concentrated on the main stem rivers and large tributaries, are licensed to operate solely in a "run-of-the-river" mode (i.e., inflow generally equals outflow).[48]

30. Exhibit 3-4 shows the distribution of hydropower dams by Salmon Habitat Recovery Unit (SHRU). As the exhibit indicates, the Downeast Coastal SHRU contains three dams that operate under a FERC hydropower license. The Merrymeeting Bay SHRU, which is comprised of both the Kennebec and Androscoggin watersheds, contains 67 (10 in New Hampshire) FERC licensed or exempt dams. Sixty-three of these dams generate electricity, while four are operated for storage or to enhance the operation of facilities downstream. Finally, the Penobscot Basin SHRU contains 39 dams operating under a FERC hydropower license or exemption. Twenty-seven of these dams generate electricity, while 12 others are operated for storage or to enhance facilities downstream.[49]

EXHIBIT 3-4. DAMS LOCATED WITHIN THE STUDY AREA

SALMON HABITAT RECOVERY UNIT (SHRU)	NUMBER OF FERC LICENSED OR EXEMPT DAMS
Downeast Coastal	3
Merrymeeting Bay	67
Penobscot Basin	39
Total	**109**

[45] Federal Energy Regulatory Commission. April 2001. Hydroelectric Project Licensing Handbook.

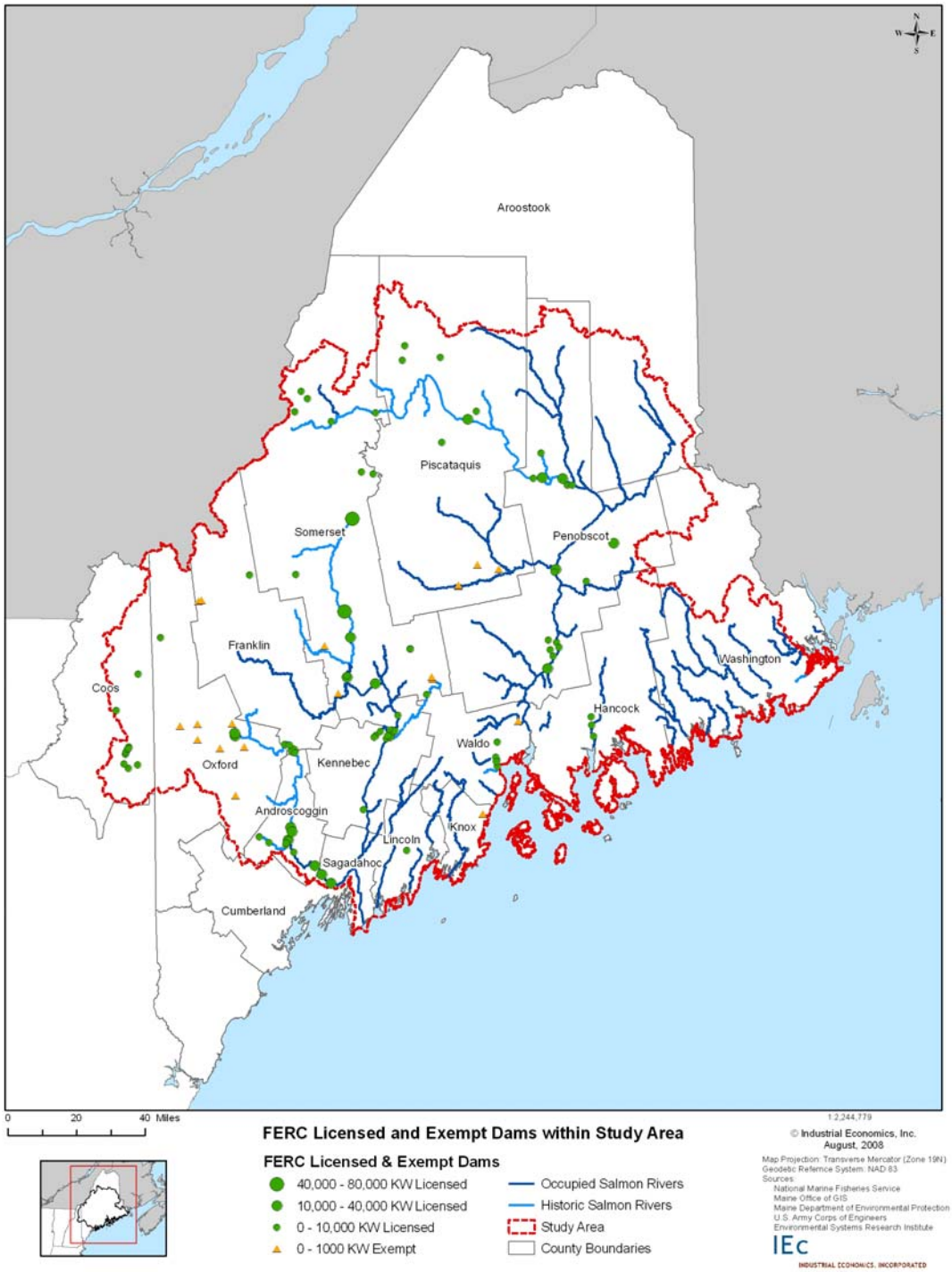
[46] Maine Department of Environmental Protection, *Hydropower Projects in Maine*, January 1, 2007.

[47] MEDEP lists 782 dams in Maine; of these, 529 are located within the study area. The NID lists an additional 659 dams in New Hampshire, 19 of which are located within the study area. IEc analysis of Maine Department of Environmental Protection Maine Impounds GIS data, Army Corps of Engineers National Inventory of Dams GIS data, and Maine Department of Environmental Protection, *Hydropower Projects in Maine*, January 1, 2007.

[48] Atlantic Salmon Biological Review Team, Status Review for Anadromous Atlantic Salmon (Salmo salar) in the United States, July 2006.

[49] IEc analysis of Maine Department of Environmental Protection Maine Impounds GIS data, Army Corps of Engineers National Inventory of Dams GIS data, and Maine Department of Environmental Protection, *Hydropower Projects in Maine*, January 1, 2007.

EXHIBIT 3-5. FERC LICENSED OR EXEMPT HYDROELECTRIC DAMS WITHIN THE STUDY AREA



31. The majority of hydropower projects in the study area are owned by private utility companies or businesses that employ hydroelectric generation to power industrial facilities (e.g., paper mills); however, several municipal utilities also operate dams in the study area. In total, 40 entities own and operate the 109 FERC licensed or exempt dams located in the study area.

3.4 IMPACTS TO CONVENTIONAL HYDROPOWER PROJECTS

32. This section describes the analysis of the economic impacts of critical habitat designation on conventional hydropower projects in the study area. As noted above, the analysis assumes that NMFS will undertake section 7 consultation considering the salmon in conjunction with the relicensing of FERC dams within the study area.

33. Through the section 7 consultation process, NMFS may recommend reasonable and prudent alternatives (RPAs) regarding hydropower projects. RPAs that may be requested for hydropower activities may be broadly divided into three major categories: capital, programmatic, and operational. Capital modifications involve direct investment in new or improved infrastructure, and require additional investment for regular operation and maintenance.[50] Programmatic changes include monitoring of fish passage efficiency and water quality, data collection and research, operation of fish hatcheries, predator control, and habitat improvements or restoration.[51] Operational changes are changes in hydropower production level or method, and may be engendered by modification to the flow regime.[52] This section first estimates the costs of a number of potential capital, programmatic, and operational modifications to hydropower projects. It then discusses the possibility of additional operational changes (i.e., to flow regime) and the potential order of magnitude of impacts that may result. Consistent with the analysis of critical habitat designation for the West Coast salmon and steelhead, this analysis does not quantify the impacts associated with potential requests for changes in flow regime at specific project sites.[53] As described in Section 3.4.2, the information required to quantify such impacts is not currently available.

[50] Capital modifications may include, for example, constructing and maintaining fish passage facilities (including ladders and screens where applicable); collection and transport of fish at particular sites; and installing improved juvenile sampling facilities, surface bypass collectors, and/or spillway weirs.

[51] Programmatic changes may include implementing or improving capture and release programs; monitoring, evaluation, and research programs; gas abatement programs; participation in research initiatives; managing riparian vegetation; controlling erosion and sediment; implementing timing constraints on instream construction; and increased pollution control standards.

[52] Operational changes may include recommendations to improve and manage flows through additional flow augmentation; reduce flow diversions; provide spill to increase fish passage efficiency; operate pools within a specified range; operate turbines within a specified range of efficiency; shut down turbines seasonally; draw down reservoirs; and implement restrictions on ramping rates.

[53] National Marine Fisheries Service, Northwest Fisheries Science Center. August 2005. Final Economic Analysis of Critical Habitat Designation for 12 West Coast Salmon and Steelhead ESUs.

34. Individual hydropower dams vary substantially in their potential for jeopardizing salmon or adversely modifying their critical habitat. As a result, the type and extent of necessary modifications may vary greatly by project. Characteristics such as size and location, as well as the presence or absence of previous modifications (e.g., fish passage facilities), are important considerations in estimating the potential economic impact of critical habitat designation. To reflect some of this variability, this analysis divides hydropower dams into several categories based on available information on site specific characteristics.

35. Communication with NMFS and review of existing salmon management documents identified the following potential section 7 project modifications associated with hydropower activities related to salmon critical habitat:

Capital Changes

- Provide upstream and downstream fish passage, including fish ladders (fishways) for the tributary dams and fish lifts on the main stem dams; and
- Add fish screens to diversions and intake structures.

Programmatic Changes

- Conduct species survival studies; and
- Develop water quality and temperature studies and controls.

Operational Changes

- Operate lifts and ladders to provide effective passage;
- Implement changes in flow regime, including seasonal restrictions, flow augmentation, or spill requirements; and
- Dam removal.

3.4.1 IMPACTS ASSOCIATED WITH PROJECT MODIFICATIONS

36. As noted above, the magnitude of potential modification costs varies widely across dams depending on site-specific characteristics and existing management. This analysis estimates a per-project cost based on the likely suite of capital modifications and programmatic expenses that may be requested via section 7 consultation for the salmon. This likely suite of modifications includes construction of fish passage facilities and monitoring of water quality and fish passage efficiency. To quantify the impacts associated with these modifications, the analysis employs the steps described below.

3.4.1.1. Step 1: Identify Dams That May Require Fish Ladders Or Fish Lifts

37. Fish are generally unable to pass upstream of a hydropower dam unless some fish passage facility is present. As described by the U.S. Office of Technology Assessment, no single solution exists for designing upstream fish passageways; effective fish passage requires

communication among dam operators, engineers, and biologists, along with a thorough understanding of site-specific characteristics.[54]

38. Many types of fish ladders exist (e.g., pool and weir, Denil, Alaska steeppass, vertical slot) to accommodate the needs of various species.[55] Fish ladders have been recommended in the past to accommodate Atlantic salmon, though they are less effective at passing other anadromous fish species that are biologically important to the Atlantic salmon. According to NMFS, diadromous fish communities, such as alewives, American shad, lampreys, and rainbow smelt, serve many ecological functions important to salmon conservation. These species, for example, provide alternate prey sources for predators, and nutrient enrichment and substrate conditioning to the habitat.[56]

39. For the following reasons, NMFS anticipates that fish lifts would serve as the preferred method of fish passage for dams located on large rivers, such as the Penobscot, Androscoggin, and Kennebec.

- Fish ladders in general are less effective than fish lifts at passing the diadromous fish that are an important biological feature of salmon habitat.
- On large rivers, fish ladders are not as effective as fish lifts at handling the volume of diadromous fish in the river, particularly alewives. Though Denil fishways are effective at passing alewives relatively quickly, they lack the capacity to pass large volumes of fish.
- The larger fish ladders that would be necessary for the main stem dams can substantially delay migration and, in some cases, preclude migration of some species.

40. Therefore, for the purpose of forecasting impacts associated with providing fish passage at hydropower dams, the analysis assumes that NMFS would request installation of fish lifts (also called fish elevators) at hydropower projects on the main stem of the three major rivers (the Kennebec, Androscoggin, and Penobscot). On the other rivers, a Denil type fish ladder would most likely be prescribed.[57]

41. The analysis divides dams into two categories: those requiring fish lifts (main stem dams) and those requiring fish ladders (dams within the tributaries). Of the 109 dams in the study area, 32 are located on the main stem of the Kennebec, Androscoggin, and Penobscot Rivers.

42. Employing information on the current operations and existing structures of projects as a baseline for assessing the costs of modifications, dams with known, adequate fish passage were removed from the analysis. The analysis identified 24 dams currently equipped

[54] U.S. Office of Technology Assessment. Fish Passage Technologies: Protection at Hydropower Facilities, OTA-ENV-641 (Washington, DC: U.S. Government Printing Office, September 1995).

[55] Ibid.

[56] Personal communication with Dan Kircheis, National Marine Fisheries Service, February 26, 2008; Saunders, Rory, et. al. 2006. "Maine's Diadromous Fish Community: Past, Present, and Implications for Atlantic Salmon Recovery." *Fisheries.* Vol. 31. 11(537-547).

[57] Personal communication with Dan Kircheis, National Marine Fisheries Service, February 26, 2008.

with fish ladders and five currently equipped with fish lifts within the study area.[58] Of the 24 dams with fish ladders, 12 are located on main stem rivers. Because fish ladders may not allow for effective passage of some diadromous fish species, the analysis quantifies the impact of installing fish lifts at these sites.[59] Conversely, the analysis does not estimate the cost of providing fish passage at dams that are slated for removal (Veazie, Great Works and Fort Halifax) or at dams that have developed plans to improve fish passage independent of critical habitat designation (Milford and Howland).

43. Overall, as a result of future section 7 consultations, the analysis forecasts that 63 dams will incorporate fish ladders and 26 dams will incorporate fish lifts.

3.4.1.2. Step 2: Identify Dams That May Require Other Capital and Programmatic Improvements

44. Other capital costs and programmatic expenses that may be recommended via section 7 consultation are fish screen installation or maintenance, fish passage research, and water quality and temperature monitoring and research. The impacts of implementing these modifications are quantified for all projects at which installation of new or improved fish passage facilities are forecast (89 projects). For facilities with known, adequate fish passage (or plans to soon incorporate adequate passage regardless of critical habitat designation), the analysis assumes that these additional salmon conservation efforts are already being employed.

3.4.1.3. Step 3: Quantify Costs of Project Modifications

45. The cost of the improvements described above may vary considerably depending on the type and scale of the modification, which is driven by multiple site-specific physical features of the hydropower project. Finding similarities across sites is difficult.[60] It is therefore difficult to project costs at particular facilities based on the implementation of similar project modifications at other sites. Absent site-specific biological assessments for each dam, this analysis employs an average cost for each potential modification.

46. The estimated installation cost for fish ladders applied in this analysis represents the average of nine projects with known ladder installation costs in Maine and Massachusetts. Similarly, average fish lift installation costs were calculated from known costs at 12 projects in Maine and Connecticut. Exhibits 3-6 and 3-7 provide information on the derivation of these averages.

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[58] To identify dams with fish ladders and lifts, the analysis referred to a number of sources, including the January 2008 Report to the Joint Standing Committees of Marine Resources and Natural Resources regarding fish passage efforts in Maine; MEDEP's fish passage data; publicly available information from dam owners and management agencies; and personal communication with dam owners and NMFS. While available information identified 24 dams as having a fish ladder and five with fish lifts, this may be an underestimate; therefore, the analysis may overestimate both the number of dams that may require new fish passage facilities and the associated costs.

[59] United States Office of Technology Assessment, *Fish Passage Technologies: Protection at Hydropower Facilities,* OTA-ENV-641 (Washington, DC: U.S. Government Printing Office, September 1995). In some cases, this rule of thumb may overstate impacts (i.e., where existing fish ladders would provide sufficient fish passage).

[60] U.S. Office of Technology Assessment. Fish Passage Technologies: Protection at Hydropower Facilities, OTA-ENV-641 (Washington, DC: U.S. Government Printing Office, September 1995).

EXHIBIT 3-6. AVERAGE INSTALLATION COSTS FOR FISH LADDERS

PROJECT	ESTIMATED COST ($2007)	SOURCE
Pleasant Lake outlet dam on Sebasticook River	$70,000	Maine Department of Marine Resources, "Sebasticook River Fish Passage Projects," accessed at http://maine.gov/dmr/rm/stockenhancement/sebasticookfishproject/sebasticookfishproject.htm on February 9, 2008.
Project on Merrimack River, MA	$115,000	The Charles George Natural Resources Trustee Council. October 2002. "Final Restoration Plan and Environmental Assessment: Charles George Land Reclamation Trust Landfill Superfund Site."
Project on Shawsheen River, MA	$287,000	The Charles George Natural Resources Trustee Council. October 2002. "Final Restoration Plan and Environmental Assessment: Charles George Land Reclamation Trust Landfill Superfund Site."
Pittsfield Project on Kennebec River	$1,510,000	Ridgewood Electric Power Trust V. 10-K. For 12/31/05. EX-99.3. Filed On 9/27/07. SEC File 0-24143, Accession Number 1214659-7-2138. Accessed at http://www.secinfo.com/ d1526c.u22w.4.htm on February 12, 2008.
Anson Project on Kennebec River	$4,520,000	Email from Timothy Konnert, FERC, to Dan Kircheis, NMFS, on February 9, 2009.
Abenaki Project on Kennebec River	$4,830,000	Email from Timothy Konnert, FERC, to Dan Kircheis, NMFS, on February 9, 2009.
Burnham Project on Sebasticook River	$934,000	Email from Timothy Konnert, FERC, to Dan Kircheis, NMFS, on February 9, 2009.
Brunswick Project on the Androscoggin River	$5,750,000	Letter from F. Allen Wiley, Vice President, FPL Energy Maine Hydro LLC, to Mary Colligan, Assistant Regional Administrator, National Marine Fisheries Service, December 5, 2008.
Cataract Project W. Channel Denil on the Saco River	$3,520,000	Letter from F. Allen Wiley, Vice President, FPL Energy Maine Hydro LLC, to Mary Colligan, Assistant Regional Administrator, National Marine Fisheries Service, December 5, 2008.
AVERAGE COST		**$2,390,000**

Notes:
Figures are rounded to three significant digits and may not sum due to rounding.
Estimates are adjusted to $2007 where necessary using the Bureau of Economic Analysis Implicit Price Deflators for Gross Domestic Product.

EXHIBIT 3-7. AVERAGE INSTALLATION COSTS FOR FISH LIFTS

PROJECT	ESTIMATED COST ($2007)	SOURCE
Cataract Project E. Channel Lift on Saco River	$7,640,000	Letter from F. Allen Wiley, Vice President, FPL Energy Maine Hydro LLC, to Mary Colligan, Assistant Regional Administrator, National Marine Fisheries Service, December 5, 2008.
Skelton Project on Saco River	$7,240,000	Letter from F. Allen Wiley, Vice President, FPL Energy Maine Hydro LLC, to Mary Colligan, Assistant Regional Administrator, National Marine Fisheries Service, December 5, 2008.
Greeneville Dam on Shetucket River, CT	$3,190,000	Norwich Public Utilities, "About the Fish Lift," accessed at http://www.norwichpublicutilities.com/fish-lift.html.
Lockwood Project on Kennebec River	$3,260,000	Letter from F. Allen Wiley, Vice President, FPL Energy Maine Hydro LLC, to Mary Colligan, Assistant Regional Administrator, National Marine Fisheries Service, December 5, 2008.
Benton Falls Hydroelectric Station (Winslow Dam) on Sebasticook River*	$1,030,000	Natural Resources Council of Maine, "Fisheries in Rivers Get a Lift," April 9, 2006. Accessed at http://www.nrcm.org/news_detail.asp?news=663 on January 4, 2008.
Worumbo Project on Androscoggin River	$3,960,000	Personal communication with Mark Isaacson at Miller Hydro Group on February 8, 2008 and March 23, 2009.
Saccarappa Falls Project on Presumpscot River	$4,520,000	Friends of Sebago, "FERC Orders Fishways at Presumpscot Dams," accessed at http://www.friendsofsebago.org/finaleis/html on February 9, 2008. Costs are from excerpts of FERC's Presumpscot River Final Environmental Impact Statement (June, 2002).
Mallison Falls Project on Presumpscot River	$2,140,000	Friends of Sebago, "FERC Orders Fishways at Presumpscot Dams," accessed at http://www.friendsofsebago.org/finaleis/html on February 9, 2008. Costs are from excerpts of FERC's Presumpscot River Final Environmental Impact Statement (June, 2002).
Little Falls Project on Presumpscot River	$2,970,000	Friends of Sebago, "FERC Orders Fishways at Presumpscot Dams," accessed at http://www.friendsofsebago.org/finaleis/html on February 9, 2008. Costs are from excerpts of FERC's Presumpscot River Final Environmental Impact Statement (June, 2002).
Gambo Falls Dam on Presumpscot River	$2,120,000	Friends of Sebago, "FERC Orders Fishways at Presumpscot Dams," accessed at http://www.friendsofsebago.org/finaleis/html on February 9, 2008. Costs are from excerpts of FERC's Presumpscot River Final Environmental Impact Statement (June, 2002).
Dundee Falls Dam on Presumpscot River	$4,940,000	Friends of Sebago, "FERC Orders Fishways at Presumpscot Dams," accessed at http://www.friendsofsebago.org/finaleis/html on February 9, 2008. Costs are from excerpts of FERC's Presumpscot River Final Environmental Impact Statement (June, 2002).
Pejepscot Dam on Androscoggin River	$4,000,000	Letter from Charles N. Lucas, Topsham Hydro Partners Limited Partnership, to Mary Colligan, Assistant Regional Administrator, National Marine Fisheries Service, December 5, 2008.
AVERAGE COST		**$3,920,000**

Notes:
Figures are rounded to three significant digits and may not sum due to rounding.
Estimates are adjusted to $2007 where necessary using the Bureau of Economic Analysis Implicit Price Deflators for Gross Domestic Product.
* Source notes that construction of the fish lift was in progress (not complete) and cost $1 million in 2006.

47. In addition to the costs of installing fish ladders and lifts, installation or improvement of fish passage facilities may result in the diversion of water from power generation. The value of the foregone power is included in this analysis as a cost attributable to the designation of critical habitat. Comments provided by hydropower operators on the August, 2008 draft of this analysis indicate that NMFS and FWS generally recommend that licensees divert approximately three to four percent of a project's turbine hydraulic capacity to provide flow for fish passage, and that this results in up to a four percent loss in annual power generation.[61] As the basis for this recommendation the Services reference two studies, one that indicates that fish passage facilities may require up to three percent of turbine capacity as attraction flow, and another that indicates a range of two to five percent.[62, 63] Accordingly, the analysis quantifies the impacts of a four percent decrease in annual hydropower generation at all generating dams for which fish ladder or lift installation is forecasted. The following method is applied to quantify the impact of the anticipated reduction in power generation:

- **Estimate current annual generation of power (KW hours per year).** The analysis employs 2006 data on the utilization of Maine's hydropower capacity to estimate the power produced annually at each affected facility.[64] In 2006, 766,000 KW of installed capacity at hydropower projects in Maine generated 4.3 billion KW hours of power. This is equivalent to approximately 5,614 KW hours for every KW of installed capacity. The analysis applies this figure, coupled with data on each dam's installed capacity, to estimate current annual power generation.
- **Estimate lost generation (KW hours per year).** As described above, the analysis assumes a loss of four percent in annual power generation at affected dams. It makes no assumptions about the timing of this impact.
- **Estimate incremental cost of replacement power (dollars per KW hour).** The analysis assumes that any reduction in the production of hydroelectricity will be offset by increased reliance on electrical generators fueled by natural gas. Based on differences in the average costs of power production for these sources (see Exhibit 3-12), the incremental cost of replacement power, on average, is approximately $0.04 per KW.

[61] Letter from Charles N. Lucas, Topsham Hydro Partners Limited Partnership, to Mary Colligan, Assistant Regional Administrator, NMFS, December 5, 2008; Letter from F. Allen Wiley, Vice President, FPL Energy Maine Hydro LLC, to Mary Colligan, Assistant Regional Administrator, NMFS, December 5, 2008; Letter from Thomas B. Saviello, Verso Paper Corp., to Mary Colligan, Assistant Regional Administrator, NMFS, December 2, 2008; Letter from Jeremy Payne, Executive Director, Independent Energy Producers of Maine, to Mary Colligan, Assistant Regional Administration, NMFS, December 2, 2008.

[62] Quinn, Richard F. "Fish Passage Facilities for *Alosa*." Anadromous *Alosa* Symposium, 1994, pp. 119-127.

[63] Jungwirth, Mathias, Stefan Schmutz, and Steven Weiss. Fish Migration and Bypasses. Fishing News Books. 1998.

[64] Source: Energy Information Administration, Electric Sales, Revenues, and Price, Accessed at http://www.eia.doe.gov/cneaf/electricity/esr/esr_sum.html on February 18, 2008.

- **For each dam, multiply lost generation (KW hours per year) by the incremental cost of replacement power (dollars per KW hour).** This calculation yields an estimate of the annual cost of replacing the foregone power.

48. The analysis does not consider the costs of externalities associated with replacing lost hydropower production with electricity produced from other sources. It is appropriate to note, however, the potential environmental impacts of increased reliance on fossil fuels (e.g., increased generation of air pollutants or greenhouse gases).

49. Exhibit 3-8 presents a summary of the unit cost data employed to estimate the potential impacts of critical habitat designation on conventional hydropower projects. As described above, dams are assigned a combination of these costs (if any) based on their known characteristics and the assumptions made about their fish passage needs. In addition, the analysis assigns an estimate of the administrative costs of formal consultation for every licensed and exempt FERC dam within the study area. As described in Chapter 2 of this report, the average administrative cost to consider adverse modification as part of a section 7 consultation is $4,800. This is not the full cost of a formal section 7 consultation, but the fraction of the total cost assumed to be related to consideration of adverse modification; that is, it excludes costs related to considering jeopardy for the species, which would be incurred even absent the critical habitat designation.

3.4.1.4. Step 4: Discount Impacts According to Expected Date of Section 7 Consultation

50. Section 7 consultation and subsequent project modification are anticipated to occur concurrent with the expiration of current FERC licenses. Relicensing dates for all FERC dams were provided by MEDEP. In the absence of that information (i.e., for the 20 exempt dams), the analysis assumes consultation will be initiated ten years after the designation of critical habitat (FERC's review schedule for exemptions is not explicit). Because FERC issues licenses for between 30 and 50 years, the analysis forecasts consultations occurring in specific years over a 50-year time horizon. Impacts are discounted and annualized over this time horizon at a seven percent discount rate.

51. Exhibit 3-9 summarizes available information on the dams included in the analysis. Exhibit 3-10 presents the estimated present value of the impact of critical habitat designation for each dam. As this exhibit indicates, total impacts to conventional hydropower operations are estimated to be $237 million over 50 years, equivalent to an annualized impact of $17,200,000.

EXHIBIT 3-8. ESTIMATED UNIT COST OF POTENTIAL PROJECT MODIFICATIONS AT CONVENTIONAL HYRDOPOWER FACILITIES

PROJECT MODIFICATION	ESTIMATED UNIT COST ($2007)	NOTES
Install fish ladder	$2,390,000	Cost is the average of fish ladder installation costs at nine projects in Maine and Massachusetts. As described, significant variation exists in the actual costs of these projects. Sources: a, b, c, d, e
Install fish lift	$3,920,000	Cost is the average of fish lift installation costs at 12 projects in Maine and one in Connecticut. Sources: e, f, g, h, I, j
Operate and maintain fish passage facilities	Variable	Loss of four percent of estimated annual power generation, replaced by power produced from natural gas.
Install and/or maintain fish screens	$27,600	These cost estimates are consistent with estimates presented in the economic analysis of critical habitat designation for West Coast salmon for West Coast dams comparable in size to the dams in the study area. These costs represent the total cost likely to be incurred over a ten-year period for fish screen maintenance, species survival studies, and water quality monitoring efforts. Source: k
Conduct species survival studies	$1,590,000	
Develop water quality and temperature studies and controls	$2,120,000	

Sources

a) Maine Department of Marine Resources, "Sebasticook River Fish Passage Projects," accessed at http://maine.gov/dmr/rm/stockenhancement/sebasticookfishproject/sebasticookfishproject.htm on February 9, 2008.
b) The Charles George Natural Resources Trustee Council. October 2002. "Final Restoration Plan and Environmental Assessment: Charles George Land Reclamation Trust Landfill Superfund Site."
c) Ridgewood Electric Power Trust V. 10-K. For 12/31/05. EX-99.3. Filed On 9/27/07. SEC File 0-24143, Accession Number 1214659-7-2138. Accessed at http://www.secinfo.com/d1526c.u22w.4.htm on February 12, 2008.
d) Email from Timothy Konnert, FERC, to Dan Kircheis, NMFS, on February 9, 2009.
e) Letter from F. Allen Wiley, Vice President, FPL Energy Maine Hydro LLC, to Mary Colligan, Assistant Regional Administrator, National Marine Fisheries Service, December 5, 2008.
f) Norwich Public Utilities, "About the Fish Lift," accessed at http://www.norwichpublicutilities.com/fish-lift.html on February 8, 2008.
g) Natural Resources Council of Maine, "Fisheries in Rivers Get a Lift," April 9, 2006. Accessed at http://www.nrcm.org/news_detail.asp?news=663 on January 4, 2008.
h) Personal communication with Mark Isaacson at Miller Hydro Group on February 8, 2008 and March 23, 2009.
i) Friends of Sebago, "FERC Orders Fishways at Presumpscot Dams," accessed at http://www.friendsofsebago.org/finaleis/html on February 9, 2008. Costs are from excerpts of FERC's Presumpscot River Final Environmental Impact Statement (June, 2002).
j) Letter from Charles N. Lucas, Topsham Hydro Partners Limited Partnership, to Mary Colligan, Assistant Regional Administrator, National Marine Fisheries Service, December 5, 2008.
k) National Marine Fisheries Service, Northwest Fisheries Science Center. August 2005. Final Economic Analysis of Critical Habitat Designation for 12 West Coast Salmon and Steelhead ESUs.

EXHIBIT 3-9 DATA AND ASSUMPTIONS EMPLOYED TO ANALYZE POTENTIAL IMPACTS ON DAMS IN THE STUDY AREA

SHRU[1]	10 DIGIT HUC	FERC PROJECT NAME[2]	FERC DAM NAME[2]	RIVER/STREAM[2]	FERC LICENSED OR EXEMPT (L/E)[2]	ANTICIPATED DATE OF CONSULATION[2]	TOTAL CAPACITY (KW)[2]	ESTIMATED ANNUAL GENERATION (KWH)	MAIN STEM STATUS	KNOWN EXTENT OF FISH PASSAGE [3,4,5,6,7,8,9]
DAMS WITH NO KNOWN, POTENTIALLY INADEQUATE, OR UNDETERMINED FISH PASSAGE										
2	103000106	Harris	Harris	Kennebec	L	2036	76,600	430,000,000	yes	None
2	104000208	Gulf Is./Deer Rips	Gulf Island	Androscoggin	L	2036	20,900	117,323,760	yes	None
2	104000208	Gulf Is./Deer Rips	Deer Rips	Androscoggin	L	2036	10,638	59,717,232	yes	None
2	104000208	Lewiston Falls	Monty Station	Androscoggin	L	2026	28,440	159,650,131	yes	None
2	104000208	Lewiston Falls	Canal System	Androscoggin	L	2026	7,914	44,425,849	yes	None
2	103000301	Wyman	Wyman	Kennebec	L	2036	78,000	437,859,008	yes	None
2	104000204	Rumford Falls	Upper Station	Androscoggin	L	2024	26,550	149,040,470	yes	None
2	104000204	Rumford Falls	Lower Station	Androscoggin	L	2024	12,800	71,853,786	yes	None
2	103000303	Williams	Williams	Kennebec	L	2017	14,500	81,396,867	yes	None
2	104000206	Riley/Jay/Livermore	Riley	Androscoggin	L	2048	7,800	43,785,901	yes	None
2	104000206	Riley/Jay/Livermore	Jay	Androscoggin	L	2048	3,125	17,542,428	yes	None
2	104000206	Riley/Jay/Livermore	Livermore	Androscoggin	L	2048	8,800	49,399,478	yes	None
3	102000109	Penobscot Mills	North Twin	West Branch Penobscot	L	2026	6,972	39,137,859	no	None
3	102000109	Penobscot Mills	Millinocket	West Branch Penobscot	L	2026	35,782	200,865,013	no	None
3	102000110	Penobscot Mills	Dolby	West Branch Penobscot	L	2026	20,886	117,245,170	no	None
3	102000110	Penobscot Mills	East Millinocket	West Branch Penobscot	L	2026	6,936	38,935,770	no	None
3	102000110	Penobscot Mills	Millinocket Lake	West Branch Penobscot	L	2026	Storage	N/A	no	None
2	103000310	Automatic (M4)	Automatic (M4)	Messalonskee	L	2036	800	4,490,862	no	Not Indicated
2	103000310	Messalonskee	Union Gas (M5)	Messalonskee	L	2036	1,800	10,104,439	no	Not Indicated
2	103000310	Messalonskee	Rice Rips (M3)	Messalonskee	L	2036	1,600	8,981,723	no	Not Indicated

SHRU[1]	10 DIGIT HUC	FERC PROJECT NAME[2]	FERC DAM NAME[2]	RIVER/STREAM[2]	FERC LICENSED OR EXEMPT (L/E)[2]	ANTICIPATED DATE OF CONSULATION[2]	TOTAL CAPACITY (KW)[2]	ESTIMATED ANNUAL GENERATION (KWH)	MAIN STEM STATUS	KNOWN EXTENT OF FISH PASSAGE [3,4,5,6,7,8,9]
2	103000310	Messalonskee	Oakland (M2)	Messalonskee	L	2036	2,800	15,718,016	no	Not Indicated
2	103000310	Messalonskee	Messalonskee Lake	Messalonskee	L	2036	Storage	N/A	no	Not Indicated
3	102000109	Ripogenus	Ripogenus	West Branch Penobscot	L	2026	37,530	210,677,546	no	None
2	103000204	Flagstaff	Flagstaff	Dead	L	2036	Storage	N/A	no	Not Indicated
2	103000104	Brassua	Brassua	Moose	L	2012	4,180	23,464,752	no	Not Indicated
3	102000105	GLHA Storage	Ragged Lake	West Branch Penobscot	L	2054	Storage	N/A	no	None
3	102000102	GLHA Storage	Seboomook Lake	West Branch Penobscot	L	2054	Storage	N/A	no	None
3	102000102	GLHA Storage	Canada Falls Lake	West Branch Penobscot	L	2054	Storage	N/A	no	None
3	102000110	Medway	Medway	West Branch Penobscot	L	2029	3,440	19,310,705	no	None
2	103000106	Moosehead Lake	Moosehead Lake	Kennebec	L	2036	Storage	N/A	yes	None
3	102000509	Stillwater	Stillwater	Stillwater	L	2038	1,950	10,946,475	no	Not Indicated
1	105000212	Ellsworth	Graham Lake	Union	L	2018	Storage	N/A	no	None
3	105000220	Goose	CMP Dam	Goose	L	2020	200	1,122,715	no	Not Indicated
3	105000218	Goose	Mill Dam	Goose	L	2020	94	527,676	no	Not Indicated
3	105000218	Goose	Kelly Dam	Goose	L	2020	0	0	no	Not Indicated
3	105000218	Goose	Mason Dam	Goose	L	2020	75	421,018	no	Not Indicated
3	105000218	Goose	Swan Lake	Goose	L	2020	Storage	N/A	no	Not Indicated
2	104000209	Barkers Mill Lower	Barkers Mill Lower	Little Androscoggin	L	2019	1,500	8,420,366	no	Not Indicated
2	103000311	American Tissue	American Tissue	Cobbosseecontee Stream	L	2019	1,000	5,613,577	no	None
2	104000106	Errol	Errol	Androscoggin	L	2023	2,010	11,283,290	yes	None

SHRU[1]	10 DIGIT HUC	FERC PROJECT NAME[2]	FERC DAM NAME[2]	RIVER/STREAM[2]	FERC LICENSED OR EXEMPT (L/E)[2]	ANTICIPATED DATE OF CONSULATION[2]	TOTAL CAPACITY (KW)[2]	ESTIMATED ANNUAL GENERATION (KWH)	MAIN STEM STATUS	KNOWN EXTENT OF FISH PASSAGE [3,4,5,6,7,8,9]
2	104000209	Barkers Mill Upper	Barkers Mill Upper	Little Androscoggin	L	2023	950	5,332,898	no	Not Indicated
2	104000103	Aziscohos	Aziscohos	Magalloway	L	2025	5,311	29,813,708	no	Not Indicated
2	103000307	Waverly Avenue	Waverly Avenue	Sebasticook	E	2018	700	3,929,504	no	Not Indicated
2	104000101	Kennebago	Mahaney Dam	Kennebago	E	2018	200	1,122,715	no	Not Indicated
2	104000101	Kennebago	Kennebago Falls	Kennebago	E	2018	700	3,929,504	no	Not Indicated
3	102000403	Milo	Milo	Sebec	E	2018	695	3,901,436	no	None
2	104000209	Hackett Mills	Hackett Mills	Little Androscoggin	L	2024	485	2,722,585	no	Not Indicated
1	105000212	Green Lake	Green Lake	Reed Brook	L	2024	500	2,806,789	no	None
3	102000403	Sebec	Sebec	Sebec	E	2018	867	4,866,971	no	None
2	103000304	Gilman Stream	Gilman Stream	Gilman Stream	E	2018	120	673,629	no	Not Indicated
2	104000202	Wight Brook	Wight Brook	Wight Brook	E	2018	30	168,407	no	None
3	102000512	Foss Mill	Foss Mill	Marsh Stream	E	2018	15	84,204	no	Not Indicated
2	104000206	Otis	Otis	Androscoggin	L	2048	10,350	58,100,522	yes	None
2	104000202	Stoney Brook	Stoney Brook	Stoney Brook	E	2018	35	196,475	no	None
2	104000204	Abbots Mills	Abbots Mills	Concord Stream	E	2018	40	224,543	no	Not Indicated
3	105000220	Seabright	Seabright	Megunticook	E	2018	94	527,676	no	Not Indicated
2	103000307	Pioneer	Pioneer	Sebasticook	E	2018	300	1,684,073	no	Not Indicated
2	104000205	Upper Spears	Upper Spears	Spears Stream	E	2018	50	280,679	no	Not Indicated
2	104000209	Biscoe Falls	Biscoe Falls	Little Androscoggin	E	2018	93	522,063	no	Not Indicated
2	104000203	Gardiner Brook	Gardiner Brook	Gardiner Brook	E	2018	50	280,679	no	Not Indicated
2	104000210	Upper Androscoggin	Upper Androscoggin	Androscoggin	L	2026	1,695	9,515,013	yes	None
2	103000201	Eustis	Eustis	North Branch Dead	L	2026	250	1,403,394	no	Not Indicated

SHRU[1]	10 DIGIT HUC	FERC PROJECT NAME[2]	FERC DAM NAME[2]	RIVER/STREAM[2]	FERC LICENSED OR EXEMPT (L/E)[2]	ANTICIPATED DATE OF CONSULATION[2]	TOTAL CAPACITY (KW)[2]	ESTIMATED ANNUAL GENERATION (KWH)	MAIN STEM STATUS	KNOWN EXTENT OF FISH PASSAGE [3,4,5,6,7,8,9]
2	104000209	Marcal	Marcal	Little Androscoggin	L	2037	1,310	7,353,786	no	Not Indicated
2	103000307	Upper & Middle Dams	Upper & Middle Dams	Rapid	L	2052	Storage	N/A	no	Not Indicated
2	104000204	Corriveau Hydro	Corriveau Hydro	Swift	E	2018	350	1,964,752	no	Not Indicated
2	104000106	CASCADE	CASCADE	Atlas	L	2024	7,290	40,922,977	no	Not Indicated
2	104000106	CROSS	CROSS	Atlas	L	2024	3,220	18,075,718	no	Not Indicated
2	104000201	GORHAM	GORHAM	Atlas	L	2024	2,150	12,069,191	no	Not Indicated
2	104000201	GORHAM	GORHAM	Androscoggin	L	2024	4,800	26,945,170	yes	None
2	104000106	J. BRODIE SMITH	J. BRODIE SMITH	Atlas	L	2024	15,000	84,203,655	no	Not Indicated
2	104000106	PONTOOK	PONTOOK	Atlas	L	2031	9,897	55,557,572	no	Not Indicated
2	104000106	RIVERSIDE	RIVERSIDE	Atlas	L	2033	7,900	44,347,258	no	Not Indicated
2	104000106	SAWMILL	SAWMILL	Atlas	L	2024	3,174	17,817,493	no	Not Indicated
2	104000201	SHELBURNE	SHELBURNE	Atlas	L	2024	3,720	20,882,507	no	Not Indicated
2	103000307	Upper & Middle Dams	Upper & Middle Dams	Rapid	L	2052	Storage	N/A	no	Not Indicated
3	102000105	GLHA Storage	Harrington Lake	West Branch Penobscot	L	2054	Storage	N/A	no	None
3	102000105	GLHA Storage	Umbazooksus Lake	West Branch Penobscot	L	2054	Storage	N/A	no	None
3	102000101	GLHA Storage	Penobscot Lake	West Branch Penobscot	L	2054	Storage	N/A	no	None
3	102000101	GLHA Storage	Dole Lake	West Branch Penobscot	L	2054	Storage	N/A	no	None
3	102000101	GLHA Storage	Long Pond	West Branch Penobscot	L	2054	Storage	N/A	no	None
2	104000210	Brunswick	Brunswick	Androscoggin	L	2029	19,000	106,657,963	yes	Fish Ladder
2	103000306	Shawmut	Shawmut	Kennebec	L	2021	8,650	48,557,441	yes	Fish Ladder

SHRU[1]	10 DIGIT HUC	FERC PROJECT NAME[2]	FERC DAM NAME[2]	RIVER/STREAM[2]	FERC LICENSED OR EXEMPT (L/E)[2]	ANTICIPATED DATE OF CONSULATION[2]	TOTAL CAPACITY (KW)[2]	ESTIMATED ANNUAL GENERATION (KWH)	MAIN STEM STATUS	KNOWN EXTENT OF FISH PASSAGE [3,4,5,6,7,8,9]
2	103000306	Weston	Weston	Kennebec	L	2036	14,750	82,800,261	yes	Fish Ladder
2	103000306	Abenaki	Abenaki	Kennebec	L	2054	19,917	111,805,614	yes	Fish Ladder
2	103000306	Anson	Anson	Kennebec	L	2054	9,000	50,522,193	yes	Fish Ladder
3	102000307	Mattaceunk	Mattaceunk	Penobscot	L	2018	19,200	107,780,679	yes	Fish Ladder
3	102000509	Milford	Gilman Falls	Penobscot	L	2038	0	0	yes	Fish Ladder
3	102000502	West Enfield	West Enfield	Penobscot	L	2024	13,000	72,976,501	yes	Fish Ladder
2	103000306	Hydro-Kennebec	Hydro-Kennebec	Kennebec	L	2036	15,433	86,634,334	yes	Fish Ladder
DAMS WITH KNOWN, ADEQUATE FISH PASSAGE										
3	102000509	Great Works	Great Works	Penobscot	L	2018	7,730	43,392,950	yes	Fish Ladder
3	102000509	Veazie	Veazie	Penobscot	L	2038	16,400	92,062,663	yes	Fish Ladder
3	102000509	Milford	Milford	Penobscot	L	2038	8,000	44,908,616	yes	Fish Ladder
2	103000309	Fort Halifax	Fort Halifax	Sebasticook	L	2036	1,500	8,420,366	no	Fish Ladder
2	103000306	Lockwood	Lockwood	Kennebec	L	2036	6,550	36,768,930	yes	Fish Lift
3	102000104	GLHA Storage	Caucomgomoc L.	West Branch Penobscot	L	2054	Storage	N/A	no	Fish Ladder
3	102000406	Howland	Howland	Piscataquis	L	2018	1,875	10,525,457	no	Fish Ladder
1	105000213	Ellsworth	Ellsworth	Union	L	2018	8,900	49,960,836	no	Fish Lift
3	102000509	Orono	Orono	Stillwater	L	2045	2,332	13,090,862	no	Fish Ladder
2	104000210	Worumbo	Worumbo	Androscoggin	L	2025	19,400	108,903,394	yes	Fish Lift
3	102000503	Pumpkin Hill	Pumpkin Hill	Passadumkeag	L	2023	1,000	5,613,577	no	Fish Ladder
2	104000210	Pejepscot	Pejepscot	Androscoggin	L	2022	13,880	77,916,449	yes	Fish Lift
2	103000306	Benton Falls	Benton Falls	Sebasticook	L	2034	4,468	25,081,462	no	Fish Lift
3	102000402	Brown's Mill	Brown's Mill	Piscataquis	E	2018	550	3,087,467	no	Fish Ladder
3	102000402	Dover Upper Dam	Dover Upper Dam	Piscataquis	E	2018	300	1,684,073	no	Fish Ladder
3	102000512	Frankfort	Frankfort	Marsh Stream	E	2018	400	2,245,431	no	Fish Ladder

SHRU[1]	10 DIGIT HUC	FERC PROJECT NAME[2]	FERC DAM NAME[2]	RIVER/STREAM[2]	FERC LICENSED OR EXEMPT (L/E)[2]	ANTICIPATED DATE OF CONSULATION[2]	TOTAL CAPACITY (KW)[2]	ESTIMATED ANNUAL GENERATION (KWH)	MAIN STEM STATUS	KNOWN EXTENT OF FISH PASSAGE [3,4,5,6,7,8,9]
2	103000305	Starks	Starks	Lemon Stream	E	2018	35	196,475	no	Fish Ladder
2	103000308	Burnham	Burnham	Sebasticook	L	2036	1,000	5,613,577	no	Fish Ladder
2	105000304	Damariscotta	Damariscotta	Damariscotta	L	2033	500	2,806,789	no	Fish Ladder
3	102000104		Loon Lake	West Branch Penobscot	L	2054	Storage	N/A	no	Fish Ladder

Notes and Sources:

1. SHRUs identified by numeric code: 1 = Downeast Coastal; 2 = Merrymeeting Bay; 3 = Penobscot Basin.
2. MEDEP, *Hydropower Projects in Maine*, January 1, 2007.
3. IEc analysis of Maine Department of Environmental Protection Maine Impounds GIS data, Army Corps of Engineers National Inventory of Dams GIS data, and MEDEP, *Hydropower Projects in Maine*, January 1, 2007.
4. Geographic Distribution of Diadromous Fish in Maine, Alewife distribution, GIS data provided by NOAA Fisheries, 2007.
5. Atlantic Salmon Biological Review Team, Status Review for Anadromous Atlantic Salmon (*Salmo salar*) in the United States, July 2006.
6. Maine Department of Inland Fisheries and Wildlife, List of Active Fishways, revised March 2001.
7. IEc analysis of FERC licensing materials and publicly available documents.
8. Personal communications with dam operators.
9. Maine Departments of Environmental Protection and Marine Resources. January 30, 2008. Report to the Joint Standing Committee on Marine Resources and the Joint Standing Committee on Natural Resources in Response to Resolve Chapter 109 (LD 1528, LR 1911).

EXHIBIT 3-10. DERIVATION OF THE PRESENT VALUE OF IMPACTS FOR INDIVIDUAL DAMS

FERC DAM NAME	COST OF LADDER OR LIFT INSTALLATION[1]	OTHER CAPITAL COSTS[2]	ADMIN CONSULTATION COST[3]	TOTAL CAPITAL AND PROGRAMMATIC COSTS[4]	*SUBTOTAL: PRESENT VALUE OF CAPITAL AND PROGRAMMATIC COSTS (7%)*[5]	ESTIMATED ANNUAL LOST GENERATION (KW HOURS)[6]	ANNUAL COST OF REPLACEMENT POWER[7]	*SUBTOTAL: PRESEENT VALUE OF ADDITIONAL POWER COSTS OVER 50 YEARS (7%)*[8]	TOTAL PRESENT VALUE IMPACTS (7%)[9]
Wyman	$3,920,000	$3,740,000	$4,880	$7,660,000	*$1,080,000*	17,514,360	$708,000	*$9,770,000*	**$10,800,000**
Harris	$3,920,000	$3,740,000	$4,880	$7,660,000	*$1,080,000*	17,200,000	$695,000	*$9,600,000*	**$10,700,000**
Ripogenus	$2,390,000	$3,740,000	$4,880	$6,140,000	*$1,700,000*	8,427,102	$341,000	*$4,700,000*	**$6,400,000**
Millinocket	$2,390,000	$3,740,000	$4,880	$6,140,000	*$1,700,000*	8,034,601	$325,000	*$4,480,000*	**$6,180,000**
Mattaceunk	$3,920,000	$3,740,000	$4,880	$7,660,000	*$3,640,000*	4,311,227	$174,000	*$2,410,000*	**$6,040,000**
Upper Station	$3,920,000	$3,740,000	$4,880	$7,660,000	*$2,420,000*	5,961,619	$241,000	*$3,330,000*	**$5,750,000**
Williams	$3,920,000	$3,740,000	$4,880	$7,660,000	*$3,890,000*	3,255,875	$132,000	*$1,820,000*	**$5,710,000**
Monty Station	$3,920,000	$3,740,000	$4,880	$7,660,000	*$2,120,000*	6,386,005	$258,000	*$3,560,000*	**$5,680,000**
Brassua	$2,390,000	$3,740,000	$4,880	$6,140,000	*$4,370,000*	938,590	$37,900	*$524,000*	**$4,900,000**
Dolby	$2,390,000	$3,740,000	$4,880	$6,140,000	*$1,700,000*	4,689,807	$190,000	*$2,620,000*	**$4,310,000**
Brunswick	$3,920,000	$3,740,000	$4,880	$7,660,000	*$1,730,000*	4,266,319	$172,000	*$2,380,000*	**$4,110,000**
Shawmut	$3,920,000	$3,740,000	$4,880	$7,660,000	*$2,970,000*	1,942,298	$78,500	*$1,080,000*	**$4,050,000**
West Enfield	$3,920,000	$3,740,000	$4,880	$7,660,000	*$2,420,000*	2,919,060	$118,000	*$1,630,000*	**$4,050,000**
Lower Station	$3,920,000	$3,740,000	$4,880	$7,660,000	*$2,420,000*	2,874,151	$116,000	*$1,600,000*	**$4,030,000**
J. BRODIE SMITH	$2,390,000	$3,740,000	$4,880	$6,140,000	*$1,940,000*	3,368,146	$136,000	*$1,880,000*	**$3,820,000**
Gulf Island	$3,920,000	$3,740,000	$4,880	$7,660,000	*$1,080,000*	4,692,950	$190,000	*$2,620,000*	**$3,690,000**
Canal System	$3,920,000	$3,740,000	$4,880	$7,660,000	*$2,120,000*	1,777,034	$71,800	*$991,000*	**$3,110,000**
GORHAM	$3,920,000	$3,740,000	$4,880	$7,660,000	*$2,420,000*	1,077,807	$43,600	*$601,000*	**$3,030,000**
Sebec	$2,390,000	$3,740,000	$4,880	$6,140,000	*$2,920,000*	194,679	$7,870	*$109,000*	**$3,020,000**
Hydro-Kennebec	$3,920,000	$3,740,000	$4,880	$7,660,000	*$1,080,000*	3,465,373	$140,000	*$1,930,000*	**$3,010,000**
Waverly Avenue	$2,390,000	$3,740,000	$4,880	$6,140,000	*$2,920,000*	157,180	$6,350	*$87,700*	**$3,000,000**

FERC DAM NAME	COST OF LADDER OR LIFT INSTALLATION[1]	OTHER CAPITAL COSTS[2]	ADMIN CONSULTATION COST[3]	TOTAL CAPITAL AND PROGRAMMATIC COSTS[4]	*SUBTOTAL: PRESENT VALUE OF CAPITAL AND PROGRAMMATIC COSTS (7%)*[5]	ESTIMATED ANNUAL LOST GENERATION (KW HOURS)[6]	ANNUAL COST OF REPLACEMENT POWER[7]	*SUBTOTAL: PRESEENT VALUE OF ADDITIONAL POWER COSTS OVER 50 YEARS (7%)*[8]	TOTAL PRESENT VALUE IMPACTS (7%)[9]
Kennebago Falls	$2,390,000	$3,740,000	$4,880	$6,140,000	*$2,920,000*	157,180	$6,350	*$87,700*	**$3,000,000**
Milo	$2,390,000	$3,740,000	$4,880	$6,140,000	*$2,920,000*	156,057	$6,310	*$87,100*	**$3,000,000**
Corriveau Hydro	$2,390,000	$3,740,000	$4,880	$6,140,000	*$2,920,000*	78,590	$3,180	*$43,800*	**$2,960,000**
Pioneer	$2,390,000	$3,740,000	$4,880	$6,140,000	*$2,920,000*	67,363	$2,720	*$37,600*	**$2,950,000**
Mahaney Dam	$2,390,000	$3,740,000	$4,880	$6,140,000	*$2,920,000*	44,909	$1,820	*$25,100*	**$2,940,000**
Gilman Stream	$2,390,000	$3,740,000	$4,880	$6,140,000	*$2,920,000*	26,945	$1,090	*$15,000*	**$2,930,000**
Seabright	$2,390,000	$3,740,000	$4,880	$6,140,000	*$2,920,000*	21,107	$853	*$11,800*	**$2,930,000**
Biscoe Falls	$2,390,000	$3,740,000	$4,880	$6,140,000	*$2,920,000*	20,883	$844	*$11,700*	**$2,930,000**
Weston	$3,920,000	$3,740,000	$4,880	$7,660,000	*$1,080,000*	3,312,010	$134,000	*$1,850,000*	**$2,920,000**
Graham Lake	$2,390,000	$3,740,000	$4,880	$6,140,000	*$2,920,000*	0	$0	*$0*	**$2,920,000**
Wight Brook	$2,390,000	$3,740,000	$4,880	$6,140,000	*$2,920,000*	6,736	$272	*$3,760*	**$2,920,000**
Foss Mill	$2,390,000	$3,740,000	$4,880	$6,140,000	*$2,920,000*	3,368	$136	*$1,880*	**$2,920,000**
Stoney Brook	$2,390,000	$3,740,000	$4,880	$6,140,000	*$2,920,000*	7,859	$318	*$4,380*	**$2,920,000**
Abbots Mills	$2,390,000	$3,740,000	$4,880	$6,140,000	*$2,920,000*	8,982	$363	*$5,010*	**$2,920,000**
Uppers Spears	$2,390,000	$3,740,000	$4,880	$6,140,000	*$2,920,000*	11,227	$454	*$6,260*	**$2,920,000**
Gardiner Brook	$2,390,000	$3,740,000	$4,880	$6,140,000	*$2,920,000*	11,227	$454	*$6,260*	**$2,920,000**
Barkers Mill Lower	$2,390,000	$3,740,000	$4,880	$6,140,000	*$2,720,000*	336,815	$13,600	*$188,000*	**$2,910,000**
CASCADE	$2,390,000	$3,740,000	$4,880	$6,140,000	*$1,940,000*	1,636,919	$66,200	*$913,000*	**$2,860,000**
Errol	$3,920,000	$3,740,000	$4,880	$7,660,000	*$2,590,000*	451,332	$18,200	*$252,000*	**$2,850,000**
American Tissue	$2,390,000	$3,740,000	$4,880	$6,140,000	*$2,720,000*	224,543	$9,080	*$125,000*	**$2,850,000**
Abenaki	$3,920,000	$3,740,000	$4,880	$7,660,000	*$319,000*	4,472,225	$181,000	*$2,500,000*	**$2,810,000**
North Twin	$2,390,000	$3,740,000	$4,880	$6,140,000	*$1,700,000*	1,565,514	$63,300	*$873,000*	**$2,570,000**

FERC DAM NAME	COST OF LADDER OR LIFT INSTALLATION[1]	OTHER CAPITAL COSTS[2]	ADMIN CONSULTATION COST[3]	TOTAL CAPITAL AND PROGRAMMATIC COSTS[4]	*SUBTOTAL: PRESENT VALUE OF CAPITAL AND PROGRAMMATIC COSTS (7%)*[5]	ESTIMATED ANNUAL LOST GENERATION (KW HOURS) [6]	ANNUAL COST OF REPLACEMENT POWER[7]	*SUBTOTAL: PRESEENT VALUE OF ADDITIONAL POWER COSTS OVER 50 YEARS (7%)*[8]	TOTAL PRESENT VALUE IMPACTS (7%)[9]
East Millinocket	$2,390,000	$3,740,000	$4,880	$6,140,000	*$1,700,000*	1,557,431	$63,000	*$869,000*	**$2,570,000**
CMP Dam	$2,390,000	$3,740,000	$4,880	$6,140,000	*$2,550,000*	44,909	$1,820	*$25,100*	**$2,570,000**
Mill Dam	$2,390,000	$3,740,000	$4,880	$6,140,000	*$2,550,000*	21,107	$853	*$11,800*	**$2,560,000**
Mason Dam	$2,390,000	$3,740,000	$4,880	$6,140,000	*$2,550,000*	16,841	$681	*$9,400*	**$2,560,000**
Kelly Dam	$2,390,000	$3,740,000	$4,880	$6,140,000	*$2,550,000*	0	N/A	*N/A*	**$2,550,000**
Swan Lake	$2,390,000	$3,740,000	$4,880	$6,140,000	*$2,550,000*	0	N/A	*N/A*	**$2,550,000**
Aziscohos	$2,390,000	$3,740,000	$4,880	$6,140,000	*$1,820,000*	1,192,548	$48,200	*$665,000*	**$2,480,000**
PONTOOK	$2,390,000	$3,740,000	$4,880	$6,140,000	*$1,210,000*	2,222,303	$89,800	*$1,240,000*	**$2,450,000**
Deer Rips	$3,920,000	$3,740,000	$4,880	$7,660,000	*$1,080,000*	2,388,689	$96,600	*$1,330,000*	**$2,410,000**
SHELBURNE	$2,390,000	$3,740,000	$4,880	$6,140,000	*$1,940,000*	835,300	$33,800	*$466,000*	**$2,410,000**
CROSS	$2,390,000	$3,740,000	$4,880	$6,140,000	*$1,940,000*	723,029	$29,200	*$403,000*	**$2,350,000**
SAWMILL	$2,390,000	$3,740,000	$4,880	$6,140,000	*$1,940,000*	712,700	$28,800	*$398,000*	**$2,340,000**
Upper Androscoggin	$3,920,000	$3,740,000	$4,880	$7,660,000	*$2,120,000*	380,601	$15,400	*$212,000*	**$2,330,000**
GORHAM	$2,390,000	$3,740,000	$4,880	$6,140,000	*$1,940,000*	482,768	$19,500	*$269,000*	**$2,210,000**
Barkers Mill Upper	$2,390,000	$3,740,000	$4,880	$6,140,000	*$2,080,000*	213,316	$8,620	*$119,000*	**$2,200,000**
RIVERSIDE	$2,390,000	$3,740,000	$4,880	$6,140,000	*$1,060,000*	1,773,890	$71,700	*$990,000*	**$2,050,000**
Green Lake	$2,390,000	$3,740,000	$4,880	$6,140,000	*$1,940,000*	112,272	$4,540	*$62,600*	**$2,010,000**
Hackett Mills	$2,390,000	$3,740,000	$4,880	$6,140,000	*$1,940,000*	108,903	$4,400	*$60,800*	**$2,000,000**
Medway	$2,390,000	$3,740,000	$4,880	$6,140,000	*$1,380,000*	772,428	$31,200	*$431,000*	**$1,820,000**
Otis	$3,920,000	$3,740,000	$4,880	$7,660,000	*$478,000*	2,324,021	$93,900	*$1,300,000*	**$1,770,000**
Eustis	$2,390,000	$3,740,000	$4,880	$6,140,000	*$1,700,000*	56,136	$2,270	*$31,300*	**$1,730,000**

FERC DAM NAME	COST OF LADDER OR LIFT INSTALLATION[1]	OTHER CAPITAL COSTS[2]	ADMIN CONSULTATION COST[3]	TOTAL CAPITAL AND PROGRAMMATIC COSTS[4]	*SUBTOTAL: PRESENT VALUE OF CAPITAL AND PROGRAMMATIC COSTS (7%)*[5]	ESTIMATED ANNUAL LOST GENERATION (KW HOURS)[6]	ANNUAL COST OF REPLACEMENT POWER[7]	*SUBTOTAL: PRESEENT VALUE OF ADDITIONAL POWER COSTS OVER 50 YEARS (7%)*[8]	TOTAL PRESENT VALUE IMPACTS (7%)[9]
Millinocket Lake	$2,390,000	$3,740,000	$4,880	$6,140,000	*$1,700,000*	0	N/A	*N/A*	**$1,700,000**
Livermore	$3,920,000	$3,740,000	$4,880	$7,660,000	*$478,000*	1,975,979	$79,900	*$1,100,000*	**$1,580,000**
Riley	$3,920,000	$3,740,000	$4,880	$7,660,000	*$478,000*	1,751,436	$70,800	*$977,000*	**$1,460,000**
Anson	$3,920,000	$3,740,000	$4,880	$7,660,000	*$319,000*	2,020,888	$81,700	*$1,130,000*	**$1,450,000**
Oakland (M2)	$2,390,000	$3,740,000	$4,880	$6,140,000	*$862,000*	628,721	$25,400	*$351,000*	**$1,210,000**
Union Gas (M5)	$2,390,000	$3,740,000	$4,880	$6,140,000	*$862,000*	404,178	$16,300	*$225,000*	**$1,090,000**
Moosehead Lake	$3,920,000	$3,740,000	$4,880	$7,660,000	*$1,080,000*	0	N/A	*N/A*	**$1,080,000**
Rice Rips (M3)	$2,390,000	$3,740,000	$4,880	$6,140,000	*$862,000*	359,269	$14,500	*$200,000*	**$1,060,000**
Stillwater	$2,390,000	$3,740,000	$4,880	$6,140,000	*$753,000*	437,859	$17,700	*$244,000*	**$998,000**
Marcal	$2,390,000	$3,740,000	$4,880	$6,140,000	*$806,000*	294,151	$11,900	*$164,000*	**$970,000**
Automatic (M4)	$2,390,000	$3,740,000	$4,880	$6,140,000	*$862,000*	179,634	$7,260	*$100,000*	**$963,000**
Gilman Falls	$3,920,000	$3,740,000	$4,880	$7,660,000	*$940,000*	0	N/A	*N/A*	**$940,000**
Jay	$3,920,000	$3,740,000	$4,880	$7,660,000	*$478,000*	701,697	$28,400	*$391,000*	**$870,000**
Messalonskee Lake	$2,390,000	$3,740,000	$4,880	$6,140,000	*$862,000*	0	N/A	*N/A*	**$862,000**
Flagstaff	$2,390,000	$3,740,000	$4,880	$6,140,000	*$862,000*	0	N/A	*N/A*	**$862,000**
Upper & Middle Dams	$2,390,000	$3,740,000	$4,880	$6,140,000	*$292,000*	0	N/A	*N/A*	**$292,000**
Upper & Middle Dams	$2,390,000	$3,740,000	$4,880	$6,140,000	*$292,000*	0	N/A	*N/A*	**$292,000**
Ragged Lake	$2,390,000	$3,740,000	$4,880	$6,140,000	*$255,000*	0	N/A	*N/A*	**$255,000**
Seboomook Lake	$2,390,000	$3,740,000	$4,880	$6,140,000	*$255,000*	0	N/A	*N/A*	**$255,000**
Canada Falls Lake	$2,390,000	$3,740,000	$4,880	$6,140,000	*$255,000*	0	N/A	*N/A*	**$255,000**

FERC DAM NAME	COST OF LADDER OR LIFT INSTALLATION[1]	OTHER CAPITAL COSTS[2]	ADMIN CONSULTATION COST[3]	TOTAL CAPITAL AND PROGRAMMATIC COSTS[4]	*SUBTOTAL: PRESENT VALUE OF CAPITAL AND PROGRAMMATIC COSTS (7%)*[5]	ESTIMATED ANNUAL LOST GENERATION (KW HOURS)[6]	ANNUAL COST OF REPLACEMENT POWER[7]	*SUBTOTAL: PRESEENT VALUE OF ADDITIONAL POWER COSTS OVER 50 YEARS (7%)*[8]	TOTAL PRESENT VALUE IMPACTS (7%)[9]
Harrington Lake	$2,390,000	$3,740,000	$4,880	$6,140,000	*$255,000*	0	N/A	*N/A*	**$255,000**
Umbazooksus Lake	$2,390,000	$3,740,000	$4,880	$6,140,000	*$255,000*	0	N/A	*N/A*	**$255,000**
Penobscot Lake	$2,390,000	$3,740,000	$4,880	$6,140,000	*$255,000*	0	N/A	*N/A*	**$255,000**
Dole Lake	$2,390,000	$3,740,000	$4,880	$6,140,000	*$255,000*	0	N/A	*N/A*	**$255,000**
Long Pond	$2,390,000	$3,740,000	$4,880	$6,140,000	*$255,000*	0	N/A	*N/A*	**$255,000**
Great Works	N/A	N/A	$4,880	$4,880	*$2,320*	N/A	N/A	*N/A*	**$2,320**
Howland	N/A	N/A	$4,880	$4,880	*$2,320*	N/A	N/A	*N/A*	**$2,320**
Ellsworth	N/A	N/A	$4,880	$4,880	*$2,320*	N/A	N/A	*N/A*	**$2,320**
Brown's Mill	N/A	N/A	$4,880	$4,880	*$2,320*	N/A	N/A	*N/A*	**$2,320**
Dover Upper Dam	N/A	N/A	$4,880	$4,880	*$2,320*	N/A	N/A	*N/A*	**$2,320**
Frankfort	N/A	N/A	$4,880	$4,880	*$2,320*	N/A	N/A	*N/A*	**$2,320**
Starks	N/A	N/A	$4,880	$4,880	*$2,320*	N/A	N/A	*N/A*	**$2,320**
Pejepscot	N/A	N/A	$4,880	$4,880	*$1,770*	N/A	N/A	*N/A*	**$1,770**
Pumpkin Hill	N/A	N/A	$4,880	$4,880	*$1,650*	N/A	N/A	*N/A*	**$1,650**
Worumbo	N/A	N/A	$4,880	$4,880	*$1,440*	N/A	N/A	*N/A*	**$1,440**
Damariscotta	N/A	N/A	$4,880	$4,880	*$840*	N/A	N/A	*N/A*	**$840**
Benton Falls	N/A	N/A	$4,880	$4,880	*$785*	N/A	N/A	*N/A*	**$785**
Fort Halifax	N/A	N/A	$4,880	$4,880	*$686*	N/A	N/A	*N/A*	**$686**
Lockwood	N/A	N/A	$4,880	$4,880	*$686*	N/A	N/A	*N/A*	**$686**
Burnham	N/A	N/A	$4,880	$4,880	*$686*	N/A	N/A	*N/A*	**$686**
Veazie	N/A	N/A	$4,880	$4,880	*$599*	N/A	N/A	*N/A*	**$599**

FERC DAM NAME	COST OF LADDER OR LIFT INSTALLATION[1]	OTHER CAPITAL COSTS[2]	ADMIN CONSULTATION COST[3]	TOTAL CAPITAL AND PROGRAMMATIC COSTS[4]	*SUBTOTAL: PRESENT VALUE OF CAPITAL AND PROGRAMMATIC COSTS (7%)*[5]	ESTIMATED ANNUAL LOST GENERATION (KW HOURS) [6]	ANNUAL COST OF REPLACEMENT POWER[7]	*SUBTOTAL: PRESEENT VALUE OF ADDITIONAL POWER COSTS OVER 50 YEARS (7%)*[8]	TOTAL PRESENT VALUE IMPACTS (7%)[9]
Milford	N/A	N/A	$4,880	$4,880	*$599*	N/A	N/A	*N/A*	**$599**
Orono	N/A	N/A	$4,880	$4,880	*$373*	N/A	N/A	*N/A*	**$373**
Caucomgo-moc L.	N/A	N/A	$4,880	$4,880	*$203*	N/A	N/A	*N/A*	**$203**
Loon Lake	N/A	N/A	$4,880	$4,880	*$203*	N/A	N/A	*N/A*	**$203**
TOTAL PRESENT VALUE IMPACTS									**$237,000,000**

Notes and Sources:

Entries may not sum to totals reported due to rounding.

1. The analysis assumes that dams on main stem rivers will install a fish lift, unless the available data indicate that a lift is already present. Similarly, it assumes that dams located on tributaries will install a fish ladder, unless the data indicate that a ladder or lift is already present (see Exhibit 3-9 for data and assumptions regarding the presence of fish passage facilities at individual dams). The estimate of lift or ladder installation costs is based on the average costs reported in Exhibit 3-8.
2. For all dams for which the analysis assumes a ladder or lift will be installed, other capital costs, as described in Exhibit 3-8, are also forecast to be incurred.
3. All dams are forecast to be subject to section 7 consultation within the next 50 years (date dependent on estimated relicensing date, as indicated in Exhibit 3-9).
4. Total capital and programmatic costs are the sum of the ladder or lift installation, other capital costs, and administrative costs of consultation.
5. The present value of total capital and programmatic costs is calculated by applying a seven percent annual discount rate. The calculation assumes that these costs would be incurred concurrent with the consultation on the dam's relicensing. Exhibit 3-9 indicates the expected date of relicensing.
6. The analysis assumes a reduction of four percent in the generation of electricity at affected facilities. Exhibit 3-9 presents an estimate of the amount of electricity that each facility currently generates.
7. The annual cost of replacement power is assumed to be $0.04 per KW hour, based on the additional cost of generating electricity with natural gas.
8. The present value of additional power costs is calculated by applying a seven percent discount rate over 50 years.
9. Total present value impacts represent the sum of the present value of capital and programmatic costs and the present value of additional power costs.

3.4.2 IMPACTS ASSOCIATED WITH ADDITIONAL OPERATIONAL CHANGES

52. In addition to the project modifications described above, NMFS may recommend changes in flow regime at dams to benefit salmon critical habitat (i.e., seasonal restrictions, flow augmentation, or spill requirements) or dam removal.

3.4.2.1 Flow Regime Changes

53. Recommendations to augment flow or change the timing of flow through a project to facilitate fish passage or improve habitat may affect the economic viability of a hydropower project. Demand for power varies seasonally; thus, the value of power changes throughout the year. To the extent that flow augmentation requires water to be passed through turbines at times of the year when it is less valuable, there may be an associated economic cost. Also, where fish passage through the dam is an issue, seasonal spill over the dam may be required to reduce the risk of fatality associated with passage through the turbines. In this case, the spilled water no longer passes through the turbines and therefore cannot be used to generate electricity. Depending on the extent of increased electricity production costs, these impacts may be passed on to power consumers in the form of higher rates.

54. The necessity, level, and method of flow regime changes to accommodate the biological needs of salmon at a particular project are determined on a case by case basis. Power generation is a function of multiple parameters related to the specific infrastructure characteristics of the dam and the hydrology of the river system. Historically, economic impacts associated with changes to flow regimes to accommodate salmon on the West Coast have been substantial, but vary by orders of magnitude depending upon the particular hydropower project and specific flow regime recommendation. If direct spill is requested, spilled water no longer passes through the turbines and therefore cannot be used to generate electricity. This may result in losses in profits to producers and/or welfare impacts to power consumers resulting from replacing lost electricity production with more expensive energy sources (for example, gas turbine generation). Alternatively, seasonal changes to flow through turbines may be requested. While the same amount of water may still pass through the turbines, demand for power varies seasonally, thus the value of power changes throughout the year. To the extent that flow change recommendations require water to be passed at times of the year when it is less valuable, there may be an associated economic cost.

55. Further, the economic impact associated with a flow regime change is dependent upon the type of project. For example, replacing power generated by peaking projects (i.e., projects that produce hydropower during periods of highest demand) is more expensive than replacing base power production. Until an individual hydropower project operation is reviewed with respect to its effect on salmon habitat, the type and level of flow changes necessary and feasible for species and habitat conservation is speculative. Moreover, changes in one project's flow regime may result in changes to other projects' flow regimes because of the hydrological

connectivity of the associated streams; it is therefore not reasonable to consider the flow regime of any single dam individually. Because of this, flow regime impacts are not attributable to the designation of any one watershed, but of the system as a whole.

56. As described above, estimating the impacts of flow regime changes is complicated by multiple factors. Estimating impacts at a specific project would require the following key pieces of information:

- **Site-specific instream minimum flow requirements for salmon**. Minimum instream flow requirements for salmon are needed to identify sites that are likely to lack sufficient stream flow for conservation. This information is also helpful in determining the incremental amount of water needed from upstream dams to increase flows downstream.
- **Method of augmenting or changing flows at specific projects**. The type and method of implementation for specified flow augmentation levels depends on the reason for the recommendation and the adaptability of the project. To determine how a hydropower project may be affected, specific information is needed on the changes being requested: for example, whether additional downstream flow or fish passage through the turbines is the primary concern. In the case of the former, additional cubic feet per second (cfs) of flow may be requested; in the case of the latter, direct spill over the dam may be requested to reduce the risk of fatality associated with passage through the turbines.
- **Project-specific operational models**. The marginal impact of implementing changes in flow regime varies by project; that is, the unit change in power generation resulting from a unit change in flow is not uniform across projects. Further, the replacement cost of lost or displaced power production depends on the operations of each project subject to modification. For example, replacing power generated by peaking projects (i.e., projects that produce hydropower during periods of highest demand) is more expensive than replacing base power production. To evaluate the impacts of flow restrictions, hydropower project operators typically develop an operations model that calculates the change in power generation associated with a particular change in flow. These models may estimate both energy generation and dependable capacity impacts, computing both annual energy and peak capacity availability for the facility both "without" and "with" the change in flow regime.

57. If sufficient data were available for all projects within the region, complex, large-scale modeling of impacts would be possible. For hydraulically-coupled dam systems within the streams, the estimation of impacts is possible only by developing a dynamic, regional hydrological model. Flow changes implemented at upstream dams will affect the level of flow change necessary for salmon conservation at downstream projects. Importantly, this means that even impoundments located outside of the study area may affect flow within the study area, and therefore may be subject to modification of their operations. Because the same water flows through

each of these projects, attributing the impacts of changes in operation to any one HUC is complicated, if not impossible. This limits the usefulness of such an analysis for 4(b)(2) decision-making on a HUC by HUC basis.

58. Until a hydropower project operation is reviewed, then, the type and level of flow changes necessary and feasible for species and habitat protection is speculative, and the complete data needed to estimate these impacts are not available. For these reasons, this analysis does not estimate the impacts of flow regime changes for the full set of hydropower projects within the study area.

59. To characterize the potential cost of changes in flow regimes, the analysis examined a series of case studies prepared by the U.S. Office of Technology Assessment (OTA) on operational modifications implemented at hydropower sites across the U.S. As Exhibit 3-11 shows, two of the case studies focused on the cost of modifying operations to provide adequate upstream and downstream passage at hydropower projects in Maine. Mitigation costs at the Brunswick dam were $0.0037 per KW hour of power generated, or approximately $389,000 per year. Mitigation costs at the West Enfield facility were $0.0039 per KW hour, or $374,000 annually. The OTA study notes, however, that it found no consistent relationship between mitigation costs and facility characteristics. Thus, the OTA study does not provide a basis for estimating mitigation costs at other facilities.

EXHIBIT 3-11. CASE STUDIES OF OPERATIONAL MODIFICATIONS TO HYDROPOWER PROJECTS IN MAINE

PLANT NAME	CAPACITY (KW)	ANNUAL ENERGY PRODUCTION (KW HOURS)	DIVERSION HEIGHT	AVERAGE SITE FLOW (CFS)	MITIGATION COST ($/KW HOUR)[1]
Brunswick	19,700	105,200,000	34	6,480	$0.0037
West Enfield	13,000	96,000,000	45	12,000	$0.0039

[1] The study presents costs in 1993 dollars, per KW hour of generation.

Source: U.S. Office of Technology Assessment. Fish Passage Technologies: Protection at Hydropower Facilities, OTA-ENV-641 (Washington, DC: U.S. Government Printing Office, September 1995).

60. To provide further perspective, this analysis considers the impact on energy production costs should flow requirements for salmon migration preclude hydropower operations from generating power during the month of May, the peak season for downstream smolt migration.[65] The estimated impact of this scenario is not included in the primary estimates of impacts of critical habitat designation because NMFS does not anticipate that such a scenario would occur. Instead, this

[65] NOAA Fisheries has identified May as the peak season for downstream smolt migration. Personal communication with Dan Kircheis and Jeff Murphy, NOAA Fisheries, January 8, 2008.

information is provided both to illustrate and to serve as an extreme upper bound on the costs associated with flow regime changes.

61. Exhibit 3-12 describes the average production costs for various energy sources in Maine in the month of May (average over the past four years). As this exhibit indicates, hydropower has the lowest production costs.

EXHIBIT 3-12. POWER PRODUCTION PROFILE FOR MAINE IN THE MONTH OF MAY

FUEL TYPE	NET GENERATION IN MAY (KWH)	WEIGHTED AVERAGE OF TOTAL PRODUCTION	PRODUCTION COSTS ($ / KWH)	TOTAL COSTS
Coal	36,250,000	3.2%	$0.026	$939,962.50
Petroleum	72,250,000	6.3%	$0.026	$1,873,442.50
Natural Gas	697,750,000	60.8%	$0.049	$34,067,643.75
Hydroelectric	322,000,000	28.1%	$0.008	$2,704,800.00
All Other Renewable	9,750,000	0.8%	$0.049	$476,043.75
Other	9,750,000	0.8%	$0.049	$476,043.75
Total	**1,147,750,000**	**100.0%**		**$40,537,936.25**

Sources:
1) Maine generation profile from Energy Information Administration Tables 1.7.A, 1.8.A, 1.10.A, 1.13.A, 1.14.A, 1.16.A. Accessed at http://www.eia.doe.gov/cneaf/electricity/epm/epm_ex_bkis.html on Feb 12, 2008.
2) Production costs from Energy Information Administration, Electric Power Annual 2006 Released: October 22, 2007 - Table 8.2. Average Power Plant Operating Expenses for Major U.S. Investor-Owned Electric Utilities, 1995 through 2006.

62. Hydropower plants within the study area account for approximately 87 percent of Maine's total hydropower capacity. Accordingly, the analysis assumes that 87 percent of the estimated 322 million KW hours ordinarily produced by hydropower facilities in May (i.e., 280 million KW hours) would need to be replaced by power from other sources. The analysis assumes that the electrical generators fueled by natural gas would provide the replacement power at an increased cost of production of $0.04 per KW hour. Exhibit 3-13 presents the results of this analysis. As the exhibit indicates, the estimated increase in energy costs is $11.3 million.

EXHIBIT 3-13. INCREASED POWER PRODUCTION COSTS ASSOCIATED WITH DECREASED HYDROPOWER PRODUCTION IN MAY

POWER REPLACED BY NATURAL GAS PRODUCTION IN MAY (KWH)	DIFFERENCE IN COST OF PRODUCTION BETWEEN HYDROPOWER AND NATURAL GAS	INCREASED POWER PRODUCTION COST
280,140,000	$0.04	$11,300,000

3.4.2.2 Dam Removal Policies and Projects

63. The analysis does not quantify costs beyond the administrative costs of consultation for dams within the study area that are planned for removal. Decommissioning and removal plans for the Veazie, Great Works, and Fort Halifax dams are in development, and removal of these dams is expected to occur regardless of the critical habitat designation. The impact of critical habitat designation on the possible removal of other dams is unknown. In the absence of such information, this section describes ongoing dam removal efforts in the region.

64. Dam removal has become an accepted practice to deal with obsolete or dangerous dams, and to open up substantial areas to fish passage.[66] Dam removal in Maine requires approval from FERC and a permit under the Maine Waterway Development and Conservation Act.[67] While infrequent, dam removals and proposals for dam removals have increased during the last 20 years. The MEDEP reports 15 dam removals since 1986, including seven since 2000.[68] In addition, at least another eight dams within the State are currently under consideration for removal. Exhibit 3-14 presents information on recent and proposed dam removals in Maine.

65. Several of the dams removed or proposed for removal have been the focus of coordinated efforts by power companies, environmental groups, Federal agencies (FERC, FWS, NMFS, EPA), State agencies, Indian tribes and other stakeholders. Two important efforts include:

- **Lower Kennebec River Comprehensive Hydropower Settlement Accord:** The 1998 Accord, signed by State and Federal agencies, environmental organizations, Kennebec Hydro-Developers Group (dam owners), and Bath Iron Works, provided for the removal of the Edwards Dam, the lowermost

[66] United States Environmental Protection Agency, *National Management Measures to Control Nonpoint Source Pollution from Hydromodification*, July 2007, EPA 841-B-07-002.

[67] 38 M.R.S.A. Section 634; Maine Department of Environmental Protection, Bureau of Land and Water, "Dam Removal Permitting Process (brief overview)," accessed at http://maine.gov/dep/blwq/docstand/removal.htm on February 4, 2008.

[68] Murch, Dana, Maine Department of Environmental Protection, "Dam Removals in Maine: Status as of October 2006," 2006.

dam on the Kennebec River.[69] The Accord also identified fish passage needs for upstream dams (on both the Kennebec and Sebasticook Rivers), established a timetable for fish passage installation, and provided some funding to accomplish these tasks.

The completion of river restoration projects at four non-hydropower dams in the upper watershed triggered the installation of fish passage at three downstream dams, the Lockwood, Benton Falls and Burnham Dams.[70] The Lockwood dam completed the installation of an interim fish lift with trapping capabilities in 2005. The Benton Falls fish passage, completed in 2006, consists of an elevator designed to provide passage for American shad, alewife and Atlantic salmon. Dam owners completed upstream fish passage at the Burnham dam in April 2006 at cost of over $1 million.[71] In addition, the Accord required the removal of the Fort Halifax Dam or the installation of fish passage at the dam by 2003. Action at the Fort Halifax Dam, however, is currently the subject of litigation and has been for the past several years.[72]

- **Lower Penobscot Basin Settlement Accord:** The 2004 agreement signed by PPL Corporation (dam owners), Federal agencies, State agencies, the Penobscot Indian Nation, and environmental organizations provides for a series of actions designed to restore sections of the Lower Penobscot River. The Penobscot Restoration Trust, a non-profit coalition created for the purpose of implementing the settlement, has a five-year (through 2009) option to purchase three hydroelectric dams from PPL Corporation for between $24 million and $26 million, depending on the year of purchase. The Trust will then finance the removal of two dams on the Lower Penobscot, the Veazie and Great Works dams, and the installation of a bypass at the Howland Dam. In return, PPL receives the option to increase generation at six existing dams, including the reconstruction and relicensing of the Orono Dam on the Stillwater River. In addition, the removal of the dams will trigger the successive installation of fish lifts at the Milford, Orono, and Stillwater dams.[73]

[69] FR Doc. 98–15913.

[70] U.S. Fish and Wildlife Service, Gulf of Maine Program, *Diadromous Fish Habitat Protection and Restoration Projects in Maine*, July 2007.

[71] Maine Department of Marine Resources, "Kennebec River Diadromous Fish Restoration Project," accessed at http://maine.gov/dmr/rm/stockenhancement/kennebec/fishpass.htm on February 4, 2008.

[72] U.S. Fish and Wildlife Service, Gulf of Maine Program, *Diadromous Fish Habitat Protection and Restoration Projects in Maine*, July 2007.

[73] FR Doc. E4-1513; Penobscot River Restoration Trust Website accessed December 16, 2007 at http://www.penobscotriver.org/; Day, Laura Rose, Penobscot Restoration Trust, Personal Communication, January 31, 2008.

EXHIBIT 3-14. RECENT AND PROPOSED DAM REMOVALS IN MAINE

DAM NAME	LOCATION	AFFECTED WATERS	YEAR	NOTES
DAMS RECENTLY REMOVED				
Milton Leatherboard Lower Dam	Lebanon, ME & Milton, NH	Salmon Falls River	1986	Removal confirmed by NH DES.
Columbia Falls Dam	Columbia Falls	Pleasant River	1988	Approved hydropower project prior to removal.
Bangor Dam	Bangor & Brewer	Penobscot River	1995	Dam was breached at time of removal.
Mast Point Dam	Berwick, ME & Somersworth, NH	Salmon Falls River	1997	Removal confirmed by NH DES.
Grist Mill Dam	Hampden	Souadabscook Stream	1998	Approved hydropower project prior to removal.
Temple Mill Dam	Hampden	Souadabscook Stream	1999	n/a
Brownville Dam	Brownville	Pleasant River	1999	Dam was breached at time of removal.
Edwards Dam	Augusta	Kennebec River	1999	Approved hydropower project prior to removal.
East Machias Dam	East Machias	East Machias River	2000	Dam was breached at time of removal.
Mill Dam	Corinna	East Branch Sebasticook River	2000-01	Removed as part of cleanup of Eastland Woolen Mill Superfund Site.
Sennebec Dam	Union	St. George River	2002	Dam replaced with rock ramp fishway.
Main Street Dam	Newport	Sebasticook River	2002	n/a
Smelt Hill Dam	Falmouth	Presumpscot River	2002	Approved hydropower project prior to removal.
Sherman Lake Dam	Newcastle	Marsh River	2005	Dam was breached and subsequently removed.
Sandy River Dam	Norridgewock & Starks	Sandy River	2006	Approved hydropower project prior to removal.
DAMS CURRENTLY PROPOSED OR UNDER STUDY FOR REMOVAL				
Fort Halifax Dam	Winslow	Sebasticook River	n/a	Part of Lower Kennebec Settlement Accord; project is currently the subject of litigation and has been for the past several years.
Gardiner Paperboard Dam	Gardiner	Cobbosseecontee Stream	n/a	Project does not produce electricity.
Mill Pond Dam	Brewer	Sedgunkedunk Stream	n/a	Dam formerly provided process water to Eastern Fine Paper Mill; now owned by City of Brewer.
Boston Felt Dam	Lebanon, ME & Rochester, NH	Salmon Falls River	n/a	Currently approved hydropower project. Dam breached in 2006.
Montsweag Dam	Wiscasset & Woolwich	Montsweag Brook	n/a	Dam formerly provided process water to Maine Yankee Atomic Power Plant.
Coopers Mills Dam	Whitefield	Sheepscot River	n/a	n/a
Veazie Dam	Veazie & Eddington	Penobscot River	n/a	Currently approved hydropower project. Removal planned as part of Penobscot River Restoration Project.
Great Works Dam	Old Town & Bradley	Penobscot River	n/a	Currently approved hydropower project. Removal planned as part of Penobscot River Restoration Project.

Source: Maine Department of Environmental Protection, *Dam Removals in Maine*, *Status as of October 2006;* Day, Laura Rose, Penobscot Restoration Trust, Personal Communication, January 31, 2008

Presently, the Trust has acquired adequate funding to purchase the dams and is in the process of raising additional funds to support dam removal, fish passage installation, and community development work along the affected stretches of the river. The Trust estimates that the entire project, including purchase, removal, fish passage construction, and community development work, will cost from $40 million to $60 million.[74]

3.5 TIDAL ENERGY PROJECTS

66. FERC also issues permits and licenses for tidal energy projects in the study area. It recently granted preliminary permits to the Maine Tidal Energy Company to explore the feasibility of two such projects, one in the Penobscot River, the other in the Kennebec.

67. The proposed Penobscot River Tidal Energy Project would be located west of Verona Island. It would consist of 100 tidal in-stream energy conversion (TISEC) devices, each generating 8.76 gigawatt-hours of power per year; the electricity would be sold to local utilities. The preliminary permit, granted in 2007 and covering a three-year period, allows Maine Tidal Energy Company to test and refine the design components of the project. During this period, the company plans to evaluate fish mortality and potential habitat effects associated with the project.[75]

68. Maine Tidal Energy received a preliminary permit from FERC for the Kennebec Tidal Energy Project in June 2008. The project would be located in a section of the Kennebec River southeast of West Chops Point, and would consist of 50 TISEC devices generating 8.76 gigawatt-hours per unit per year.[76]

3.5.1 SCOPE AND SCALE OF FUTURE TIDAL ENERGY PROJECTS

69. A preliminary permit does not authorize in-water work or construction; therefore the issuance of such permits does not require section 7 consultation.[77] Consultation regarding critical habitat for the salmon would be required, however, if these projects move forward. The analysis assumes that consultations will occur when FERC receives a license application, following the completion of feasibility studies. For the purpose of quantifying impacts, the analysis assumes that two consultations (one for the Penobscot project and one for the Kennebec) will occur in 2010.

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[74] Day, Laura Rose, Penobscot Restoration Trust, Personal Communication, January 31, 2008.

[75] TRC Environmental Corporation to Federal Energy Regulatory Commission. March 30, 2006. *Preliminary Permit Application (Penobscot Tidal Energy Project);* and Federal Energy Regulatory Commission. May 16, 2007. *Order Issuing Preliminary Permit: Project No. 12668-000.*

[76] TRC Environmental Corporation to Federal Energy Regulatory Commission. March 30, 2006. *Preliminary Permit Application (Kennebec Tidal Energy Project).*

[77] National Marine Fisheries Service to Federal Energy Regulatory Commission. June 16, 2006. *Comments: Kennebec Tidal Energy Hydroelectric Project, Project No. 12666-000 Application for Preliminary Permit*; and National Marine Fisheries Service to Federal Energy Regulatory Commission. Undated. *Project No. 12668-000 Comments.*

70. Beyond the projects noted above, it is difficult to forecast the number and location of potential future tidal energy projects within the study area. FERC estimates that it may receive up to 134 preliminary permit applications over the next 20 years, and that these applications ultimately could lead to the licensing of approximately 13 tidal energy projects within the study area.[78] While this information indicates growing interest in the development of tidal energy, details on the potential location, generating capacity, or design of these projects is unavailable. The analysis therefore does not forecast consultations beyond those anticipated for the Kennebec and Penobscot River projects.

3.5.2 PROJECT MODIFICATIONS ASSOCIATED WITH TIDAL ENERGY PROJECTS

71. The two tidal energy projects described above are in the early stages of development. Both NMFS and the U.S. Fish and Wildlife Service have commented on the preliminary permit applications for these projects. In its comments, NMFS noted that the project areas provide habitat for the Atlantic salmon, as well as multiple other sensitive species, including the American shad, Atlantic sturgeon, sea lamprey, and American eel, and requested that the impacts of the projects on these resources be considered. At this point in the projects' development, however, NMFS has offered no specific recommendations regarding the protection of sensitive resources; it has simply asked that the developer be required to coordinate with NMFS and other natural resource management agencies.[79] Until specific plans for the projects are made available, their potential impact on salmon habitat will remain uncertain, as will the nature of any modifications that might be requested to mitigate adverse impacts. In the absence of more detailed information, the analysis offers no estimate of the cost of project modifications that NMFS might request.

72. Consideration of project modifications that have been required of hydrokinetic projects in other regions may provide some sense of the potential impact of critical habitat designation on tidal energy projects in the study area. As a point of reference, the analysis provides information on a recent hydrokinetic project in Washington State: the Makah Bay Offshore Wave Energy Pilot Project in Clallam County, Washington. FERC recently completed an Environmental Assessment (EA) of this project.[80] The EA considered the effects of the project on salmon, among other species, and concluded that the construction and operation of the project may affect the species by increasing the risk of entanglement in abandoned gear; increasing the turbidity of surrounding waters (thereby disrupting feeding and impairing respiration); and increasing the risk of predation due to artificial night-lighting.

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[78] Letter from J. Mark Robinson, Director, Office of Energy Projects, FERC, to Assistant Regional Administrator, NMFS, October 23, 2008.

[79] National Marine Fisheries Service to Federal Energy Regulatory Commission. June 16, 2006. *Comments: Kennebec Tidal Energy Hydroelectric Project, Project No. 12666-000 Application for Preliminary Permit*; and National Marine Fisheries Service to Federal Energy Regulatory Commission. Undated. *Project No. 12668-000 Comments*.

[80] Federal Energy Regulatory Commission. Environmental Assessment for Hydropower License: Makah Bay Offshore Wave Energy Pilot Project. FERC Project No. 12751-000. May 2007.

FERC estimated that the cost of efforts to minimize or avoid these types of threats would be approximately $45,900 (one-time costs at the time of construction in 2007).[81] The EA also noted the potential for ongoing costs associated with species conservation, attributable either to changes in facility operations or to regular monitoring and reporting requirements. These measures would not be undertaken solely for salmon conservation purposes, but for multiple wildlife and habitat concerns.

73. While review of the Makah Bay EA sheds light on the potential threats hydrokinetic projects may pose to salmon and offers potential insights to measures designed to reduce those threats, it is not appropriate to transfer the costs of these measures to the two potential tidal energy projects considered in this analysis. The design of the Makah Bay project (a wave energy project) is likely to differ significantly from the design of tidal energy projects in the Kennebec and Penobscot Rivers. In addition, the conservation measures described in the Makah Bay EA were not undertaken to protect critical habitat. It is unclear whether similar measures would be required of tidal energy projects in Maine. Given these uncertainties, transfer of the costs of salmon-related conservation efforts at the Makah Bay project to tidal energy projects in the study area would be speculative and inappropriate.

3.6 IMPACTS TO HYDROPOWER OPERATIONS AND TIDAL ENERGY PROJECTS

74. Exhibits 3-15 and 3-16 summarize the estimated impacts of salmon critical habitat designation on hydropower operations and tidal energy projects by HUC and SHRU. As indicated in Exhibit 3-16, the present value of estimated impacts is approximately $237 million. The impacts are likely to be greatest in the Merrymeeting Bay SHRU, where the largest number of potentially affected hydropower dams is located.

[81] Costs relevant to salmon conservation include: $3,400 for removing derelict fishing gear; $4,000 for erosion control, re-vegetation, and noxious weed control; $2,500 for water quality monitoring; $2,500 for project facilities inspection and maintenance plan development; $2,500 for fuel and oil spill control and prevention plan; $2,500 for recreation planning; and $26,000 for displays for recreationists.

EXHIBIT 3-15. IMPACTS TO HYDROPOWER OPERATIONS ACROSS THE STUDY AREA

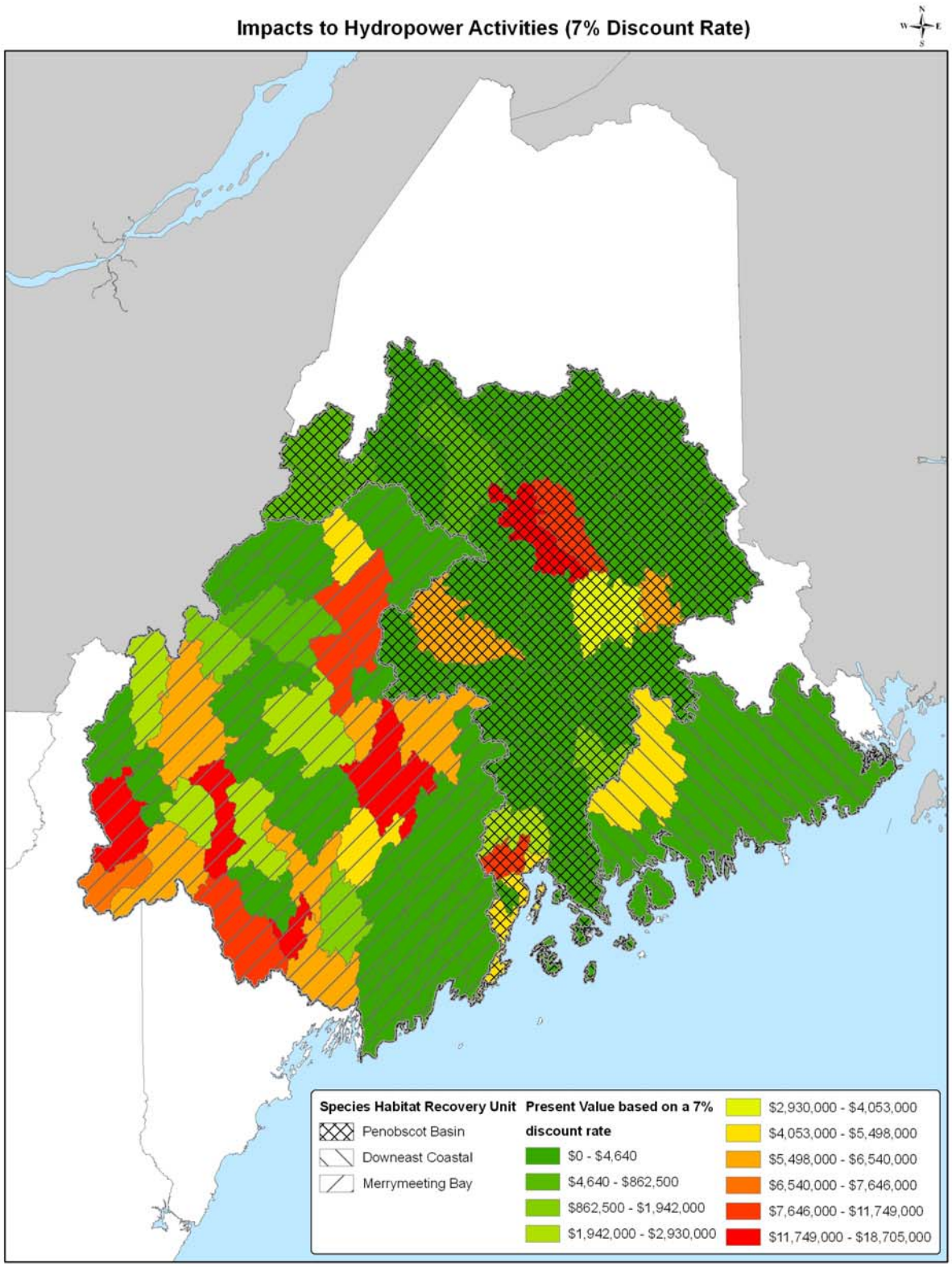

EXHIBIT 3-16. IMPACTS TO HYDROPOWER OPERATIONS BY HUC

DOWNEAST COASTAL		MERRYMEETING BAY		PENOBSCOT BASIN	
10 DIGIT HUC	PRESENT VALUE	10 DIGIT HUC	PRESENT VALUE	10 DIGIT HUC	PRESENT VALUE
0105000212	$4,920,000	0104000106	$18,700,000	0102000109	$15,100,000
0105000213	$2,320	0104000204	$15,700,000	0102000110	$10,400,000
0105000201	$0	0104000208	$14,900,000	0105000218	$10,200,000
0105000203	$0	0103000306	$14,200,000	0102000307	$6,040,000
0105000204	$0	0103000106	$11,700,000	0102000403	$6,030,000
0105000205	$0	0104000209	$11,000,000	0105000220	$5,500,000
0105000206	$0	0103000301	$10,800,000	0102000502	$4,050,000
0105000207	$0	0104000201	$7,650,000	0102000512	$2,920,000
0105000208	$0	0103000307	$6,540,000	0102000509	$1,940,000
0105000209	$0	0104000210	$6,440,000	0102000101	$766,000
0105000210	$0	0104000101	$5,940,000	0102000105	$766,000
0105000211	$0	0104000202	$5,840,000	0102000102	$510,000
0105000214	$0	0103000303	$5,710,000	0102000402	$4,640
0105000215	$0	0104000206	$5,680,000	0102000513	$3,980
		0103000310	$5,190,000	0102000406	$2,320
		0103000104	$4,900,000	0102000503	$1,650
		0103000304	$2,930,000	0102000104	$406
		0104000205	$2,920,000	0102000103	$0
		0104000203	$2,920,000	0102000106	$0
		0103000311	$2,850,000	0102000107	$0
		0104000103	$2,480,000	0102000108	$0
		0103000201	$1,730,000	0102000201	$0
		0103000204	$862,000	0102000202	$0
		0105000307	$3,980	0102000203	$0
		0103000305	$2,320	0102000204	$0
		0105000304	$840	0102000205	$0
		0103000309	$686	0102000301	$0
		0103000308	$686	0102000302	$0

DOWNEAST COASTAL		MERRYMEETING BAY		PENOBSCOT BASIN	
10 DIGIT HUC	PRESENT VALUE	10 DIGIT HUC	PRESENT VALUE	10 DIGIT HUC	PRESENT VALUE
		0103000101	$0	0102000303	$0
		0103000102	$0	0102000304	$0
		0103000103	$0	0102000305	$0
		0103000105	$0	0102000306	$0
		0103000202	$0	0102000401	$0
		0103000203	$0	0102000404	$0
		0103000302	$0	0102000405	$0
		0103000312	$0	0102000501	$0
		0104000102	$0	0102000504	$0
		0104000104	$0	0102000505	$0
		0104000105	$0	0102000506	$0
		0104000207	$0	0102000507	$0
		0105000301	$0	0102000508	$0
		0105000302	$0	0102000510	$0
		0105000303	$0	0102000511	$0
		0105000305	$0	0105000216	$0
		0105000306	$0	0105000217	$0
				0105000219	$0
Subtotal	**$4,920,000**	**Subtotal**	**$168,000,000**	**Subtotal**	**$64,300,000**
				PRESENT VALUE OF IMPACTS ACROSS ALL HUCS	**$237,000,000**

Notes:

1. Figures are rounded to three significant digits and may not sum due to rounding.
2. Estimates reflect present value of impacts for the 2008-2057 time horizon of the analysis and reflect a 7 percent discount rate.
3. Highlighting denotes HUCs that Atlantic salmon currently occupy.

3.7 ASSUMPTIONS AND CAVEATS

75. Exhibit 3-17 summarizes the major assumptions and caveats underlying the analysis.

EXHIBIT 3-17. CAVEATS AND ASSUMPTIONS

ASSUMPTION	POTENTIAL EFFECT ON RESULTS[1]
Unless a dam is known to be equipped with fish passage facilities, the analysis assumes that no passage is present and quantifies the effects of adding fish passage facilities at the time of relicensing.	+
Absent review of each individual dam project, this analysis assumes that main stem dams are likely to require fish lifts, while for tributary dams, fish ladders are likely to be adequate for salmon habitat conservation needs.	+/-
The estimated date for future consultation and project modification is based upon FERC relicensing schedules or, absent that information, assumed to occur ten years from the proposed critical habitat rule (in 2018). The timing of consultations and modifications may vary from these assumptions.	+/-
Each hydropower project will be the subject of an individual consultation. In reality, a consultation may cover more than one project. To the extent that costs of particular project modifications associated with a single consultation may be jointly borne by the project owners, this analysis may overstate its costs.	+
Dam operators will divert water from hydropower generation to ensure effective passage at ladder and lift facilities, resulting in a four percent decrease in annual power generation. Actual impacts on individual dams may vary from this assumption.	+/-
Hydropower projects may be required to provide additional flow for salmon habitat and, as a result, may experience economic impacts to the extent that the change in flow regimes results in a reduction or redistribution of power generation. The likelihood of a particular project being required to provide additional flow will depend on many factors, including the biological significance of the dam project to salmon survival and recovery, the seasonality of flow, the economic importance of the dam project, whether there is public concern over the project, and other factors. In light of limited data, costs associated with flow requirements are not included in the estimates of section 7 implementation costs assigned to a particular watershed.	-
To the extent possible, this analysis uses the location of dam infrastructure for the spatial analysis. In some instances, the sources disagree on a dam's location. The location of every dam in the data layers has not been independently corroborated.	+/-
Absent information on the scope and scale of additional future tidal energy projects, the analysis forecasts only the administrative costs of consultation for two projects that have received preliminary permits.	-
Notes: +: This assumption may result in an overestimate of real costs. - : This assumption may result in an underestimate of real costs. +/-: This assumption has an unknown effect on estimates.	

CHAPTER 4 | AGRICULTURAL ACTIVITIES

4.1 INTRODUCTION

1. This chapter addresses the potential impacts of Atlantic salmon critical habitat designation on agricultural activities in the study area. According to the 2001 National Land Cover Database (NLCD), approximately 433,891 acres of agricultural land in Maine (53 percent of the State's total agricultural land) and 1,594 acres in New Hampshire (0.6 percent of the State's total agricultural land) fall within the boundaries of the study area.[1,2] The vast majority of this land (92 percent) is privately owned.

2. Several activities that enhance agricultural production may have an adverse impact on the salmon's critical habitat. For example, the use of water to irrigate cropland may lower the water table and diminish in-stream flows below the levels that salmon require. Further, runoff or drift of petro-chemicals (pesticides, herbicides, fungicides, fertilizers, etc.) may affect water quality and the availability of prey species in salmon habitat.[3] Petro-chemical runoff may also increase eutrophication, promoting algal blooms that impair the growth of submerged aquatic vegetation and reducing the concentration of dissolved oxygen available to support other forms of aquatic life, including the salmon.

3. Farmers receiving technical, financial, or other assistance from the Natural Resource Conservation Service (NRCS), Farm Service Agency (FSA), or from federally funded programs managed by the Maine Department of Agriculture, Food, and Rural Resources (MEDAFRR) may be requested to modify their activities to avoid destruction or adverse

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[1] In the absence of more specific Geographic Information Systems (GIS) data, the analysis defines agricultural land using the 2001 NLCD land cover categories "Pasture/Hay" and "Cropland". The NLCD is a national Landsat 5 and 7 imagery-based raster dataset classifying land into 21 different categories. According to NLCD land cover definitions (http://www.epa.gov/mrlc/definitions.html), "Pasture/Hay" lands include "areas of grasses, legumes, or grass-legume mixtures planted for livestock grazing or the production of seed or hay crops, typically on a perennial cycle. Pasture/hay vegetation accounts for greater than 20 percent of total vegetation." Areas identified as "Cropland" include "areas used for the production of annual crops, such as corn, soybeans, vegetables, tobacco, and cotton, and also perennial woody crops such as orchards and vineyards. Crop vegetation accounts for greater than 20 percent of total vegetation. This class also includes all land being actively tilled."

[2] While NLCD data suggests there are 823,082 acres of agricultural land in Maine, the United States Department of Agriculture (USDA) National Agricultural Statistics Service reported approximately 1,360,000 acres of agricultural land for the state in 2006. The discrepancy between the NLCD and USDA estimates likely reflects the fact that if two or more crops were harvested from the same acre of land during a given year, USDA counted that acre twice. As USDA reports, "the total acres of all crops harvested generally exceeded the acres of cropland harvested." The impacts presented in this chapter reflect the average economic value per acre farmed regardless of whether land is harvested once or more than once during the year. Therefore, this analysis uses the NLCD data rather than the USDA data to estimate the acreage of agricultural land in the study area.

[3] "Drift" refers to the aerial transportation of pesticide spray that may travel beyond the area intended for application.

modification of the salmon's critical habitat. The modifications requested may include developing alternative water supplies, establishing riparian setbacks, or restricting pesticide application within certain distances from perennial streams within the study area. Exhibit 4-1 summarizes the projected economic impacts of these changes in agricultural activity, assuming that the project modifications described above would be required throughout the 105-HUC study area.

EXHIBIT 4-1. IMPACTS OF SALMON CRITICAL HABITAT DESIGNATION ON AGRICULTURAL ACTIVITIES

SPECIES HABITAT RECOVERY UNIT	PRESENT VALUE[1]	
	LOW	HIGH
Downeast Coastal	$457,000	$549,000
Merrymeeting Bay	$5,510,000	$5,900,000
Penobscot Basin	$2,110,000	$2,530,000
Total[2]	**$8,080,000**	**$8,980,000**

1. Impact estimates reflect a 20-year time horizon (2008-2027) over which impacts are discounted at an annual rate of 7 percent.
2. Entries may not sum to totals reported due to rounding.

4. The remainder of this chapter provides additional detail on development of the impact estimates presented in Exhibit 4-1. To provide context for the analysis, the first section presents a profile of Maine's agriculture industry.[4] Following this discussion, the second section describes the data and methods from which the impact estimates are derived.[5] The third section summarizes the projected economic impacts to agricultural activities, and the final section highlights major assumptions and caveats that may affect the results of the analysis.

4.2 PROFILE OF MAINE'S AGRICULTURE INDUSTRY

5. Exhibit 4-2 provides information on the distribution of agricultural land within the study area. As the exhibit indicates, more than two-thirds of this land is concentrated in six Maine counties: Penobscot, Kennebec, Somerset, Washington, Waldo, and Androscoggin. Exhibit 4-3 graphically illustrates the concentration of agricultural lands in these counties relative to the remainder of the study area.

[4] Because the New Hampshire portion of the study area contains little agricultural land, the background portion of this chapter focuses primarily on Maine.

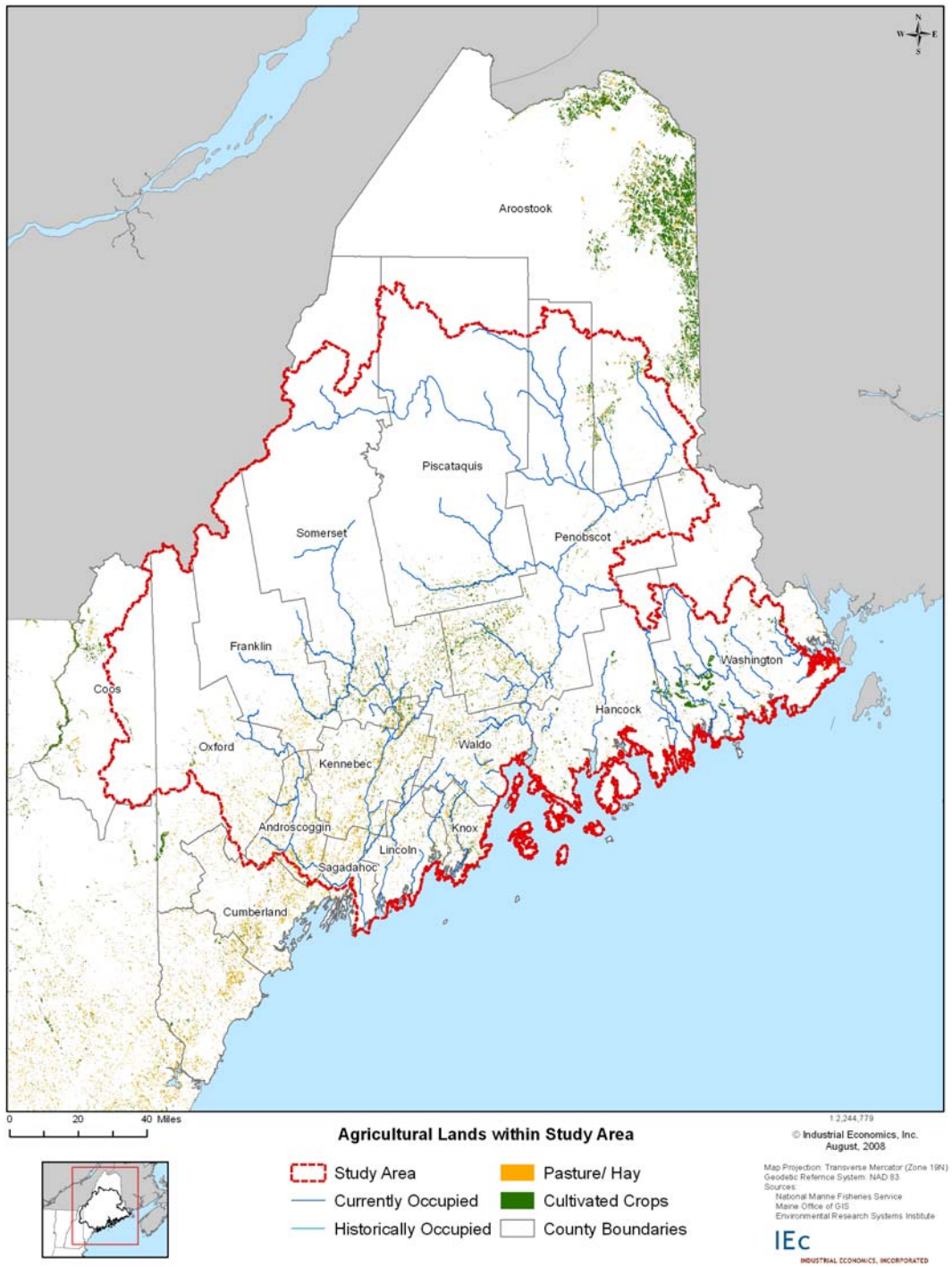
[5] Existing State, local, or other agricultural management standards are believed to be unlikely to require modifications of agricultural activity similar to those that NMFS may request to conserve critical habitat for the Gulf of Maine DPS of Atlantic salmon. For this reason, this chapter does not include a separate discussion of current State, local, or other standards.

EXHIBIT 4-2. ACRES OF PASTURE AND CROPLAND WITHIN STUDY AREA[1]

STATE	COUNTY	PASTURE/ HAY LAND (ACRES)	CROPLAND (ACRES)	TOTAL AGRICULTURAL LAND (ACRES)	PERCENT OF TOTAL AGRICULTURAL LAND
ME	Androscoggin	28,522	7,644	36,166	8.3%
	Aroostook	6,011	10,442	16,453	3.8%
	Cumberland	517	128	645	0.1%
	Franklin	12,678	5,159	17,837	4.1%
	Hancock	8,008	8,952	16,960	3.9%
	Kennebec	42,559	18,397	60,956	14.0%
	Knox	10,512	7,831	18,343	4.2%
	Lincoln	11,921	5,076	16,997	3.9%
	Oxford	16,604	6,956	23,560	5.4%
	Penobscot	33,392	38,431	71,822	16.5%
	Piscataquis	6,605	9,495	16,100	3.7%
	Sagadahoc	10,503	1,461	11,964	2.7%
	Somerset	26,377	27,299	53,676	12.3%
	Waldo	20,809	13,294	34,102	7.8%
	Washington	7,771	30,538	38,309	8.8%
NH	Coos	189	1,405	1,594	0.4%
Total[2]		**242,978**	**192,507**	**435,486**	**100%**

Notes:
1. Acres derived from GIS overlay of the study area and areas identified by the 2001 NLCD data set as "cropland" and "pastureland."
2. Entries may not sum to totals reported due to rounding.

EXHIBIT 4-3. AGRICULTURAL LANDS WITHIN THE STUDY AREA



6. Maine's agriculture industry plays a significant role in the State's economy, particularly in the central and northern portions of the State. As New England's top agricultural producer, Maine is the world's largest producer of blueberries and brown eggs; it also ranks second in the nation in maple syrup production and sixth in potato production.[6] According to the USDA 2002 Census of Agriculture, the market value of all agricultural products sold in Maine in 2002 was nearly $464 million.[7, 8]

7. Based on the available data, the number of individuals employed by Maine's agricultural industry is uncertain. According to the U.S. Census Bureau, Maine's agriculture industry employed nearly 2,000 people in the counties located in the study area in 2005. As indicated in Exhibit 4-4, this represents approximately 0.4 percent of the labor force in these counties.[9] In contrast, the USDA Census of Agriculture reported approximately 16,000 "hired farm laborers" in the Maine portion of the study area for 2002.[10] It is unclear why these figures differ so significantly, but one potential reason is that the Census Bureau only counted workers employed by the same farm for two consecutive quarters. To the extent that agricultural laborers migrate from farm to farm, the Census Bureau may underestimate agricultural employment.

8. Expanding upon the estimates of direct employment presented above, the USDA's Economic Research Service estimated that roughly 15 percent of Maine's employment (more than 100,000 jobs) was related to agricultural "production", "farm inputs", "processing and marketing", and "wholesale and retail trade".[11] This estimate significantly exceeds the values presented above because it reflects jobs that are indirectly related to agriculture (e.g., sales staff at farm machinery vendors), as well as jobs directly related to agricultural activities.

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[6] Maine State Planning Office, March 2001. "Fishing, Farming, and Forestry: Resources for the Future". Accessed at http://www.maine.gov/spo/economics/docs/farmfish01.pdf on November 20, 2007.

[7] USDA, 2002 Census of Agriculture, Maine State and County Data, Volume 1, Geographic Area Series Part 19, Table 2. "Market Value of Agricultural Products Sold Including Landlord's Share, Direct, and Organic: 2002 and 1997". Pg. 8.

[8] The size of Maine's agricultural industry could alternatively be measured according to its contribution to the state's gross domestic product (GDP). GDP reflects the "value-added" by an industry; in contrast, gross sales reflects value added plus the value of the inputs purchased by the industry. According to the Bureau of Regional Economic Analysis (http://www.bea.gov/regional/gsp/), crop and animal production contributed approximately $216 million toward the state GDP (roughly 0.5 percent) in 2005.

[9] U.S. Census Bureau. Local Employment Dynamics, Quarterly Workforce Indicators (Online) at http://lehd.did.census.gov/led/datatools/qwiapp.html on August 15, 2007.

[10] USDA, 2002 Census of Agriculture, Maine State and County Data, Volume 1, Geographic Area Series Part 19, Table 7. "Hired Farm Labor – Workers and Payroll". Pgs. 218-220.

[11] USDA Economic Research Service, "State Fact Sheets: Maine". Accessed at http://www.ers.usda.gov/StateFacts/ME.HTM on December 18, 2007.

EXHIBIT 4-4. AGRICULTURAL EMPLOYMENT WITHIN THE MAINE PORTION OF THE STUDY AREA

STATE	COUNTY	TOTAL EMPLOYMENT IN THE COUNTY (2005)[1]	CENSUS ESTIMATES		USDA ESTIMATES	
			TOTAL COUNTY AGRICULTURE-RELATED EMPLOYMENT (2005)[1]	AGRICULTURE EMPLOYMENT AS A PERCENT OF TOTAL EMPLOYMENT	TOTAL COUNTY AGRICULTURE-RELATED EMPLOYMENT (2002)[2]	AGRICULTURE EMPLOYMENT AS A PERCENT OF TOTAL EMPLOYMENT
ME	Androscoggin	52,675	107	0.20%	1,115	2.12%
	Aroostook	28,425	672	2.36%	3,789	13.33%
	Cumberland	167,480	161	0.10%	772	0.46%
	Franklin	11,985	0	0.00%	312	2.60%
	Hancock	21,657	64	0.30%	860	3.97%
	Kennebec	56,980	293	0.51%	899	1.58%
	Knox	17,420	34	0.20%	469	2.69%
	Lincoln	11,053	40	0.36%	366	3.31%
	Oxford	17,933	102	0.57%	485	2.70%
	Penobscot	68,339	134	0.20%	1,148	1.68%
	Piscataquis	5,383	0	0.00%	327	6.07%
	Sagadahoc	15,576	0	0.00%	160	1.03%
	Somerset	17,424	111	0.64%	421	2.42%
	Waldo	10,474	54	0.52%	439	4.19%
	Washington	10,095	164	1.62%	4,516	44.74%
Total		**512,899**	**1,936**	**0.38%**	**16,078**	**3.13%**

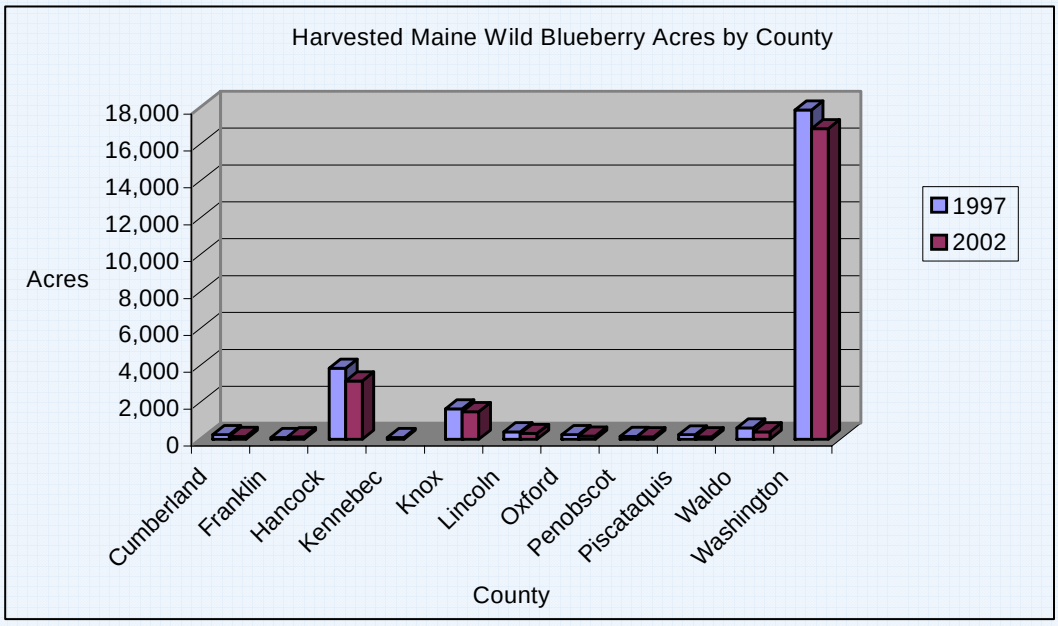
Notes:

1. 2005 averages obtained from U.S. Census QWI online database (http://lehd.did.census.gov/led/datatools/qwiapp.html). Estimates reflect jobs in "Crop Production" (NAICS code 111) and "Animal Production" (NAICS code 112) as well as "support activities".
2. USDA, 2002 Census of Agriculture, Maine State and County Data, Volume 1, Geographic Area Series Part 19, 2004.

Maine's Blueberry Industry

After potato, milk, and egg production, blueberries are Maine's most significant agricultural commodity.[1] Statewide, blueberry cultivation generated more than $60 million in revenues in 2006.[2] Concentrated in Washington and Hancock counties, east of the Penobscot River, the State has more than 60,000 acres in wild blueberry production (of which, approximately half is harvested annually during the crop's two-year growing cycle). The graph below highlights the number of cultivated blueberry acres harvested by county in 1997 and 2002.

Maine's blueberry industry may be affected by critical habitat designation as a number of commercial blueberry growers withdraw water directly from streams supporting wild Atlantic salmon.[3] This water is used for berry processing, frost protection, and for the irrigation of some 6,000 acres across the study area.[4] In recent years, to help farmers during drought and to conserve instream habitat, the State of Maine has promoted irrigation and the use of alternative water storage facilities through Federal cost-share programs. While irrigation is expected to increase in coming years, direct surface water withdrawals are expected to decline. To date, several large blueberry growers have already invested millions in constructing alternative water storage facilities to reduce surface water withdrawals and lessen their impact on instream habitat.[5]



Notes:

[1] Smith, Stewart. "Maine Agriculture: A Natural Resource Based Industry Constantly Adapting to Change". University of Maine. A Paper for the Blaine House Conference on Natural Resource-based Industries. October, 2003.

[2] University of Maine, Cooperative Extension. Wild Blueberry Fact Sheet, Crop Statistics. Accessed from http://wildblueberries.maine.edu/factsheets/Miscellaneous/acres.html on August 27, 2007.

[3] Farmers also extract water from wells situated along waterways that may impact stream levels.

[4] National Maine Fisheries Service and US Fish and Wildlife Service, Anadromous Atlantic Salmon Biological Review Team. 1999. Review of the status of anadromous Atlantic salmon (*Salmo salar*) under the US Endangered Species Act. Pg. 81.

[5] Harker, John. "Water Use in Maine Agriculture". Maine Department of Agriculture, Food, and Rural Resources. Accessed at http://www.stratexllc.com/presentations/pdf/Harker.pdf on November 20, 2007.

4.3 ANALYTIC METHODOLOGY

9. This section describes the methods employed to estimate economic impacts to the agriculture industry associated with Atlantic salmon critical habitat designation. To begin, this section identifies agricultural land in the study area for which Federal funding, permitting, or other oversight may necessitate a section 7 consultation regarding the salmon and its habitat. The methodology for quantifying impacts associated with section 7-related project modifications is then outlined in detail.

4.3.1 FEDERAL ASSISTANCE SUPPORTING AGRICULTURAL ACTIVITIES

10. Agricultural activities with a Federal nexus that may affect the salmon's critical habitat may be modified following a section 7 consultation to avoid adverse modification. Agricultural activities in the study area have a Federal nexus if they receive assistance from the USDA or through State programs financed by discretionary Federal funding.

11. The NRCS and FSA provide most of the direct assistance that farmers in the study area receive from the Federal government. These agencies manage a myriad of programs and services offering technical and financial assistance to farm operators. NRCS manages a number of voluntary programs to maintain, enhance, and conserve natural resources for farmers, whereas FSA administers voluntary farm loans, conservation programs, commodity programs, disaster payments, and outreach programs.

12. MEDAFRR also distributes monies to Maine farmers under two federally-funded programs: the Senior FarmShare Program and the Organic Certification Reimbursement Program. The Senior FarmShare Program subsidizes approximately 150 participating Maine farms that provide fresh, unprocessed, locally grown produce to roughly 16,000 low-income seniors.[12] Similarly, the Organic Certification Reimbursement Program allows eligible organic farmers to be reimbursed for up to 75 percent of their costs for receiving their organic certification (not to exceed $500).

13. All of these programs are voluntary and constitute a Federal nexus, requiring consultation between the Federal agency involved in the program and NMFS. Data identifying the specific farms participating in these programs are not readily available; however, the 2002 U.S. Census of Agriculture presents data describing the number of farms, by county, that received Federal assistance in 2002. Of the 6,511 farms in the Maine portion of the study area, approximately 1,195 (or 18.4 percent) received some form of Federal assistance.[13] Similarly, 37 of the 208 farms in Coos County, New Hampshire (or 17.8 percent) received Federal assistance that year.[14] Absent more detailed information, the

[12] Personal communication with Deanne Herman, Marketing Manager, Maine Department of Agriculture, on October 17, 2007. Farms in the program vary in size (from 1 to 100 acres) and provide small mixed produce.

[13] USDA. National Agriculture Statistics Service, 2002 U.S. Census of Agriculture. Table 5. Government Payments and Commodity Credit Corporation Loans: 2002 and 1997. Pg. 215. The distribution of government payments varied by county and was comparable to the number of farms receiving government assistance in 1999.

[14] USDA. 2002 Census of Agriculture, New Hampshire State and County Data; Volume 1, Geographic Area Series, Part 29, AC-02-A-29. Issued June 2004.

analysis assumes that the share of agricultural land subject to a Federal nexus is equal to the percentage of farms receiving assistance in each county, as presented in Exhibit 4-5.

EXHIBIT 4-5. DISTRIBUTION OF GOVERNMENT MONIES BY COUNTY, 2002

STATE	COUNTY	NUMBER OF FARMS	FARMS RECEIVING GOV'T ASSITANCE	% OF FARMS RECEIVING GOV'T ASSITANCE
ME[1]	Androscoggin	334	46	13.8%
	Aroostook	1,084	541	49.9%
	Cumberland	596	53	8.9%
	Franklin	317	53	16.7%
	Hancock	317	39	12.3%
	Kennebec	575	75	13.0%
	Knox	275	14	5.1%
	Lincoln	292	21	7.2%
	Oxford	469	52	11.1%
	Penobscot	575	97	16.9%
	Piscataquis	201	25	12.4%
	Sagadahoc	158	9	5.7%
	Somerset	504	94	18.7%
	Waldo	415	43	10.4%
	Washington	399	33	8.3%
NH[2]	Coos	208	37	17.8%
Total		**6,719**	**1,232**	**18.3%**

Notes:
1. USDA, 2002 Census of Agriculture, Maine State and County Data, Volume 1, Geographic Area Series Part 19, 2004. Table 1. Pgs. 201-202.
2. USDA, 2002 Census of Agriculture, New Hampshire State and County Data, Volume 1, Geographic Area Series Part 29, 2004. Table 1. Pgs. 187-188.

4.3.2 ANTICIPATED MODIFICATIONS TO AGRICULTURAL ACTIVITIES

14. This analysis assumes that all farmers receiving Federal assistance and engaging in activities potentially affecting the salmon's critical habitat will undertake a section 7 consultation with NMFS or FWS and subsequently modify their activities to avoid adverse modification.[15] NMFS has specified the following project modifications that may be requested via section 7 consultations:

- Establishing 30-meter setbacks to riparian areas along perennial streams and restricting the application of petrochemicals (pesticides, herbicides, fungicides, and fertilizers) within these areas (to protect the health of invertebrate communities, reduce run-off, and maintain a natural state of temperature, siltation, and nutrient flux); and

[15] Because only a portion of the farms that receive Federal assistance in the study area are located adjacent to rivers and streams, consultations are not expected to be conducted for all farms in the study area that receive Federal assistance.

- Accessing water sources that would serve as an alternative to withdrawing surface water from perennial streams within the study area. [16]

4.3.3 METHODOLOGY FOR QUANTIFYING IMPACTS TO AGRICULTURAL ACTIVITIES

15. The analysis of potential impacts on agricultural activities considers the costs associated with establishing a 30-meter setback on all riparian areas and the costs of developing alternative sources for the irrigation of agricultural lands. The analysis does not separately estimate impacts for restrictions on pesticide application within 30 meters of a perennial stream because the 30-meter riparian setback will satisfy this requirement. The approach for estimating the impacts of these measures is described below. Also included is a description of the methodology used to estimate the administrative costs associated with section 7 consultations concerning agricultural activity.

4.3.3.1 Quantifying the Impacts of Establishing a 30-Meter Setback

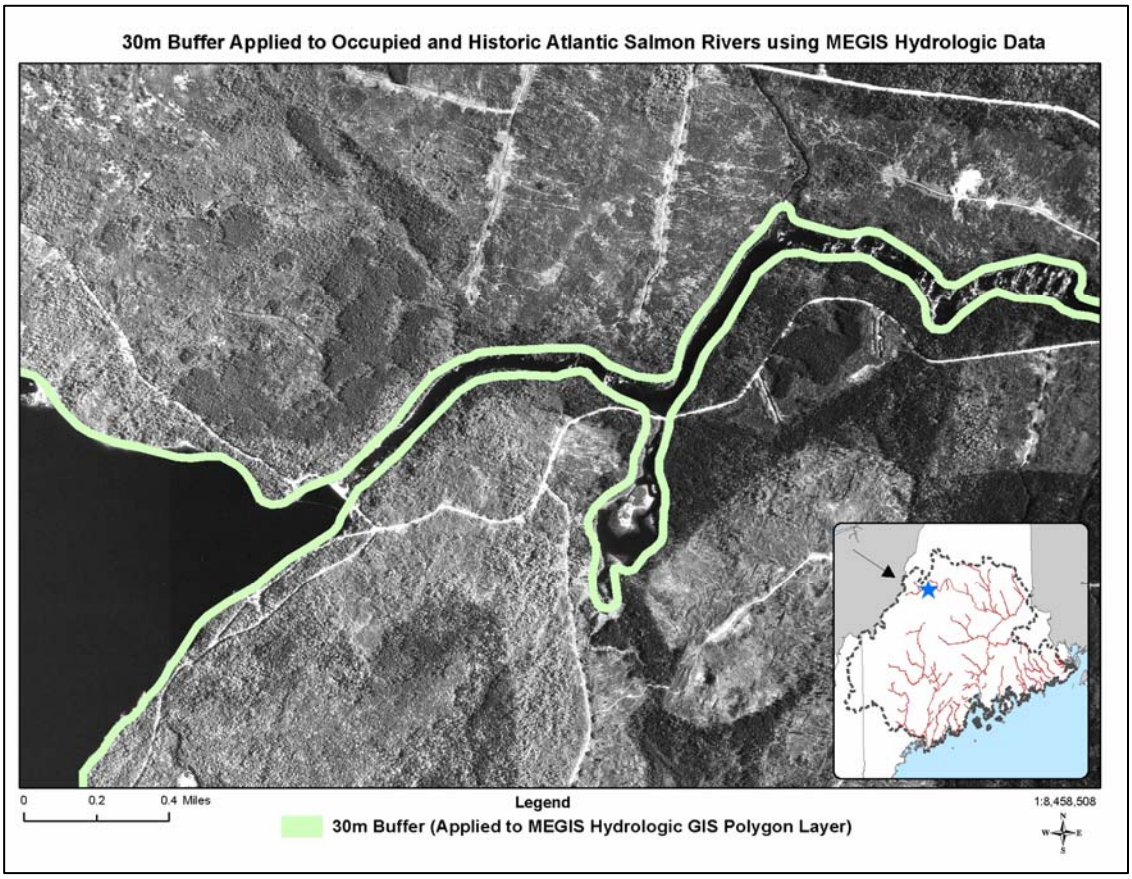
16. To establish a riparian setback (i.e., a buffer), the analysis assumes that farms carrying out agricultural activities with a Federal nexus will provide for the retirement of all lands within 30 meters of a perennial stream. The cost of this measure is estimated as the value of the agricultural output foregone as a result of the setback. The following outlines the methodology employed to estimate these costs.

1) **Apply 30-meter buffer to all perennial streams within the study area**. Using GIS layers published by the Maine Office of GIS, a polygonal representation of the bank-full width of all perennial streams within the study area was generated.[17] Subsequently, a 30-meter buffer was applied to the stream layer to produce the riparian setback area. Exhibit 4-6 illustrates the application of the 30-meter buffer; the solid green polygon along the river banks delineates the setback area.

[16] NMFS. May 2007. Draft Habitat Requirements and Management Considerations for Atlantic Salmon (*Salmo salar*) in the Gulf of Maine Distinct Population Segment (DPS). Pg. 19.

[17] To establish a state stream polygon layer, the analysis employs two hydrologic GIS layers published by the Maine Office of GIS (MEGIS), "hydro_04202006" and "streams_04202006". The layer "hydro_04202006" provides a polygonal representation of the main stems of the major rivers in the study area; "streams_04202006" offers a polyline representation of all perennial streams in Maine. Based on Google Earth© imagery, the average stream width of perennial streams in Maine was estimated to be approximately 4 meters. Consequently, the "streams_04202006" layer was buffered by 2 meters (on each side of the polyline); the analysis assumes that the resultant polygon feature represents the bank-full width of perennial streams. The two polygonal layers were then combined to generate a GIS layer representing the bank-full width of all streams within the study area.

EXHIBIT 4-6. PERENNIAL STREAMS WITHIN THE STUDY AREA (30-METER BUFFER APPLIED TO POLYGON LAYER)



2) **Identify agricultural lands within the 30-meter buffer.** All lands NLCD defines as "cropland" or "pastureland" within the 30-meter buffered area were identified. Approximately 9,880 acres of agricultural land lie within the setback area (4,190 cropland acres and 5,690 pastureland acres).

3) **Estimate the acreage of agricultural land identified in Step 2 on which activities with a Federal nexus occur.** Although 9,880 acres of agricultural land in the study area may lie within 30 meters of perennial streams, only a portion of this acreage (on which activities with a Federal nexus occur) will be taken out of production to accommodate the 30-meter riparian buffer. To estimate the acreage taken out of production, the percentage of farms receiving Federal assistance was multiplied by the acreage within the 30-meter setback (this calculation was performed

at the county level using county level acreage values from step 2 and the county-level data presented in Exhibit 4-5).

4) **Calculate annual loss of agricultural production within riparian setback area.** To estimate the cost of the riparian setback, the value of each county's annual agricultural production per acre was multiplied by the county-level acreage estimates generated in Step 3.[18] The resultant values represent the annual agricultural production value lost, by county, within the 30-meter setbacks.

5) **Array impacts by HUC.** Finally, the costs of the setback were assigned to each HUC within the study area. To generate these HUC-level estimates, cropland and pastureland areas within the 30-meter setbacks were overlaid with the GIS HUC layer.

4.3.3.2 Quantifying the Impacts of Developing Alternative Water Sources

17. As described above, the analysis assumes that farms that withdraw water directly from a perennial stream and which engage in agricultural activities with a Federal nexus would be required to access alternative water sources for their irrigation systems. Ideally, this analysis would use geospatial information outlining farm boundaries and acres currently irrigated by surface water to determine the specific design needed for alternative water supplies. Because these data are unavailable, the analysis employs estimates of the number of acres that would require service from an alternative source and the average cost of providing such service. The approach for estimating these costs is as follows:

1) **Identify acreage currently serviced by surface water withdrawals.** The 2002 Census of Agriculture estimates the average irrigated acreage per farm by county for both Maine and New Hampshire, but does not distinguish between acres served by surface water and acres served by other water sources.[19] A 2002 MEDAFRR water use survey indicates, however, that surface water serves as the water source for roughly 13 percent of Maine irrigators.[20] Based on this figure, the analysis estimates that approximately 2,325 acres of agricultural land in the study area (i.e., 13 percent of the

[18] County level production values per acre were taken from USDA, 2002 Census of Agriculture, Maine State and County Data, Volume 1, Geographic Area Series Part 19, Table 1. Pg. 200-204 and USDA, 2002 Census of Agriculture, New Hampshire State and County Data, Volume 1, Geographic Area Series Part 29, Table 1. Pg. 187-188. These values represent a composite of the various agricultural activities within each county.

[19] USDA, 2002 Census of Agriculture, Maine State and County Data, Volume 1, Geographic Area Series Part 19, Table 10. Pg. 16. USDA, 2002 Census of Agriculture, New Hampshire State and County Data, Volume 1, Geographic Area Series Part 29, Table 10. Pg. 16.

[20] "The Future of Water Use for Maine Farmers", John Harker. Maine Department of Agriculture, Food, and Rural Resources. 2003.

irrigated farm land) is irrigated by surface water. Because farms are unlikely to rely upon ephemeral streams for irrigation, we assume that all of this acreage is served by perennial streams.

2) **Estimate acreage from Step 1 that is subject to a Federal nexus**. Although surface waters irrigate an estimated 2,325 acres of agricultural land in the study area, alternative water sources are likely to be developed for only the portion of this acreage on which activities with a Federal nexus occur. To estimate the acreage for which alternative water sources may be developed, the estimated acreage of farmland irrigated by surface water in each county was multiplied by the percentage of agricultural land in each county on which activities with a Federal nexus occur (as presented in Exhibit 4-5).

3) **Estimate the costs of supplying water from alternative water sources.** According to the MEDAFRR's 2003 "Sustainable Agricultural Water Source and Use Policy and Action Plan", the total (non-annualized) cost of supplying water from an alternative water source (e.g., a well or irrigation pond) is between $2,185 to $2,875 per acre (2007 dollars).[21] This range was applied to the acreage values generated in Step 2 (i.e., those acres expected to switch to alternative water sources to avoid adverse modification of salmon critical habitat) to estimate the cost of switching to alternative water sources.

   It is important to note that the $2,185 to $2,875 unit cost range only reflects the cost of developing alternative water supplies. It does not include the cost of retrofitting existing irrigation systems to extract water from these sources. To the extent that retrofitting is needed, the analysis may underestimate the costs of switching to alternative sources.

4) **Array costs of developing alternative water sources by HUC.** Finally, county level impact estimates related to the development of alternative water supplies were distributed to each HUC within each county based on the ratio of perennial river miles within each HUC (or portion thereof) to the total river miles within the county.

4.3.3.3 Quantifying the Impacts of Administrative Costs

18. During a section 7 consultation, NMFS, the Federal agency involved in the activity (e.g., FSA, NRCS, USDA), and the third party applying for Federal funding or permitting (if applicable) incur administrative costs as they coordinate to minimize potential adverse effects to the species and/or to the proposed critical habitat. The duration and complexity of these interactions depends on a number of variables, including the type of consultation (i.e., formal or informal), the species, the activity of concern, the potential effects of the

[21] ibid., pg. 9. These estimates are based on a limited number of projects and represent the average cost per acre served by a well ($1,900) or pond ($2,500). These 2003 estimates were inflated to 2007 dollars using the GDP Deflator. These estimates are similar to the $1,000- $2,500 estimates cited in "Water Management Issues for Maine" by John Harker, Agricultural Water Use Program Manager, MEDAFRR (ftp://ftp-fc.sc.egov.usda.gov/ME/STTCweb/irrigationtalk.ppt).

proposed activity on the species and its critical habitat, the Federal agency involved, and whether there is a private applicant involved.[22]

19. Ideally, this analysis would estimate the administrative costs associated with section 7 consultations based on the number of farms where agricultural activities subject to a consultation occur. Based on the available data, however, this figure is uncertain. In the absence of such information, this analysis uses two separate approaches for estimating the administrative costs of section 7 consultations for agriculture: one approach for consultations related to riparian setbacks and a second for consultations associated with alternative water supplies. A key assumption of the analysis is that there is no overlap between the consultations associated with these project modifications. In addition, the analysis assumes that all section 7 consultations related to agricultural activities will be informal and will not require additional biological research efforts on the part of NMFS. The general approach for estimating the consultation costs associated with each project modification is as follows:

- **Administrative costs for section 7 consultations related to riparian setbacks**

    1) **Estimate consultation costs per acre.** The administrative costs of an informal consultation are estimated to range from $3,700 per farm to $10,700 per farm.[23] To estimate costs on a per acre basis, this range was divided by the average farm size, by county, as specified by the USDA 2002 Census of Agriculture. Based on this approach, the estimated cost of an informal consultation ranges from $10 to $118 per acre across the study area.

    2) **Apply consultation cost per acre to the agricultural acreage in riparian setbacks.** To estimate the total administrative costs associated with section 7 consultations for riparian setbacks, the cost per acre, by county (as estimated in Step 1), was multiplied by the acreage of agricultural land in the riparian setback for each county.

[22] Informal consultations consist of discussion between NMFS, the Federal agency, and the applicant concerning an action that may affect a listed species or its designated critical habitat. The process is designed to identify and resolve potential concerns at an early stage in the planning process. By contrast, a formal consultation is required if the Federal agency determines that its proposed action may or will adversely affect the listed species or designated critical habitat in ways that cannot be resolved through informal consultation. The formal consultation process results in the Service's determination in a Biological Opinion of whether the action is likely to jeopardize a species or adversely modify critical habitat, and recommendations to minimize those impacts.

[23] Source: Industrial Economics, Inc. analysis of administrative costs based on data from the Federal Government Schedule Rates, Office of Personnel Management, 2007, and a review of consultation records from several U.S. Fish and Wildlife Service field offices across the country conducted in 2002. The range of consultation costs given above corresponds to the range of costs attributable to an incremental, informal consultation resulting entirely from the designation of critical habitat, excluding the costs of a biological assessment. The figures reported in Exhibit 2-1 represent the midpoint of this range.

3) **Array consultation costs by HUC.** The consultation costs associated with riparian setbacks were assigned to individual HUCs within each county based on the acreage of riparian buffer within each HUC.

- **Administrative costs for section 7 consultations related to alternative water supplies**

1) **Estimate the number of farms that directly withdraw surface water**. As indicated in the discussion of impacts associated with developing alternative water supplies, the number of farms that withdraw from surface waters can be estimated from 2002 Census of Agriculture data on the number of irrigated farms by county and the 2002 MEDAFRR water use survey, which indicates that approximately 13 percent of Maine irrigators withdraw water directly from a stream or river.

2) **Estimate the number of farms developing alternative water supplies**. To estimate the number of farms developing alternative water supplies, the estimated number of farms that withdraw directly from surface water (as estimated in Step 1) was multiplied by the percentage of agricultural land within each county on which activities with a Federal nexus occur (as presented in Exhibit 4-5).

3) **Estimate administrative costs for consultations related to the development of alternative water supplies.** To estimate the total administrative costs for consultations associated with alternative water supplies, the number of farms likely to develop alternative water supplies (as estimated in Step 2) was multiplied by the estimated cost per consultation ($3,700-$10,700).

4) **Array consultation costs by HUC**. The administrative costs for consultations related to alternative water supplies were distributed to each HUC within each county based on the ratio of perennial river miles within each HUC (or portion thereof) to the total river miles within the county.

4.4 IMPACTS TO AGRICULTURAL ACTIVITIES

20. Exhibits 4-7 and 4-8 summarize the estimated impacts to agricultural activities. As indicated in Exhibit 4-8, the present value of the impacts to agricultural activities over a 20-year period is $8.08 million to $8.98 million. Impacts are most heavily concentrated in Androscoggin, Sagadahoc, Kennebec, Washington, and Aroostook counties.

EXHIBIT 4-7. IMPACTS TO AGRICULTURAL ACTIVITIES BY HUC: HIGH ESTIMATE

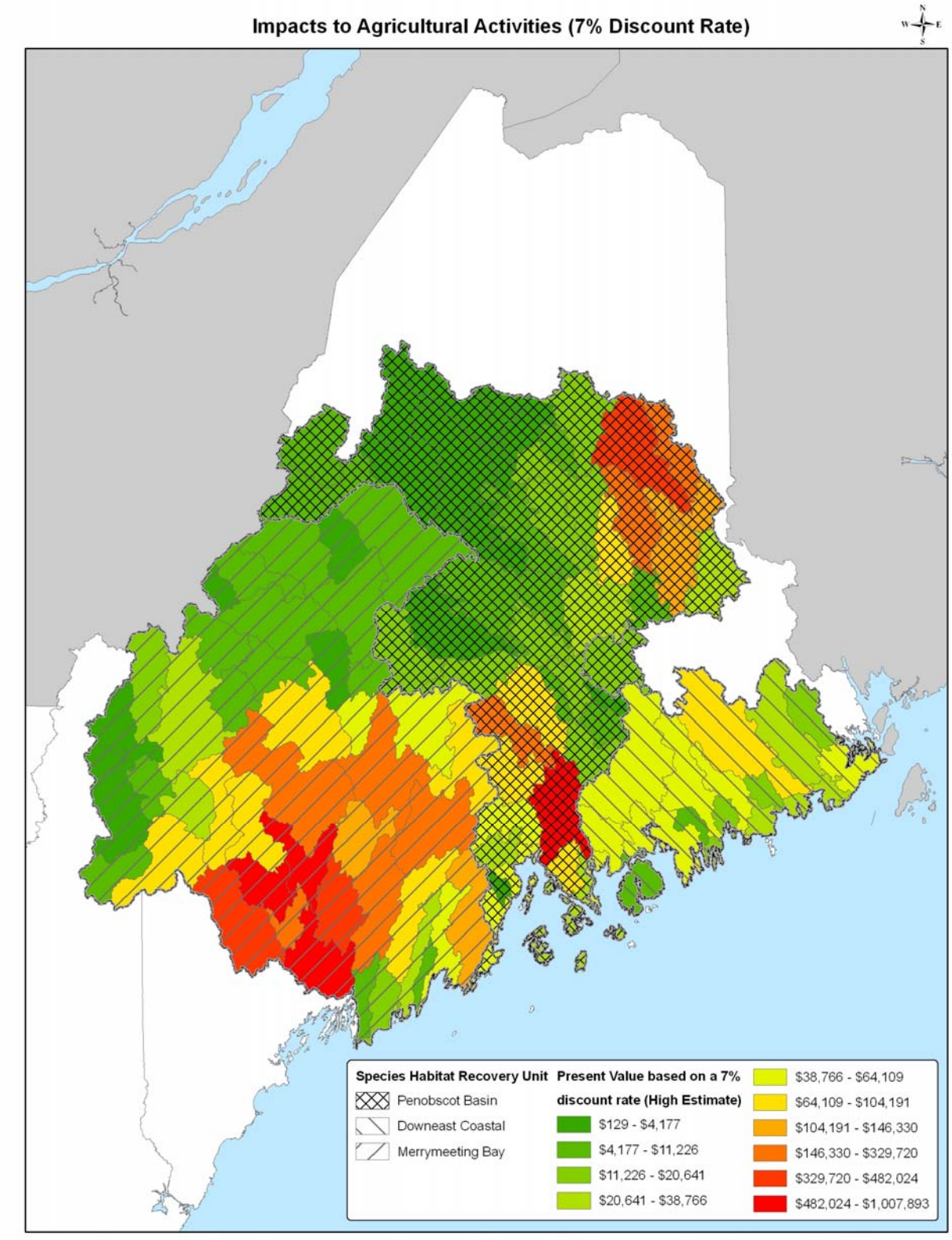


EXHIBIT 4-8. IMPACTS TO AGRICULTURAL ACTIVITIES BY HUC (TABLUAR FORMAT)[1,2]

DOWNEAST COASTAL			MERRYMEETING BAY			PENOBSCOT BASIN		
	PRESENT VALUE			PRESENT VALUE			PRESENT VALUE	
10 DIGIT HUC	LOW	HIGH	10 DIGIT HUC	LOW	HIGH	10 DIGIT HUC	LOW	HIGH
0105000205	$83,800	$102,000	0104000210	$968,000	$1,010,000	0102000513	$475,000	$482,000
0105000214	$55,000	$62,100	0104000206	$851,000	$868,000	0102000301	$270,000	$354,000
0105000212	$42,200	$55,400	0104000207	$669,000	$681,000	0102000302	$223,000	$280,000
0105000213	$49,600	$53,000	0104000209	$457,000	$482,000	0102000306	$186,000	$243,000
0105000209	$36,800	$45,200	0103000311	$373,000	$389,000	0102000510	$142,000	$147,000
0105000203	$36,900	$43,000	0103000312	$308,000	$330,000	0102000303	$103,000	$138,000
0105000208	$38,000	$42,900	0103000305	$281,000	$297,000	0102000305	$96,400	$131,000
0105000204	$29,500	$38,800	0103000306	$230,000	$237,000	0102000511	$86,700	$90,600
0105000206	$31,700	$38,400	0104000208	$218,000	$228,000	0105000216	$81,200	$83,400
0105000211	$17,900	$20,600	0103000309	$198,000	$218,000	0102000501	$59,300	$73,800
0105000201	$13,600	$17,000	0103000310	$104,000	$117,000	0102000508	$59,800	$64,300
0105000207	$10,600	$13,600	0105000301	$83,500	$111,000	0102000512	$44,500	$50,800
0105000210	$7,910	$9,730	0103000304	$95,900	$104,000	0105000220	$33,300	$46,500
0105000215	$3,330	$6,660	0104000202	$93,200	$104,000	0102000304	$26,700	$36,400
			0105000305	$82,300	$97,000	0102000502	$27,900	$34,300
			0103000308	$90,100	$95,500	0105000218	$25,000	$28,400
			0104000205	$71,800	$80,700	0105000217	$18,100	$26,300
			0104000204	$67,900	$74,600	0102000402	$19,200	$20,100
			0103000303	$59,500	$60,900	0102000406	$17,800	$19,400
			0103000307	$51,900	$55,400	0102000204	$10,900	$17,500
			0105000302	$33,300	$46,300	0102000205	$11,400	$17,000
			0104000203	$22,400	$28,000	0102000503	$8,530	$16,000
			0105000304	$20,300	$27,700	0102000401	$12,700	$14,400
			0104000101	$11,100	$25,400	0102000509	$9,850	$12,500
			0104000103	$9,880	$18,500	0102000506	$9,980	$12,400

DOWNEAST COASTAL			MERRYMEETING BAY			PENOBSCOT BASIN		
	PRESENT VALUE			PRESENT VALUE			PRESENT VALUE	
10 DIGIT HUC	LOW	HIGH	10 DIGIT HUC	LOW	HIGH	10 DIGIT HUC	LOW	HIGH
			0105000306	$7,320	$12,100	0102000110	$7,820	$11,300
			0105000307	$5,530	$10,100	0102000307	$6,400	$9,130
			0103000201	$3,150	$8,790	0102000404	$6,710	$8,420
			0104000201	$7,090	$8,440	0102000507	$5,060	$6,250
			0103000204	$3,030	$8,120	0102000102	$2,590	$5,960
			0103000103	$2,570	$6,650	0102000405	$3,340	$5,880
			0104000102	$3,080	$6,410	0102000505	$2,960	$5,440
			0103000202	$2,280	$6,390	0102000203	$3,250	$5,380
			0105000303	$3,600	$6,310	0102000101	$2,040	$5,330
			0103000106	$2,310	$6,110	0102000109	$2,800	$4,940
			0103000105	$2,300	$5,640	0102000403	$1,980	$3,580
			0103000302	$4,060	$5,190	0102000103	$1,520	$3,530
			0103000203	$2,060	$4,980	0102000105	$1,270	$2,880
			0103000102	$1,850	$4,960	0105000219	$1,220	$2,570
			0104000106	$2,020	$4,180	0102000504	$1,420	$2,530
			0104000104	$2,260	$3,900	0102000202	$1,090	$2,210
			0103000301	$1,930	$3,880	0102000201	$913	$2,080
			0103000104	$1,170	$3,120	0102000104	$682	$1,540
			0103000101	$1,080	$3,010	0102000107	$447	$931
			0104000105	$49	$129	0102000108	$393	$852
						0102000106	$322	$654
Subtotal	**$457,000**	**$549,000**	**Subtotal**	**$5,510,000**	**$5,900,000**	**Subtotal**	**$2,110,000**	**$2,530,000**

	LOW	HIGH
PRESENT VALUE OF IMPACTS ACROSS ALL HUCS	**$8,080,000**	**$8,980,000**

DOWNEAST COASTAL			MERRYMEETING BAY			PENOBSCOT BASIN		
	PRESENT VALUE			PRESENT VALUE			PRESENT VALUE	
10 DIGIT HUC	LOW	HIGH	10 DIGIT HUC	LOW	HIGH	10 DIGIT HUC	LOW	HIGH

Notes:

1. Figures are rounded to three significant digits and may not sum due to rounding.
2. Estimates reflect present value of impacts for the 2008-2027 time horizon of the analysis and were calculated based on a 7 percent discount rate.
3. Highlighting denotes HUCs that Atlantic salmon currently occupy.

4.5 ASSUMPTIONS AND CAVEATS

21. Exhibit 4-9 summarizes the major assumptions and caveats underlying the analysis of impacts to agricultural activities. As suggested by the exhibit, many of these assumptions relate to the spatial component of the analysis. For example, the GIS data for many of the streams included in the study area do not indicate the width of the stream, so a default value of 4 meters was applied to such streams. In addition, because the available data on Federal assistance do not identify specific farms that receive aid, the analysis assumes that the agricultural acreage receiving aid, by county, is proportional to the number of farms that receive aid in each county.

EXHIBIT 4-9. CAVEATS AND ASSUMPTIONS

ASSUMPTION	POTENTIAL EFFECT ON RESULTS[1]
Based on aerial photography, this analysis assumes that perennial streams identified by MEGIS were approximately 4 meters wide. Under this assumption, the analysis may overestimate stream width in some areas and underestimate it in others.	+/-
Because detailed information related to the productive value of agricultural land within the 30-meter setback area was not available, the analysis applies county averages to this land ($ per acre). For any given county, however, it is possible that the productive value of farmland near streams differs from the county average.	+/-
The analysis assumes that the lost agricultural production value within the riparian setback areas is constant over time; however, annual losses could vary as the real prices of agricultural products change.	+/-
The analysis related to the development of alternative water supplies does not include the cost of retrofitting irrigation systems to draw from these sources.	-
The analysis assumes that the percentage of agricultural land subject to a Federal nexus, by county, is equal to the percentage of farms that received Federal assistance in 2002 (the most recent year for which data on Federal assistance are available), and that this percentage will remain constant over time.	+/-
The analysis ignores any cost savings associated with taking land out of production (i.e., variable costs such as seed planting, fuel, etc.).	+
The analysis assumes that impacts associated with developing alternative sources of supply (i.e., wells or irrigation ponds) occur in the first year of the analytic time horizon (2008).	+
According to irrigation data provided by MEDAFRR, 13 percent of irrigators across the State of Maine obtain their water from surface water. The analysis employs this figure to estimate the acreage of agricultural land within each county that is irrigated by surface water. This approach ignores likely variation in counties' reliance on surface water for irrigation.	+/-
This analysis assumes that section 7 consultations occurring between NMFS, Federal action agencies (e.g., NRCS and FSA) and third parties (farmers or the State of Maine) will occur for all individual farms incurring impacts from the designation of critical habitat.	+
The analysis of the administrative costs associated with section 7 consultations assumes that there is no overlap between consultations related to riparian setbacks and consultations related to the development of alternative water supplies.	+

Notes:
1. +: This assumption may result in an overestimate of real costs.
   - : This assumption may result in an underestimate of real costs.
   +/-: This assumption has an unknown effect on estimates.

CHAPTER 5 | DEVELOPMENT

5.1 INTRODUCTION

1. This chapter assesses the potential impacts of Atlantic salmon critical habitat designation on the value of future residential, commercial, and industrial development in the study area. Based on data from the Maine Land Use Regulation Commission (LURC) and the 2001 National Land Cover Database (NLCD), approximately 5.5 million acres of developable land in Maine and 302,000 acres of developable land in New Hampshire fall within the boundaries of the study area.[1] Combined, this represents 38 percent of the land within the study area. All of this land is privately owned (publicly owned land is excluded from this analysis under the assumption that it will remain undeveloped indefinitely).

2. Development, through the associated clearing of land and construction of infrastructure, may adversely affect critical habitat for the Gulf of Maine DPS of Atlantic salmon.[2] For example, the construction of impervious surfaces, such as parking lots and buildings, leads to increased erosion and also increases pollutant loads in nearby streams. Changes in land cover can also disrupt geomorphological and riparian processes and result in excessive nutrient enrichment of a stream or river.

3. To address the potential effects of development on the salmon's critical habitat, development projects within the study area that have a Federal nexus may be asked to incorporate measures to avoid adverse modification, such as measures designed to protect the health of invertebrate communities, reduce run-off, and help maintain a natural state of temperature, siltation, and nutrient flux in perennial rivers and streams. One such measure may be to incorporate a 30-meter riparian setback along perennial streams and rivers.[3] Exhibit 5-1 summarizes the costs associated with this setback. These costs represent the extent to which the setback would reduce the value of developable land within the study area.

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[1] LURC GIS zoning data were obtained from Ellen Jackson, GIS Coordinator, LURC on January 16, 2008. The 2001 NLCD database is published by the United States Geological Survey and can be accessed at http://www.mrlc.gov/mrlc2k_nlcd.asp.

[2] Atlantic Salmon Biological Review Team, *Status Review for Anadromous Atlantic Salmon (Salmo salar) in the United States*, July 2006.

[3] NMFS. May 2007. Draft Habitat Requirements and Management Considerations for Atlantic Salmon (*Salmo salar*) in the Gulf of Maine Distinct Population Segment (DPS). Pg. 19.

4. The remainder of this chapter provides additional detail on the generation of the impact estimates presented in Exhibit 5-1. To provide context for the analysis, the first section presents a profile of development in the study area, identifying developable lands in this area and characterizing development activity. The second section describes major development projects in the study area that may be affected by efforts to conserve the salmon and its habitat. This section also includes a discussion of existing State and local regulations limiting development activities along perennial rivers and streams. The third section outlines the methods employed to derive the economic impact estimates, the fourth summarizes the projected impacts, and the fifth section highlights major assumptions and caveats that may affect the results of the analysis.

EXHIBIT 5-1. IMPACTS OF ATLANTIC SALMON CRITICAL HABITAT DESIGNATION ON DEVELOPMENT ACTIVITIES

SPECIES HABITAT RECOVERY UNIT	PRESENT VALUE[1]	
	LOW	HIGH
Downeast Coastal	$5,200,000	$8,530,000
Merrymeeting Bay	$74,300,000	$95,600,000
Penobscot Basin	$14,900,000	$23,000,000
Total[2]	**$94,400,000**	**$127,000,000**

1. Impact estimates reflect a 20-year time horizon (2008-2027) over which impacts are discounted at an annual rate of 7 percent.
2. Entries may not sum to totals reported due to rounding.

5.2 PROFILE OF DEVELOPMENT IN THE STUDY AREA

5.2.1 DEVELOPABLE LAND WITHIN THE STUDY AREA

5. To provide context for the impact estimates presented in Exhibit 5-1, Exhibits 5-2 and 5-3 summarize the distribution of developable land across the study area. As the exhibits indicate, the vast majority of developable land is located in the southern portion of the area. This is consistent with the relative levels of development within the study area but also reflects the difference between the way in which this analysis identifies developable land in areas under LURC's jurisdiction versus other areas. For LURC areas, land zoned for development—excluding areas identified as developed, wetlands, or surface water in the NLCD—is assumed to be developable for the purposes of this analysis. For the remainder of the study area, detailed zoning data were not readily available. Absent this information, the analysis assumes that areas outside of the LURC region are developable unless they are characterized as developed, open water, or wetlands by the NLCD.

6. A portion of the developable land included in this analysis may overlap with agricultural or silvicultural land identified in Chapters 4 and 7 of this report. This will not lead to double-counting of impacts, however, as the scope of the agriculture and silviculture analyses is limited to impacts associated with these activities. Neither of these analyses contemplated changes in the potential development value of agricultural or silvicultural

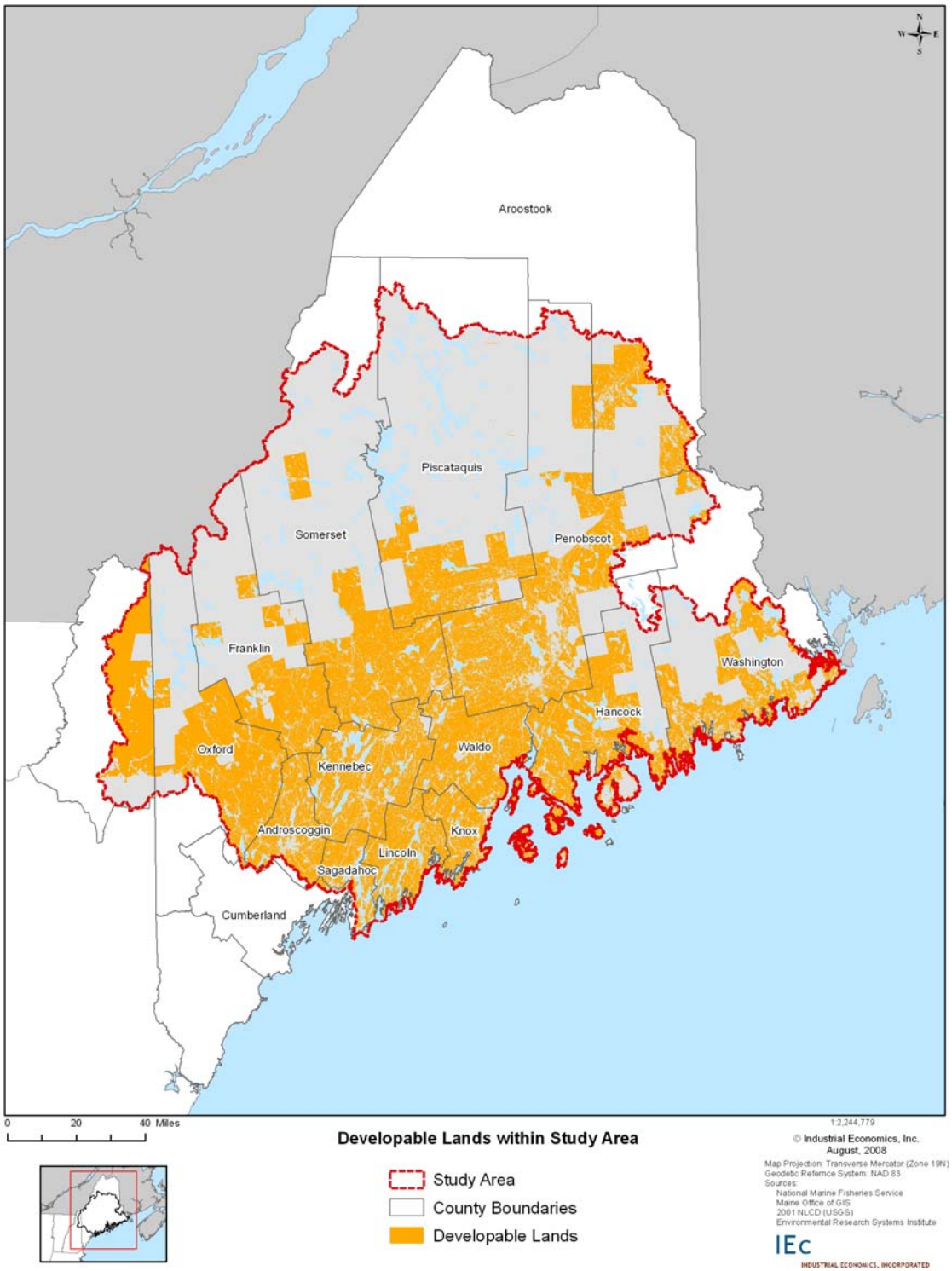
land. In addition, although the analysis presented in this chapter includes some land currently managed for agriculture or silviculture, the analysis only considers development-related impacts for such lands. This chapter does not assess impacts related to agricultural or silivicultural activities on developable land.

EXHIBIT 5-2. ACRES OF DEVELOPABLE LAND IN THE STUDY AREA[1]

STATE	COUNTY	TOTAL DEVELOPABLE LAND (ACRES)	PERCENT OF TOTAL DEVELOPABLE LAND
ME	Androscoggin	219,000	3.8%
	Aroostook	208,000	3.6%
	Cumberland	9,080	0.2%
	Franklin	382,000	6.6%
	Hancock	514,000	8.9%
	Kennebec	431,000	7.5%
	Knox	167,000	2.9%
	Lincoln	236,000	4.1%
	Oxford	534,000	9.3%
	Penobscot	851,000	14.8%
	Piscataquis	373,000	6.5%
	Sagadahoc	113,000	2.0%
	Somerset	607,000	10.6%
	Waldo	379,000	6.6%
	Washington	423,000	7.4%
NH	Coos	302,000	5.2%
Total[2]		**5,760,000**	**100%**

Notes:
1. Acres derived from the 2001 NLCD data set (land use codes 31-89) and LURC's GIS zoning layer.
2. Entries may not sum to totals reported due to rounding.

EXHIBIT 5-3. DEVELOPABLE LAND WITHIN THE STUDY AREA



5.2.2 DEVELOPMENT ACTIVITY IN THE STUDY AREA

7. Exhibit 5-4 summarizes the level of residential development activity in the study area from 2002 through 2006, as measured by the number of residential building permits issued each year.[4] As indicated by the exhibit, nearly half of the residential development activity within the study area is concentrated in Cumberland, Penobscot, and Kennebec Counties. In addition, the data in Exhibit 5-4 suggest that residential development activity in the study area has declined since peaking in 2005.

EXHIBIT 5-4. RESIDENTIAL BUILDING PERMITS ISSUED IN THE STUDY AREA[1]

STATE	COUNTY	2002	2003	2004	2005	2006	TOTAL PERMITS: 2002-2006	PERCENT OF PERMITS: 2002-2006
ME	Androscoggin	378	508	545	521	320	2,272	7.1%
	Aroostook	150	145	183	169	172	819	2.6%
	Cumberland	1,778	1,758	1,712	1,909	1,385	8,542	26.7%
	Franklin	139	219	247	271	217	1,093	3.4%
	Hancock	517	478	565	484	398	2,442	7.6%
	Kennebec	616	596	715	806	679	3,412	10.6%
	Knox	312	371	345	268	209	1,505	4.7%
	Lincoln	264	338	385	302	217	1,506	4.7%
	Oxford	333	352	456	477	406	2,024	6.3%
	Penobscot	559	656	741	996	709	3,661	11.4%
	Piscataquis	68	88	90	102	87	435	1.4%
	Sagadahoc	190	231	237	257	227	1,142	3.6%
	Somerset	97	117	128	155	115	612	1.9%
	Waldo	230	212	196	192	197	1,027	3.2%
	Washington	163	203	237	215	160	978	3.1%
NH	Coos	103	91	133	126	126	579	1.8%
	Total	**5,897**	**6,363**	**6,915**	**7,250**	**5,624**	**32,049**	**100.0%**

Notes:
1. Source: U.S. Census Bureau residential building permit data as presented in U.S. Department of Housing and Urban Development, State of the Cities Data System (SOCDS) Database, http://socds.huduser.org/permits/index.html, accessed January 12, 2008.

8. Although future development patterns within the study area are uncertain, the Maine State Planning Office and the New Hampshire Office of Energy and Planning have developed county-level population projections to inform future planning efforts. Exhibit 5-5 summarizes these projections through 2020. Assuming that these projections are a

[4] Ideally, this analysis would also examine the recent trend in the issuance of commercial building permits in Maine and New Hampshire. Although the U.S. Census Bureau previously compiled and published commercial building permit data, the Bureau stopped releasing these data in 1995.

reasonable indicator of future development activity, they suggest that Cumberland County will experience significant development in coming years relative to other counties in the study area, followed by Waldo and Hancock Counties. Conversely, the projections suggest that future development activity will be fairly limited in Aroostook and Washington Counties. It is important to note, however, that population growth is not always the best indicator of development activity. Other variables, such as the availability of recreational amenities that seasonal residents would enjoy or the age of the existing housing stock, might also play a role in the siting of future development projects.

EXHIBIT 5-5. POPULATION PROJECTIONS FOR THE STUDY AREA

STATE	COUNTY	2006[1]	2010[2]	2020[2]	PROJECTED CHANGE: 2006 TO 2020
ME	Androscoggin	107,552	109,468	111,270	3,718
	Aroostook	73,008	69,082	59,740	-13,268
	Cumberland	274,598	285,401	299,983	25,385
	Franklin	30,017	29,971	29,686	-331
	Hancock	53,797	56,243	59,730	5,933
	Kennebec	121,068	123,595	125,966	4,898
	Knox	41,096	42,905	45,291	4,195
	Lincoln	35,234	37,512	40,706	5,472
	Oxford	57,118	58,606	60,792	3,674
	Penobscot	147,180	151,007	152,483	5,303
	Piscataquis	17,585	17,506	17,060	-525
	Sagadahoc	36,837	39,207	42,366	5,529
	Somerset	52,249	52,616	53,225	976
	Waldo	38,715	41,130	45,065	6,350
	Washington	33,288	32,865	30,849	-2,439
NH	Coos	33,019	33,170	33,369	350
	Total	**1,152,361**	**1,180,284**	**1,207,581**	**55,220**

Notes:
1. U.S. Census Bureau, Annual Estimates of the Population for Counties: April 1, 2000 to July 1, 2006, http://www.census.gov/popest/counties/CO-EST2006-01.html, accessed January 14, 2008.
2. Maine projections from Maine State Planning Office, "Maine County Economic Forecast," September 2005. New Hampshire projections from New Hampshire Office of Energy and Planning, "New Hampshire Population Projections for State and Counties," November 2006.

5.2.3 MAJOR DEVELOPMENT PROJECTS POTENTIALLY AFFECTED BY CRITICAL HABITAT DESIGNATION FOR THE ATLANTIC SALMON

9. Efforts to conserve critical habitat for the Gulf of Maine DPS of Atlantic salmon may affect development projects that are currently underway or that have already been planned. The most prominent of these projects are summarized below.

5.2.3.1 Plum Creek Proposed Resource Plan at Moosehead Lake

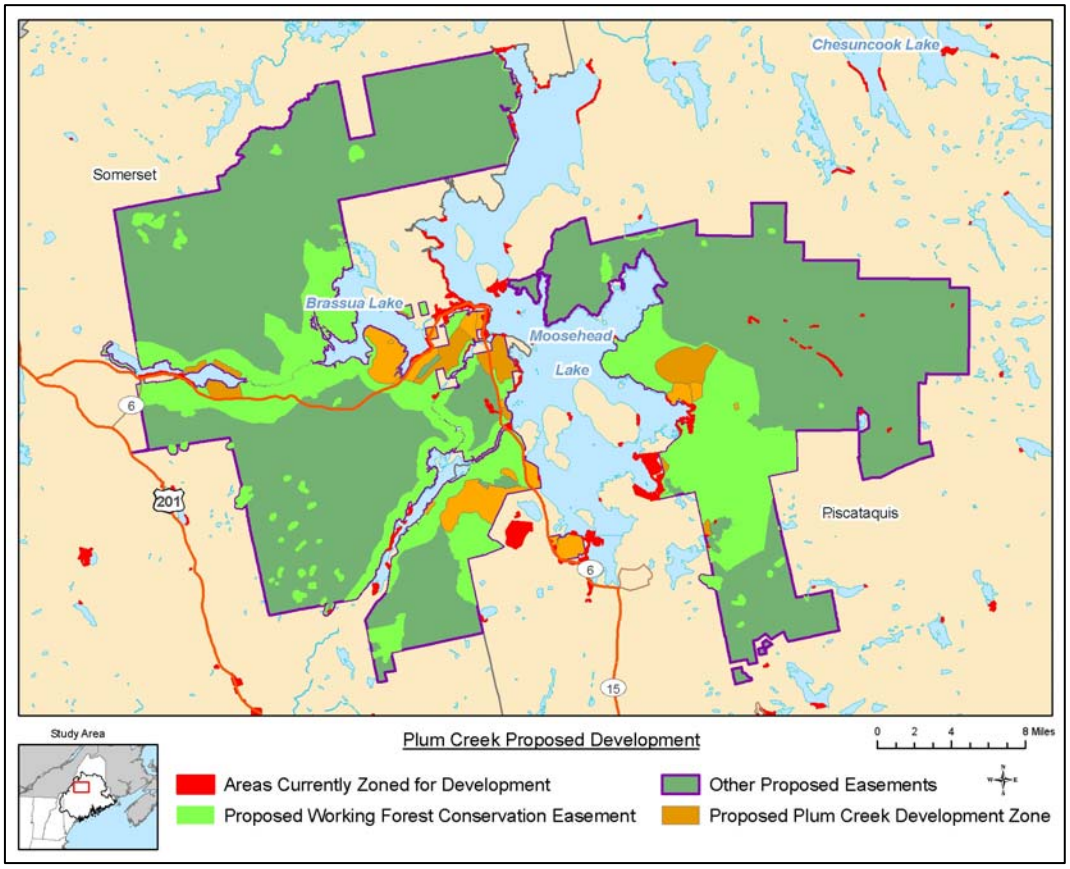
10. The Plum Creek Timber Company's proposed resource plan for the Moosehead Lake region of Maine is currently under review by Maine's Land Use Regulation Commission (LURC). The plan covers 29 townships and includes the re-zoning of approximately 408,000 acres of land, all of which is located in the study area.[5] Plum Creek's October 2007 concept plan proposes the development of up to 20,000 acres for residences, campgrounds and associated recreational facilities, a lodge facility, nature-based facilities, and sport camps. The proposal also includes plans for approximately 91,000 acres of working forest conservation easement and more than 300,000 acres of additional easement through binding agreements with the Nature Conservancy. Exhibit 5-6 compares the current zoning of the Moosehead Lake region with the zoning proposed by Plum Creek.

11. LURC has yet to issue a ruling on the Plum Creek proposal. At present, therefore, the potential impact of efforts to conserve the salmon's critical habitat on the Plum Creek project are unknown. Because the proposed development would be located on land that is not currently characterized as developable, the analysis does not estimate impacts that may be associated with this land.[6] Instead, it estimates impacts on the basis of LURC's current zoning. If future actions yield a net increase in the amount of LURC land zoned for development, this approach may understate the potential effects of critical habitat designation. Conversely, if future actions yield a net decrease in the amount of LURC land zoned for development, this approach may overstate impacts.

[5] Plum Creek, Revised Integrated Concept Plan for the Moosehead Lake Region, October 2007.

[6] As indicated above, this analysis assumes that land in areas under LURC's jurisdiction is developable only if it is currently zoned for development.

EXHIBIT 5-6. PLUM CREEK'S DEVELOPMENT PLAN FOR THE MOOSEHEAD LAKE REGION



5.2.3.2 Twin River Energy Center

12. Point East, a subsidiary of National RE/Sources of Greenwich, Connecticut, has proposed the construction of a coal and biomass gasification plant at the former Maine Yankee nuclear power plant site in Wiscassett, Maine. The proposed facility, referred to as the Twin River Energy Center, would occupy approximately 431 acres along the Back River.[7] Proposed as a co-generation facility, the Twin River Energy Center would produce both electricity and diesel fuel, with a maximum capacity of 700 megawatts (MW) of electricity or 9,000 barrels of diesel per day.[8] The proposed facility would also include a research and development center dedicated to the development of technologies to reduce carbon emissions. Through a November 2007 referendum, however, Wiscassett voters denied an ordinance change that would have been necessary for the Twin River project to move forward. The future of the project is therefore uncertain.

[7] Personal communication with Poe Cilley, Point East, January 16, 2008.

[8] Point East, Twin River Energy Center: A New Era Begins, public information presentation, July 24, 2007, http://www.twinriverenergy.com/, accessed January 21, 2008.

5.2.3.3 Point East Maritime Village Development Project

13. At the site of the former coal- and oil-fired Mason Power Station in Wiscasset, Maine, Point East has begun the development of a mixed residential and commercial maritime property. Point East has obtained all of the necessary permits for the project from Maine DEP, Maine Department of Inland Fisheries and Wildlife, the U.S. Army Corps of Engineers (USACE), and the town of Wiscasset. As part of this process, NMFS conducted an informal consultation with USACE but did not conclude that any project modifications would be necessary to avoid jeopardy to the Gulf of Maine DPS of Atlantic salmon as currently listed.[9] None of the available information suggests that NMFS would conclude that the project would result in adverse modification of salmon habitat. Therefore, the project is unlikely to be affected by efforts to protect the salmon or its habitat.

5.2.3.4 Green Line Electricity Transmission Project

14. In December 2006, the New England Independent Transmission Company (New England ITC), LLC proposed the construction of a 660 MW high-voltage transmission line between the 345 kilovolt (kV) Maine Yankee substation in Wiscasset and the K Street 345 kV substation in Boston.[10] Covering a distance of approximately 140 miles, the underwater line, referred to as the Green Line, would traverse the Gulf of Maine and relieve congestion along the existing high-voltage transmission lines between northern and southern New England. New England ITC's proposal also indicates that development of the Green Line would require the construction of a converter station at the Wiscasset end of the line to convert alternating current (AC) power to direct current (DC).

In February 2007, the Federal Energy Regulatory Commission issued a finding stating that the proposed Green Line project would meet the "independence" and "capability" requirements of ISO-New England's open access transmission tariff. Before moving forward, however, the project must obtain additional approvals from Federal, State, and local authorities. Because New England ITC has not developed detailed plans for the pathway of the Green Line or the construction of the Wiscasset converter station, it is uncertain whether efforts to conserve the salmon's critical habitat would affect the project.

5.2.3.5 Wind Development Projects in Maine

15. To help meet the growing demand for renewable energy within New England, developers have planned or proposed the construction of several wind farms within the study area. Exhibit 5-7 lists a number of major wind projects proposed for the study area, all of which would be located in areas under LURC's jurisdiction. Because all commercial development within LURC territory is subject to a 100-foot setback from streams and

[9] For information on the current listing, see 65 Federal Register 69459, November 17, 2000.

[10] New England Independent Transmission Company, LLC. The Green Line Project: A 660 MW High Voltage Underwater DC Transmission Project Between Maine and Massachusetts, proposal to ISO New England. December 5, 2006.

wetlands, these wind projects are unlikely to be affected by efforts to conserve critical habitat for the Gulf of Maine DPS of Atlantic salmon.[11]

EXHIBIT 5-7. PROPOSED WIND PROJECTS IN MAINE

PROJECT	PLANNED GENERATING CAPACITY (MW)	LOCATION	STATUS
Record Hill Wind Project[1]	75 MW	Byron and Roxbury Townships, Oxford County	Project is in pre-permitting phase (still collecting wind data and conducting preliminary environmental and engineering studies).
Passamaquoddy Land[2]	50 MW	Prentiss Township, Somerset County	Wind monitoring and transmission feasibility studies are underway.
Kibby Mountain Wind Project[3]	132 MW	Skinner, Kibby, and Merrill Strip Townships, Franklin County	Feasibility studies completed and preliminary development plan approved by LURC.
Redington Wind Project[4]	54 MW	Redington Township, Franklin County	LURC rejected plan for the 54 MW project on Black Nubble Mountain on January 14, 2008. Project's future is uncertain.
Stetson Ridge[5]	57 MW	Danforth and Springfield Townships, Washington County	Received LURC approval on January 3, 2008. Commercial operations underway.

Notes:
1. Record Hill Wind. Official Website. Accessed at http://www.recordhillwind.com/ on January 22, 2008.
2. U.S. Department of Energy. Energy and Renewable Energy, Wind and Hydropower Technologies Program. New England Wind Forum. Accessed at http://www.eere.energy.gov/windandhydro/windpoweringamerica/ne_project_detail.asp?id=41 on January 22, 2008.
3. Natural Resources Council of Maine. Kibby Mountain Wind Project. Accessed at http://www.nrcm.org/kibby_mountain.asp on January 22, 2008.
4. Natural Resources Council of Maine. "LURC Takes One Step Forward for Clean Energy, Not Two". Accessed at http://www.nrcm.org/news_detail.asp?news=2090 on January 22, 2008.
5. Natural Resources Council of Maine. "LURC Approves Stetson Wind Farm". Accessed at http://www.nrcm.org/news_detail.asp?news=2057 on January 22, 2008.

5.2.3.6 Development Plan for Saddleback Mountain

16. In July 2007 LURC approved the Saddleback Ski Area's petition to amend its 10-year development plan and to re-zone approximately 1,898 acres for development.[12] The approval paves the way for the construction of two new day lodges, an amenity center, additional housing units, new ski trails, and additional lift capacity at the mountain.

[11] Personal communication with Marcia Spencer-Famous, Planning and Administration Division at LURC, January 30, 2008.

[12] Maine Land Use Regulation Commission, Minutes of the Commission's Regular Monthly Meeting, July 11, 2007, http://www.maine.gov/tools/whatsnew/attach.php?id=27019&an=3, accessed January 27, 2008.

Because this analysis identifies developable land in areas under LURC's jurisdiction based on zoning data that pre-date the approval of Saddleback's petition, this analysis does not capture potential development-related impacts associated with Saddleback's re-zoned land and therefore may underestimate total impacts.

5.2.4 EXISTING REGULATION OF WATERFRONT DEVELOPMENT IN THE STUDY AREA

5.2.4.1 State Policies and Programs

17. To preserve Maine's rivers and streams and to ensure the health of the State's aquatic ecosystems, State and local government in Maine have developed policies that limit shoreline land use activities. More specifically, the State's Mandatory Shoreland Zoning Act requires municipalities to establish land use controls for all land within 250 feet of great ponds, rivers with watersheds of at least 25 square miles, coastal wetlands and tidal waters, and lands within 75 feet of streams.[13] Under the Act, Maine's Department of Environmental Protection (DEP) has issued guidelines recommending a 125-foot setback along significant river segments identified by the State, a 100-foot setback along great ponds and rivers that flow into great ponds, and a 75-foot setback along all other streams (except for streams in intensively developed areas).[14,15] Although the Act does not require municipalities to adhere to these guidelines, DEP staff have indicated that most municipalities do so.[16] This analysis assumes that all municipalities implement the DEP guidelines.

18. The setback requirements described above will limit the magnitude of development-related impacts associated with efforts to avoid adverse modification of the salmon's critical habitat. As indicated above, NMFS may request the preservation of a 30-meter riparian buffer for waterfront development projects subject to a Federal nexus. The 125-foot setback for significant river segments and the 100-foot setback for great ponds and rivers that flow into great ponds, however, are more stringent than the 30-meter (approximately 98 feet) riparian setback that NMFS may request for development projects. This analysis therefore assumes that, within Maine, there will be no development-related impacts for land along significant river segments, great ponds, or rivers that flow into great ponds. For development projects adjacent to streams where Maine's 75-foot setback is in effect (and that are subject to a Federal nexus), the analysis assumes that NMFS would request extending this buffer to 30 meters (approximately 98

[13] As defined in the Act, a great pond is any inland body of water that, in a natural state, has a surface area exceeding 10 acres or an artificially formed inland body of water with a surface area greater than 30 acres.

[14] Significant river segments in Maine include portions of the following rivers: Aroostook, Dennys, East Machias, Fish, Machias, Mattawamkeag, Narraguagus, the East Branch of the Penobscot, Pleasant, Rapid, the West Branch of the Pleasant, and the West Branch of the Union.

[15] In addition, LURC requires a 100-foot setback for multi-family dwellings and commercial, industrial, and other non-residential structures. Maine Land Use Regulation Commission, *Land Use Districts and Standards for Areas Within the Jurisdiction of the Land Use Regulation Commission*, July 23, 2007.

[16] Personal communication with Richard Baker, Maine Department of Environmental Protection, Bureau of Land & Water Quality, December 18, 2007.

feet). This would represent a 23-foot extension of the current buffer. To the extent that municipalities do not follow the State's setback guidelines, the analysis underestimates impacts.

19. The State of New Hampshire has also implemented measures to protect rivers and aquatic ecosystems in the State through the New Hampshire Rivers Management and Protection Program. Other than placing restrictions on the siting of waste management facilities, however, the program includes no limits on land use adjacent to the State's rivers.[17] Therefore, this analysis assumes that the entire 30-meter buffer that NMFS may request for development projects in New Hampshire would represent a new restriction on development.

5.2.4.2 Federal Policies and Programs

20. In addition to the State policies outlined above, the Federal government also influences waterfront construction in the study area through the National Flood Insurance Program (NFIP). Under the NFIP, property owners may purchase insurance as protection against flood losses if their communities adopt floodplain management regulations to reduce potential flood damages. The NFIP floodplain management requirements, which outline the minimum measures necessary for community participation in the program, include a series of standards related to the design of buildings constructed in the floodplain (e.g., elevation of a structure above the Base Flood Elevation). With respect to the siting of buildings, the requirements include restrictions only for high-hazard "Class V" zones in coastal areas.[18] For these zones, the NFIP floodplain management requirements state that all new buildings must be constructed landward of the reach of mean high tide; however, they do not restrict building within any specific distance of the water. Therefore, this analysis assumes that the NFIP does not restrict development within the 30-meter buffer that NMFS may request for development projects with a Federal nexus.

5.3 ANALYTIC METHODOLOGY

21. This section describes the methods employed to estimate the economic impacts of critical habitat designation on the value of future residential, commercial, and industrial development in the study area. The discussion begins by describing Federal permitting activities in the study area that may necessitate a section 7 consultation. The methodology for quantifying impacts associated with section 7-related project modifications is then outlined in detail.

5.3.1 FEDERAL PERMITTING OF DEVELOPMENT PROJECTS

22. Development projects that may threaten the salmon's habitat and have a Federal nexus may be modified following a section 7 consultation to avoid destruction or adverse

[17] New Hampshire Department of Environmental Services, Environmental Fact Sheet: The New Hampshire Rivers Management and Protection Program, 2007, http://www.des.state.nh.us/factsheets/r&l/inc/2.html, accessed on January 27, 2008.

[18] Federal Emergency Management Agency, National Flood Insurance Program (NFIP) Floodplain Management Requirements: A Study Guide and Desk Reference for Local Officials, undated, available at http://www.fema.gov/plan/prevent/floodplain/fm_sg.shtm, accessed January 21, 2008.

modification of critical habitat. This analysis considers two permitting programs that may provide a Federal nexus for development projects: National Pollutant Discharge Elimination System (NPDES) permits issued under the authority of the Clean Water Act and Clean Water Act Section 404 permits issued by the USACE.

5.3.1.1 MEPDES and NPDES Permitting

23. The Clean Water Act established the NPDES program to regulate the discharge of pollutants into the waters of the United States. Although established under Federal law, the U.S. Environmental Protection Agency (EPA) may delegate NPDES permitting authority to individual states. The Maine Department of Environmental Protection (DEP) maintains delegated authority from EPA to administer the NPDES program in Maine, known statewide as the Maine Pollutant Discharge Elimination System (MEPDES).[19] NMFS reviews all MEPDES permits issued by the State of Maine to determine whether they may result in a "more than minor detrimental effect" on endangered salmon. If it determines that issuance of a permit may result in more than a minor detrimental effect, NMFS works cooperatively with DEP to resolve the matter (through modification requests). If the matter cannot be resolved cooperatively, NMFS may request EPA to object to and Federalize the permit. Once EPA takes these steps, a section 7 consultation may be required for the permitting action.[20]

24. In New Hampshire, EPA maintains authority over the issuance of all Clean Water Act NPDES permits. Because a Federal nexus exists for these permits, any NPDES permit issued in New Hampshire may require a section 7 consultation.

25. Although both MEPDES and New Hampshire NPDES permits may have a Federal nexus, NMFS does not anticipate that the process or conditions for issuing these permits will be affected by the designation of critical habitat. NMFS records indicate that since the listing of the Atlantic salmon as an endangered species, there have been no discussions between NMFS and Maine DEP or the U.S. EPA concerning MEPDES or NPDES permit applications for new development projects in the study area. Moreover, since 2001, EPA has not objected to and Federalized any MEPDES permits, and no section 7 consultations have occurred on MEPDES or New Hampshire NPDES permits. This analysis therefore does not anticipate that the issuance of MEPDES or NPDES permits associated with new development projects is likely to result in consultation regarding the salmon and its habitat.[21]

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[19] Memorandum of Agreement Between the Environmental Protection Agency, Fish and Wildlife Service and National Marine Fisheries Service Regarding Enhanced Coordination Under the Clean Water Act and Endangered Species Act. Federal Register Vol. 66, No. 36, Thursday, February 22, 2001.

[20] Memorandum of Agreement Between the Environmental Protection Agency, Fish and Wildlife Service and National Marine Fisheries Service Regarding Enhanced Coordination Under the Clean Water Act and Endangered Species Act. Federal Register Vol. 66, No. 36, Thursday, February 22, 2001.

[21] Although NMFS does not anticipate that the issuance of MEPDES or NPDES permits will result in section 7 consultations, NMFS may initiate a consultation for a given permit if the activity regulated by the permit adversely affects the salmon or its habitat.

5.3.1.2 USACE Section 404 Permits

26. Development projects within the study area may have a Federal nexus through permits issued by the USACE under the authority of Section 404 of the Clean Water Act (CWA). Pursuant to Section 404, it is unlawful for any person to discharge dredged or fill materials into the navigable waters of the United States unless a permit is obtained under the provisions of the Act. Therefore, any development project that would involve the discharge of dredged or fill materials into navigable waters would require a Section 404 permit, and thus would have a Federal nexus that may trigger a section 7 consultation.

27. This analysis estimates the likelihood that a future development project would require a Section 404 permit based on the residential building permit data presented in Exhibit 5-4 and historical Section 404 permit data maintained by USACE.[22] As indicated in Exhibit 5-4, the Census Bureau estimates that 12,622 residential building permits were issued in the counties that make up the Maine portion of the study area in 2005 and 2006. Only a portion of these permits, however, were issued for the development of waterfront property. Assuming that the number of permits associated with waterfront development is proportional to the percentage of developable land in the study area that is within 30 meters of a perennial river or stream (2.3 percent), the analysis estimates that approximately 290 of the 12,622 residential permits issued in 2005 and 2006 were for waterfront projects. In addition, the USACE Section 404 permit data suggest that approximately 215 Section 404 permits were issued for residential development in the Maine counties of the study area in 2005 and 2006.[23] Based on the ratio of these two values (215/290), the analysis assumes that 74 percent of waterfront development within the study area would require a Section 404 permit, and therefore would have a Federal nexus.

5.3.2 ANTICIPATED MODIFICATIONS TO DEVELOPMENT PROJECTS

28. The analysis assumes that development projects requiring a Section 404 permit will undertake a section 7 consultation with NMFS and will subsequently be modified to avoid adverse modification of critical habitat. To estimate the economic impact of project modifications, the analysis examines the implications of maintaining a 30-meter setback from the banks of perennial streams. This setback is expected to avoid adverse modification by protecting the health of invertebrate communities, reducing run-off, and helping to maintain a natural state of temperature, siltation, and nutrient flux in perennial rivers and streams.[24] In some cases, NMFS may instead recommend the implementation of stormwater controls, which in many cases could prove less costly than a 30-meter setback. By assuming that a full 30-meter setback would be implemented as part of every

[22] Ideally, this analysis would estimate this probability based on both residential and commercial building activity. The Census Bureau, however, no longer publishes commercial building permit data.

[23] U.S. Army Corps Database of permitted projects in Maine. Data provided by Greg Pinta, Regulatory Division, U.S. Army Corps of Engineers on January 11, 2008. Although the database does not explicitly identify permits issued for residential building projects, this analysis assumes that any Section 404 permit issued to an individual or to a known residential developer was for a residential building project.

[24] NMFS. May 2007. Draft Habitat Requirements and Management Considerations for Atlantic Salmon (*Salmo salar*) in the Gulf of Maine Distinct Population Segment (DPS). Pg. 19.

development project that has a Federal nexus, the analysis likely overstates project modification costs.

5.3.2.1 Quantifying the Impacts of Establishing a 30-Meter Setback

29. As indicated above, the analysis assumes the establishment of a 30-meter riparian buffer for waterfront development projects with a Federal nexus. The economic cost associated with this setback is represented by the foregone option value for future development within the 30-meter buffer. The analysis assumes that the loss in option value will be realized immediately after the designation of critical habitat for all developable land potentially included in the 30-meter buffer. Although much of this land may remain undeveloped for several years, its market value would presumably change shortly after the designation of critical habitat to reflect the potential for a section 7 consultation. The following discussion outlines the methodology employed to estimate these impacts.

1) **Identify developable land within the 30-meter buffer recommended by NMFS.** Using GIS layers published by the Maine Office of GIS, a polygonal representation of the bank-full width of all perennial streams within the study area was generated.[25] Subsequently, a 30-meter buffer was applied to this stream layer to produce the riparian setback area. This buffer was then superimposed on the developable land layer shown in Exhibit 5-3 to identify all developable land within 30 meters of perennial streams.

2) **Exclude land protected under State and local law from the 30-meter buffer.** Local land use controls in Maine require the preservation of a 125-foot buffer for development along significant river segments, a 100-foot setback along great ponds and rivers that flow into great ponds, and a 75-foot setback along all other streams (except for streams in intensively developed areas).[26] Imposition of the 30-meter buffer recommended by NMFS would have no incremental impact where 125-foot or 100-foot setbacks are already in effect, since these setbacks exceed 30 meters and the land within them is already excluded from development. The incremental impact of the 30-meter buffer would be limited to areas where only a 75-foot setback is currently in effect. In these areas, the imposition of a 30-meter buffer would extend the width of the setback by approximately 23 additional feet.[27]

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[25] To establish a state stream polygon layer, the analysis employs two hydrologic GIS layers published by the Maine Office of GIS (MEGIS), "hydro_04202006" and "streams_04202006". The layer "hydro_04202006" provides a polygonal representation of the main stems of the major rivers in the study area; "streams_04202006" offers a polyline representation of all perennial streams in Maine. Based on Google Earth© imagery, the average stream width of perennial streams in Maine was estimated to be approximately 4 meters. Consequently, the "streams_04202006" layer was buffered by 2 meters (on each side of the polyline); the analysis assumes that the resultant polygon feature represents the bank-full width of perennial streams. The two polygonal layers were then combined to generate a GIS layer representing the bank-full width of all streams within the study area.

[26] Under Maine's Mandatory Shoreland Zoning Act, a river is defined as a free-flowing body of water that provides drainage for a watershed of 25 square miles to its mouth. Maine Department of Environmental Protection, *Mandatory Shoreland Zoning Act Title 38 MRSA Sections 435 through 449*, September 17, 2005.

[27] 30 meters is approximately 98 feet, 5 inches.

To identify developable land within the 30-meter buffer recommended by NMFS, it is necessary to determine the areas already excluded from development by local setback requirements. In certain areas of Maine, however, the information needed to determine whether a 75-foot vs. 100-foot setback is currently in effect is not available. To address this uncertainty, the analysis estimates the acreage of currently developable land within the NMFS 30-meter buffer (and the corresponding impacts) as a range. The low end of this range assumes that the 100-foot setback requirement is currently in effect in the areas of uncertainty, while the high-end estimate assumes that only the 75-foot setback is in effect. Based on these assumptions, approximately 29,100 to 32,800 acres of land within 30 meters of perennial streams and rivers in the study area may be developed under current State and local law.

3) **Estimate probability of a Federal nexus.** Although the analysis assumes that 29,100 to 32,800 acres of developable land lie within 30 meters of perennial streams, the development of this land will require a section 7 consultation only where individual development projects have a Federal nexus. The analysis assumes that the percentage of waterfront development projects requiring a Section 404 permit, which was estimated above to be 74 percent, represents the probability that developable land within 30 meters of perennial streams will be subject to a Federal nexus requiring a section 7 consultation. Based on this value, an estimated 21,600 to 24,300 acres of developable land within 30 meters of perennial streams in the study area are subject to a Federal nexus.

4) **Estimate Lost Option Values for Foregone Developments.** This analysis estimates the lost option value of land identified in Step 3 based on the difference between its baseline value and its residual value following the establishment of the riparian buffer.[28] The baseline value of affected land was estimated from assessment data provided by LURC and a limited number of cities and towns outside of LURC's jurisdiction.[29,30] South of the area under LURC's jurisdiction, the residual value of affected land was estimated as the sum of its conservation value ($150 per acre) and any rents associated with its current use (i.e., $308 per acre for silvicultural land, $325 per acre for pastureland, and $400 per acre for

[28] This approach is consistent with the theoretical models for land valuations presented in D.R. Capozza and Yuming Li, "The Intensity and Timing of Investment: The Case of Land," *The American Economic Review*, Vol. 84, No. 4 (Sep., 1994):889:904, and D.R. Capozza and R.W. Helsley, "The Stochastic City," *Journal of Urban Economics* 28(1990):187-203.

[29] MRS appraisal data with ID numbers matching those on LURC parcel polygons were provided by Ellen Jackson, LURC GIS Coordinator, on April 19, 2006. Based on appraisal values for LURC area parcels that intersect the 30-meter buffer, this analysis assumes a baseline value of $1,023 per acre for waterfront land under LURC's jurisdiction and for waterfront land in Coos County, New Hampshire.

[30] Towns outside of LURC's jurisdiction that provided parcel assessment data include Bath, Casco, Ellsworth, Rockport, Rumford, and Skowhegan, each of which are located in different counties. This analysis used the per acre value of waterfront property in each of these towns as a proxy for the baseline value of waterfront property in the county where each is located. In addition, the assessment values for these six towns were combined with the LURC assessment data to generate a weighted average baseline value per acre ($2,093) to apply to the other non-LURC counties in the study area.

cropland).[31,32,33] Because insufficient data are available to support the use of a specific conservation value for land under LURC's jurisdiction, the estimated residual value of affected LURC land is based solely on the rents associated with its current use.

5) **Array impacts by HUC.** Finally, the lost option values associated with the 30-meter riparian buffer were assigned to each HUC within the study area. To generate these HUC-level estimates, developable areas within the 30-meter setback (excluding setbacks required under State and local law) were overlaid with the GIS HUC layer.

5.3.2.2 Quantifying the Impacts of Administrative Costs

30. During a section 7 consultation, NMFS, the Federal agency involved in the activity (e.g., USACE), and the third party applying for Federal funding or permitting (if applicable) incur administrative costs as they coordinate to avoid destruction or adverse modification of critical habitat. The duration and complexity of these interactions depends on a number of variables, including the type of consultation (i.e., formal or informal), the species, the activity of concern, the potential effects of the proposed activity on the species and its critical habitat, and the Federal agency involved.

31. This analysis estimates the administrative costs associated with development-related section 7 consultations in the study area based on (1) the incremental costs for an informal consultation on critical habitat issues, assuming that the consultation will not require additional biological research efforts on the part of NMFS, and (2) the number of such consultations expected to take place during the 2008-2027 time horizon of the analysis. The incremental cost of an informal section 7 consultation is estimated to range from $3,700 to $10,700 per project.[34] To forecast the number of section 7 consultations for development projects between 2008 and 2027, the analysis assumes that the future annual issuance of Section 404 permits for development projects will be similar to the 2005-2006 average by county. Based on this approach, the analysis estimates that 289

[31] The $150 per acre conservation value reflects the per acre value of restricted land in relatively densely populated areas in Maine. Value provided by William Brune of the Nature Conservancy, personal communication, January 18, 2008.

[32] MRS appraisal data provided by LURC on April 19, 2006 provided a per acre value of timberland of $200, and subsequent communication with Bob Doirion, Supervisor of Unorganized Territories at MRS on April 26, 2006 suggested that timberland value likely ranges from $200 to $400 per acre. This value range was also corroborated by Tim Glidden, Land for Maine's Future (personal communication on April 27, 2006). This analysis therefore applies the average estimate of $300 per acre, adjusted for inflation to $308 per acre.

[33] Per acre values for agriculture from Maine Revenue Service, Bulletin No. 18, issued August 1, 2004. These values represent the typical agricultural value of farmland.

[34] Source: Industrial Economics, Inc. analysis of administrative costs based on data from the Federal Government Schedule Rates, Office of Personnel Management, 2007, and a review of consultation records from several U.S. Fish and Wildlife Service field offices across the country conducted in 2002. The range of consultation costs given above corresponds to the range of costs attributable to an incremental, informal consultation resulting entirely from the designation of critical habitat, excluding the costs of a biological assessment. The figures reported in Exhibit 2-1 represent the midpoint of this range.

section 7 consultations concerning the effect of development projects on the salmon's critical habitat will take place each year.

32. It is important to note that the timing of the administrative costs associated with section 7 consultations is different than that associated with the 30-meter buffer that may affect developable land in the study area. This analysis assumes that consultation costs will be spread evenly over the 20-year time horizon of the analysis as consultations take place, while the loss in option value associated with the 30-meter buffer is assumed to be realized immediately following the designation of critical habitat for the salmon.

5.4 IMPACTS TO DEVELOPMENT ACTIVITIES

33. Exhibits 5-8 and 5-9 summarize the estimated impacts to development activities. As indicated in Exhibit 5-9, the present value of the impacts to development activities over a 20-year period is $94.4 million to $127 million. Impacts are most heavily concentrated in the southern portion of the study area.

EXHIBIT 5-8. IMPACTS TO DEVELOPMENT ACTIVITIES BY HUC: HIGH ESTIMATE

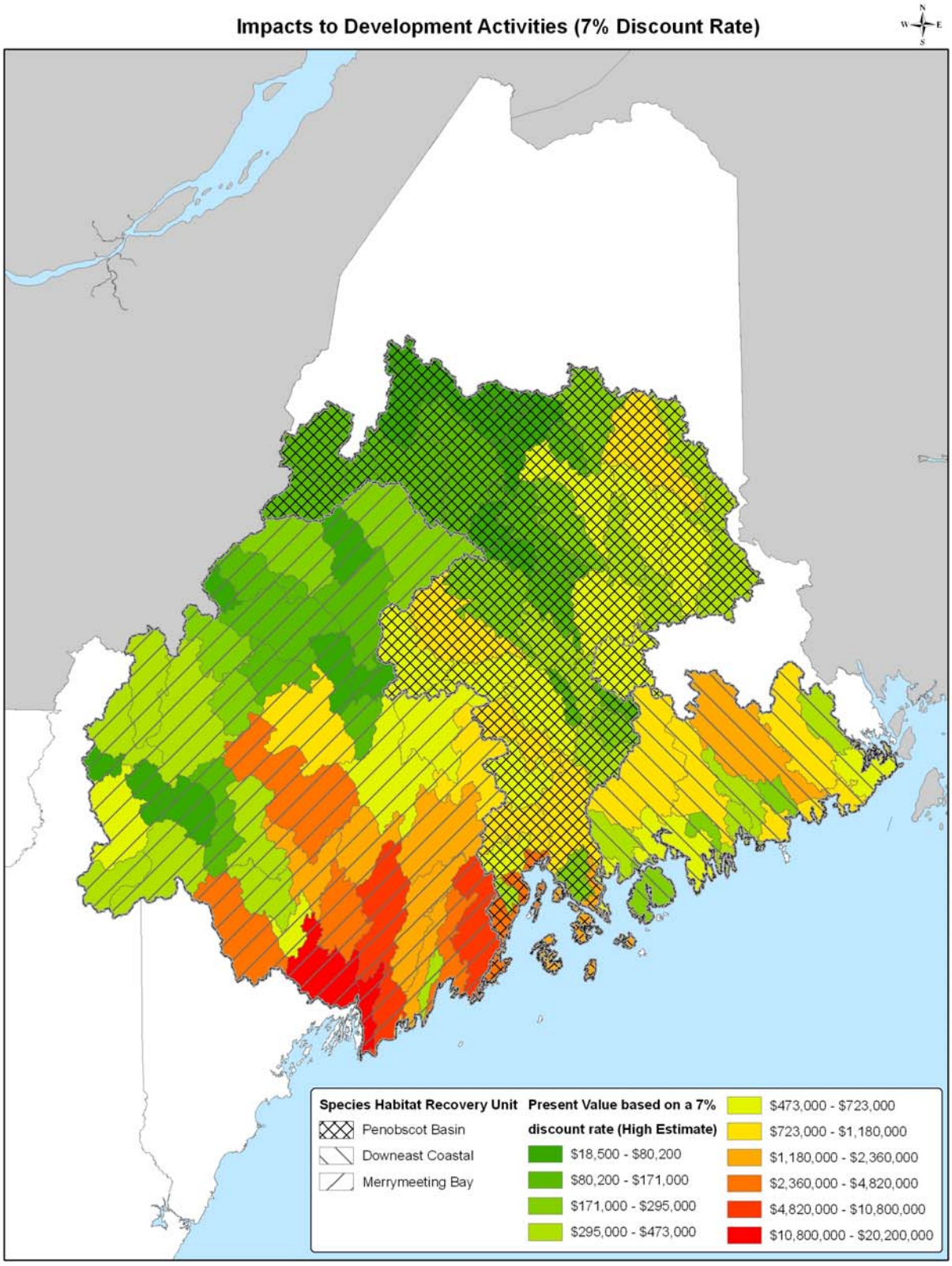


EXHIBIT 5-9. IMPACTS TO DEVELOPMENT ACTIVITIES BY HUC (TABLUAR FORMAT)[1,2]

DOWNEAST COASTAL			MERRYMEETING BAY			PENOBSCOT BASIN		
	PRESENT VALUE			PRESENT VALUE			PRESENT VALUE	
10 DIGIT HUC	LOW	HIGH	10 DIGIT HUC	LOW	HIGH	10 DIGIT HUC	LOW	HIGH
0105000205	$941,000	$1,420,000	0104000210	$15,700,000	$20,200,000	0105000220	$3,380,000	$4,660,000
0105000212	$416,000	$1,180,000	0105000307	$15,400,000	$16,900,000	0105000217	$1,700,000	$2,360,000
0105000209	$555,000	$891,000	0105000301	$7,090,000	$10,800,000	0102000301	$611,000	$1,100,000
0105000206	$633,000	$755,000	0105000306	$8,690,000	$8,960,000	0102000403	$594,000	$953,000
0105000204	$410,000	$741,000	0103000312	$6,310,000	$7,000,000	0102000512	$660,000	$874,000
0105000214	$339,000	$723,000	0105000302	$3,100,000	$4,820,000	0102000510	$697,000	$849,000
0105000203	$349,000	$487,000	0103000311	$2,280,000	$2,850,000	0102000513	$425,000	$768,000
0105000208	$328,000	$444,000	0103000305	$2,360,000	$2,850,000	0102000508	$531,000	$689,000
0105000211	$385,000	$444,000	0104000209	$1,140,000	$2,830,000	0102000306	$316,000	$613,000
0105000201	$242,000	$360,000	0105000304	$1,670,000	$2,020,000	0102000502	$338,000	$591,000
0105000213	$121,000	$309,000	0105000305	$1,400,000	$2,010,000	0102000511	$436,000	$587,000
0105000215	$111,000	$295,000	0103000309	$1,260,000	$1,880,000	0102000401	$446,000	$569,000
0105000207	$227,000	$277,000	0103000310	$1,100,000	$1,570,000	0105000218	$407,000	$543,000
0105000210	$143,000	$202,000	0104000206	$982,000	$1,510,000	0102000205	$333,000	$519,000
			0103000308	$699,000	$938,000	0102000503	$292,000	$515,000
			0103000304	$590,000	$815,000	0102000402	$400,000	$495,000
			0104000106	$538,000	$708,000	0102000305	$212,000	$494,000
			0103000307	$509,000	$620,000	0102000302	$216,000	$473,000
			0103000306	$353,000	$520,000	0102000304	$174,000	$416,000
			0104000208	$234,000	$514,000	0102000307	$245,000	$356,000
			0104000207	$248,000	$461,000	0102000501	$207,000	$354,000
			0104000205	$296,000	$440,000	0102000406	$283,000	$353,000
			0104000104	$307,000	$425,000	0102000506	$257,000	$336,000
			0104000101	$152,000	$422,000	0102000303	$179,000	$328,000
			0104000202	$291,000	$397,000	0105000219	$228,000	$328,000

DOWNEAST COASTAL			MERRYMEETING BAY			PENOBSCOT BASIN		
	PRESENT VALUE			PRESENT VALUE			PRESENT VALUE	
10 DIGIT HUC	LOW	HIGH	10 DIGIT HUC	LOW	HIGH	10 DIGIT HUC	LOW	HIGH
			0104000201	$291,000	$387,000	0102000509	$179,000	$325,000
			0105000303	$203,000	$324,000	0102000204	$101,000	$289,000
			0104000103	$232,000	$315,000	0102000404	$181,000	$242,000
			0103000202	$111,000	$204,000	0102000505	$146,000	$238,000
			0103000201	$72,400	$201,000	0102000110	$103,000	$230,000
			0103000105	$67,600	$190,000	0105000216	$90,700	$218,000
			0103000103	$87,800	$177,000	0102000507	$118,000	$156,000
			0103000204	$59,100	$171,000	0102000405	$52,900	$143,000
			0103000106	$46,700	$135,000	0102000109	$51,200	$143,000
			0103000203	$54,700	$129,000	0102000102	$38,700	$112,000
			0104000204	$48,700	$123,000	0102000105	$37,700	$109,000
			0103000102	$35,000	$101,000	0102000101	$37,100	$107,000
			0103000303	$67,400	$98,000	0102000504	$51,600	$98,000
			0104000102	$37,600	$80,200	0102000103	$33,000	$95,400
			0104000203	$29,500	$77,100	0102000203	$31,300	$90,600
			0103000301	$25,000	$72,900	0102000201	$27,100	$78,400
			0104000105	$27,400	$69,600	0102000202	$24,600	$68,800
			0103000104	$22,900	$66,200	0102000104	$17,300	$50,100
			0103000101	$22,100	$64,000	0102000108	$11,000	$31,700
			0103000302	$27,600	$54,300	0102000107	$9,610	$27,800
						0102000106	$6,570	$18,500
Subtotal	**$5,200,000**	**$8,530,000**	**Subtotal**	**$74,300,000**	**$95,600,000**	**Subtotal**	**$14,900,000**	**$23,000,000**

	LOW	HIGH
PRESENT VALUE OF IMPACTS ACROSS ALL HUCS	**$94,400,000**	**$127,000,000**

DOWNEAST COASTAL			MERRYMEETING BAY			PENOBSCOT BASIN		
	PRESENT VALUE			PRESENT VALUE			PRESENT VALUE	
10 DIGIT HUC	LOW	HIGH	10 DIGIT HUC	LOW	HIGH	10 DIGIT HUC	LOW	HIGH

Notes:

1. Figures are rounded to three significant digits and may not sum due to rounding.
2. Estimates reflect present value of impacts for the 2008-2027 time horizon of the analysis and reflect a 7 percent discount rate.
3. Highlighting denotes HUCs that Atlantic salmon currently occupy.

5.5 ASSUMPTIONS AND CAVEATS

34. Exhibit 5-10 summarizes the major assumptions and caveats underlying the analysis of impacts to development activities.

EXHIBIT 5-10. CAVEATS AND ASSUMPTIONS

ASSUMPTION	POTENTIAL EFFECT ON RESULTS[1]
Based on aerial photography, this analysis assumes that perennial streams identified by MEGIS were approximately 4 meters wide. This assumption may overestimate stream width in some areas and underestimate it in others.	+/-
To assess the probability that developable land will be subject to a Federal nexus, the analysis relies on the ratio of historical Section 404 permits believed to be related to residential development to the number of residential building permits believed to be for waterfront development projects. If this aspect of the analysis were to considerer commercial building activity, the estimated probability of a Federal nexus could change.	+/-
In the absence of more detailed data, developable lands in non-LURC areas were identified using the NLCD data set. Because NLCD data are derived from remote sensing, they only provide an approximate characterization of the location of existing development and developable lands. The dataset is also only current as of 2001.	+/-
Because developable lands in areas under LURC's jurisdiction were identified based on current zoning, this analysis does not consider the possibility that land in these areas could be re-zoned for development.	-
This analysis does not characterize publicly owned land as developable and does not consider potential impacts for public land that may be sold to a private landowner in the future.	-
Although NMFS may recommend the implementation of stormwater controls instead of the 30-meter setback for some development projects, the analysis assumes that all streamside development projects with a Federal nexus will be modified to include a 30-meter setback.	+
Because limited data were available on the baseline and residual values of individual parcels in the study area, the analysis uses a series of average values. Based on these averages, the analysis may overestimate or underestimate the development option value of individual parcels.	+/-
The analysis of the administrative costs associated with section 7 consultations is based on the number of Section 404 permits issued in 2005 and 2006, and assumes that the number of development-related Section 404 permits issued per year will remain constant over time. To the extent that permit activity changes over time, so too will the administrative costs associated with section 7 consultations.	+/-

Notes:
1. +: This assumption may result in an overestimate of real costs.
   - : This assumption may result in an underestimate of real costs.
   +/-: This assumption has an unknown effect on estimates.

CHAPTER 6 | MISCELLANEOUS IN-STREAM ACTIVITIES

6.1 INTRODUCTION

1. This chapter evaluates the potential effect of critical habitat designation for the Gulf of Maine DPS of Atlantic salmon on transportation and other in-stream construction activities in the study area, including such activities as building or maintaining road crossings, stabilizing stream banks, planting vegetation, dredging, installing pilings, or constructing docks and piers.[1]

2. Transportation and other in-stream construction activities may affect the physical and biological features of salmon habitat by modifying the hydrologic and sediment transport regimes of watersheds, blocking fish passages, and increasing sedimentation. In-stream construction activities may affect the habitat by altering water depth and velocity, sediment transport, woody debris volumes, water quality, and habitat connectivity.[2] These potential threats may be minimized or avoided through the use of conservation measures, such as:

   - Seasonal restrictions on construction activity;
   - Construction of road crossings to allow for the passage of adult salmon and accommodate peak flow conditions; and
   - Employing non-toxic construction materials.

3. Section 7 consultation considering critical habitat for the Gulf of Maine DPS of Atlantic salmon is likely to occur for transportation and other in-stream construction activities that are subject to a Federal nexus, either through the receipt of funding from Federal agencies, such as the Federal Highway Administration (FHWA), or through Federal permitting programs, such as those administered by the U.S. Army Corps of Engineers (USACE) under the authority of the Clean Water Act (CWA) or Rivers and Harbors Act (RHA).

4. In some situations, the use of Best Management Practices (BMPs) and compliance with other State regulations may adequately address the potential impacts of transportation or other in-stream construction activities on salmon habitat. Large and well-funded projects are in most cases currently managed in a manner consistent with salmon habitat conservation needs. Smaller projects, however, are less likely to meet

[1] As discussed later in this chapter, the analysis also considers the potential impact of critical habitat designation on the construction of liquefied natural gas (LNG) terminals. At this time, however, there are no plans for the development of such projects within the study area.

[2] National Marine Fisheries Service, *Final Recovery Plan for the Gulf of Maine Distinct Population Segment of Atlantic Salmon*, November 2005.

this standard, particularly when budgets are limited and State requirements fail to mandate the implementation of BMPs. While the incremental impact of critical habitat designation on these activities is expected to be minor, it may nonetheless lead to an increase in the use of BMPs, and thus impose some additional costs. Because data to quantify these costs are unavailable, this chapter may underestimate the impact of critical habitat designation on transportation and other in-stream construction activities.

5. The remainder of this chapter is divided into four sections. The first provides background on transportation and other in-stream construction activities in Maine and New Hampshire. The second discusses current management of these activities, highlighting any overlap with project modifications that may be recommended via section 7 consultation to protect the species and its habitat. The third section describes the methods employed to estimate the impacts of critical habitat designation on transportation and other in-stream construction activities. The fourth section presents the resulting forecast of economic impacts across the study area.

6.2 EXTENT OF TRANSPORTATION AND OTHER IN-STREAM CONSTRUCTION ACTIVITIES IN THE STUDY AREA

6. As noted above, in-stream construction can include a wide range of activities. Those likely to be of greatest concern include development and maintenance of stream crossings (e.g., bridges and culverts), docks or piers, and liquefied natural gas (LNG) facilities.

6.2.1 STREAM CROSSINGS

7. Maine contains approximately 36,700 kilometers of public roads, while the length of public roads in New Hampshire totals approximately 25,100 kilometers. As shown in Exhibit 6-1, most of the public roads in both States are municipally owned. Within the study area, these roads include 1,608 bridges, many of which span rivers and streams (see Exhibit 6-2). According to State transportation plans, ninety-three of these bridges are expected to undergo construction sometime in the next six years.[3]

8. In addition to the major road crossings mapped in Exhibit 6-2, many minor road crossings, including culverts, are found in the study area. While spatial data are not available for these smaller crossings, some percentage of these will also require replacement or repair within the next six years.

[3] Maine DOT, Keeping Maine Moving: 2004-2035 Long-Range Transportation Improvement Plan. New Hampshire DOT, New Hampshire Long-Range Transportation Plan, June 6, 2006.

EXHIBIT 6-1. PUBLIC ROAD LENGTH BY OWNERSHIP (KM)

OWNER	MAINE	NEW HAMPSHIRE
State Highway Agency	13,757	6,397
County	0	2
Municipal	22,418	18,390
Federal Agency	276	214
Other	253	49
Total	**36,704**	**25,052**

Source: Federal Highway Administration, Highway Statistics 2005, accessed at: http://www.fhwa.dot.gov/policy/ohim/hs05/metric_tables.htm.

9. Public funding for transportation projects in Maine and New Hampshire comes primarily from the States' dedicated highway funds and from the Federal government (i.e., the FHWA). The Maine Department of Transportation's total estimated funding for 2008 and 2009 combined is $816 million.[4] These funds were slated for allocation to a wide array of projects, ranging from $150,000 for installation of a culvert invert lining to $11.3 million for rehabilitation of a bridge.[5] The New Hampshire Department of Transportation (NH DOT) reported funding of approximately $540 million in 2005, derived mainly from the State highway trust fund and other Federal sources.[6]

6.2.2 DOCKS OR PIERS AND MARINE TRANSPORTATION PROJECTS

10. On average, Maine and the USACE issue approximately 200 permits for dock or pier construction per year. These facilities typically range in length from 50 to 150 feet. Although spatial information is not available for all future projects, the large number of permits issued for the construction of docks and piers suggests that some are likely to be located within the study area.[7]

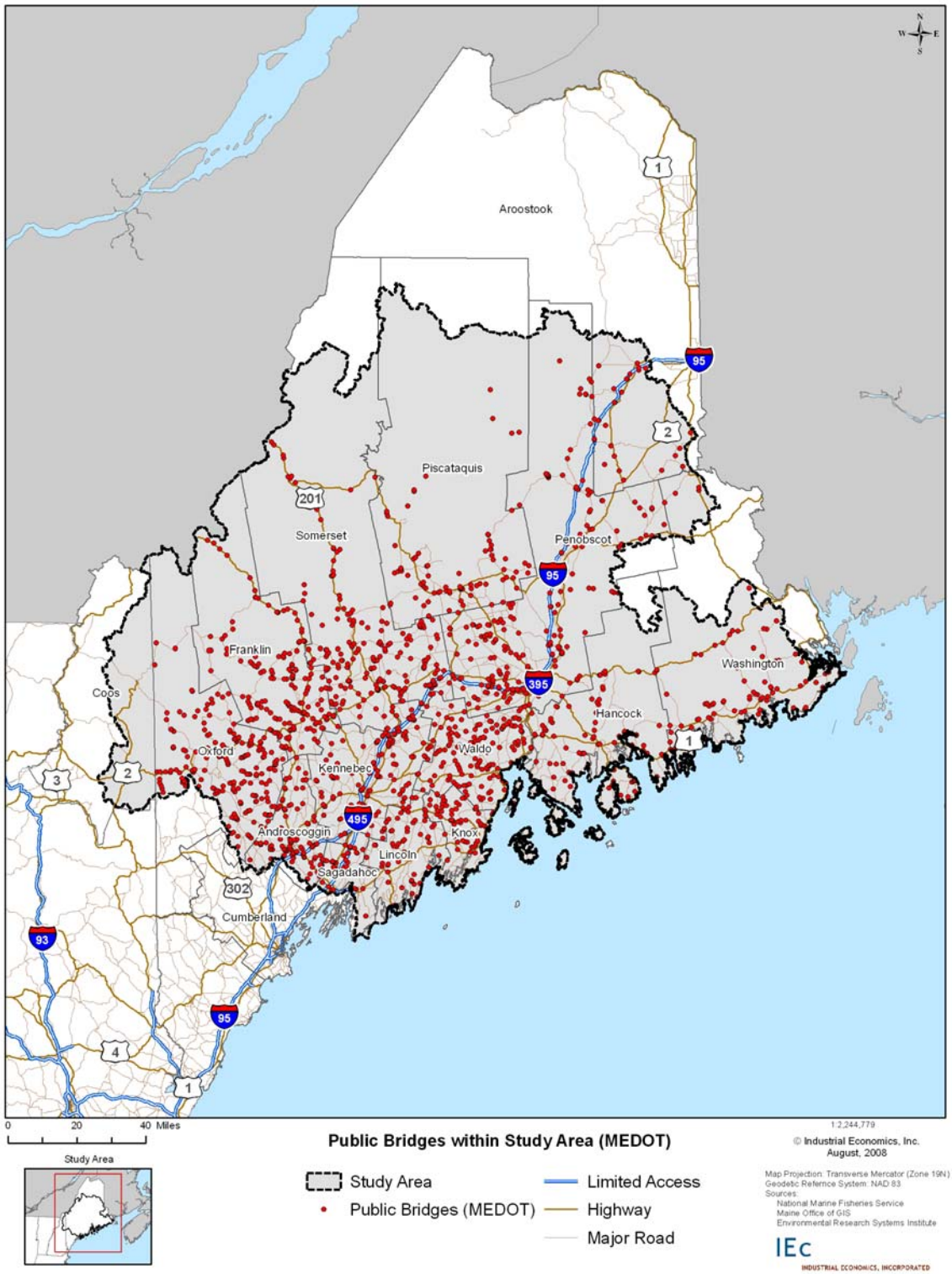
[4] Maine Department of Transportation, *Biennial Capital Work Plan for Fiscal Years 2008-2009,* April 2007. Accessed at: http://mainegov-images.informe.org/mdot/planning-documents/bcwp2008-2009/Complete Book.pdf.

[5] Maine Department of Transportation. Current Projects Under Construction January 2008. Accessed at http://www.maine.gov/mdot/major-construction-projects/current.pdf.

[6] New Hampshire DOT, New Hampshire Long-Range Transportation Plan, June 6, 2006.

[7] NOAA Residential Dock and Pier Management Database. Accessed at https://www8.nos.noaa.gov/docks/publicview.aspx on January 8, 2008.

EXHIBIT 6-2. PUBLIC BRIDGES WITHIN THE STUDY AREA



11. A potentially significant marine transportation project within the study area is the development of a freight container port on Sears Island. Located off the coast of Searsport in Waldo County, Sears Island is one of the largest uninhabited islands on the east coast of the U.S. Development of the 941-acre island, which is owned by the State of Maine, has been the focus of public controversy for several decades. In 2007, the State, the Town of Searsport, and numerous stakeholders entered into a consensus agreement that established a process for developing recommendations on the island's future use. In January, 2009, Governor Baldacci signed an executive order implementing the recommendations that emerged from this process. The order directs the Maine Department of Transportation (ME DOT) to grant a conservation easement on a 601-acre parcel to the Maine Coast Heritage Trust; the conservation easement restricts future development of this parcel. It also identifies a 330-acre parcel to be held by ME DOT for transportation use, and directs ME DOT to work with the Maine Port Authority and other interested parties to begin the process of marketing and developing a cargo/container port on this parcel (and/or on nearby Mack Point).[8] To date, however, specific plans for the parcel's development have not been proposed. Thus, the impact of critical habitat designation on this effort is uncertain and attempts to quantify such impacts would be speculative. Accordingly, the impact estimates presented in this chapter do not reflect impacts associated with potential development of a freight container port on Sears Island.

6.2.3 LNG TERMINALS

12. While natural gas suppliers have proposed to construct three LNG terminals in Maine, none of these facilities would be located within the study area, and available information suggests that the pipelines that would link to these terminals would be constructed outside the study area.[9] Thus, activities associated with the construction of these facilities are unlikely to occur within the study area, and are unlikely to have an adverse impact on critical habitat for the Gulf of Maine DPS of Atlantic salmon.

[8] Executive Order 24 FY 08/09, January 22, 2009.

[9] The three LNG projects, which are proposed for development no earlier than 2009, would connect to the existing Maritimes and Northeast natural gas pipeline serving the New England area (Energy Information Administration, Office of Oil and Gas. August 2006. Additions to Capacity on the U.S. Natural Gas Pipeline Network: 2005). The sendout line for the proposed Quoddy Bay LNG terminal would run through the towns of Perry, Pembroke, and Charlotte, connecting with the Maritimes and Northeast pipeline in Princeton, Maine (Quoddy Bay LNG, *Project Overview and Purpose*. Accessed at: http://www.quoddylng.com/). This route is north of the study area. Detailed information on the potential route of sendout lines for the other proposed LNG terminals is not available. The facility that would be located in Robbinston, however, would connect to the Maritimes and Northeast pipeline in Baileyville, Maine, north of the study area (Downeast LNG. Question and Answer Briefing. July 2005. Accessed at http://www.downeastlng.com/docs/QABriefingFINAL.pdf). Similarly, an LNG terminal proposed for Calais, Maine, would be located north of the study area and in close proximity to either the Princeton or Baileyville connection points (Federal Energy Regulatory Commission, Office of Energy Projects. Potential North American LNG Terminals. January 2008. Accessed at http://www.ferc.gov/industries/lng/indus-act/terminals/horizon-lng.pdf). Based on this information, it seems unlikely that sendout lines associated with any of these facilities would enter the study area.

6.3 EXISTING REGULATION OF TRANSPORTATION AND OTHER IN-STREAM CONSTRUCTION ACTIVITIES

13. Transportation and other in-stream construction projects in Maine and New Hampshire are currently subject to a suite of State and Federal requirements, several of which provide for conservation efforts that benefit the salmon and its habitat. As described below, this includes requirements enacted both before and after the listing of Atlantic salmon as an endangered species.

- **Requirements implemented prior to listing of the salmon in 2000:**

  38 M.R.S.A. Sections 480 Q 2.A. and 9 (1993 and 1989). This State of Maine regulation requires that a person repairing, replacing or maintaining an existing culvert "… shall ensure that erosion control measures are taken to prevent sedimentation of the water and that the crossing does not block fish passage in the water course." It also requires that public works "shall employ erosion control measures to prevent sedimentation of any surface water [and] shall not block fish passage in any water course."

  38 M.R.S.A. Sect. 480-A through Z (1987). This State of Maine regulation, issued under the Maine Natural Resources Protection Act, requires permitting for any structure in, on, over, or adjacent to a protected natural resource. This includes docks or piers in place for more than seven months.[10] Permits are issued by the Maine Department of Environmental Protection.

  Maine Natural Resources Protection Act. Chapter 305. Permit By Rule Standards. Section 11.B.8 (Effective 1989, amended 2006). This statute mandates that a project "not permanently block any fish passage in any watercourse containing fish. The applicant must improve passage beyond what restriction may exist unless the Department of Inland Fisheries and Wildlife, Department of Marine Resources, the Atlantic Salmon Commission, and the Department of Environmental Protection's Division of Environmental Assessment concur that the improvement is not necessary."

  New Hampshire Comprehensive Shoreland Protection Act (1991). This statute provides certain minimum standards to protect aquatic life as well as minimize erosion and sedimentation.

  Clean Water Act (1972, amended in 1977). This act regulates the discharge of pollutants into U.S. waters, and also regulates the discharge of dredged or fill materials. The Maine Department of Environmental Protection has assumed authority for issuing and overseeing the State's National Pollutant Discharge Elimination System (NPDES) permits. In New Hampshire, the U.S. Environmental Protection Agency (EPA) maintains this authority. The

[10] NOAA Residential Dock and Pier Management Database. Accessed at https://www8.nos.noaa.gov/docks/publicview.aspx on January 8, 2008.

USACE is responsible for issuing permits for the discharge of dredged or fill materials, pursuant to Section 404 of the Clean Water Act.

Rivers and Harbors Appropriation Act, Section 10 (1899). Section 10 of the Rivers and Harbors Act regulates the construction of structures such as wharves, docks, piers, etc. in navigable waters of the United States. Under Section 10, these projects require approval from USACE and are subject to USACE permitting requirements.

- **Requirements implemented after listing of the Gulf of Maine DPS as delineated in 2000:**

  Maine Department of Transportation Fish Passage Policy and Design Guide (December 2004). This policy requires that transportation projects take into consideration various factors, including avoidance of adverse effects to endangered, threatened, and candidate species and their habitats; maintaining minimum and maximum flows; and using non-toxic materials. Atlantic salmon is specifically mentioned as a fish species that should be considered when designing a fish passage.

  Clean Water Act. Army Corps of Engineers Programmatic General Permit – State of Maine, Items #10, 11, 21, and 22 (Effective October 11, 2005). Under this permit, the Corps states that it will work with NMFS "to protect and conserve the habitat of marine, estuarine, and anadromous finfish, mollusks, and crustaceans." It states that "conservation recommendations made by NMFS will normally be included as a permit requirement by the Corps." In addition, "all temporary and permanent crossing of waterbodies shall be suitably culverted, bridged, or otherwise designed to withstand and to prevent the restriction of high flows, and to maintain existing low flows, and to not obstruct the movement of aquatic life indigenous to the waterbody."

  Maine Department of Transportation Best Management Practices (Revised 2002). This manual details standards and management practices designed to mitigate erosion and sedimentation that may occur during transportation projects. It specifically notes that the seven watersheds supporting wild Atlantic salmon populations "merit the highest level of habitat protection and erosion and sedimentation control."

14. These requirements were developed for a variety of reasons. Many of the regulations promulgated prior to the listing of the Gulf of Maine DPS as it was delineated in 2000 were developed to protect a broad range of natural resources. For example, the purposes section of Maine's Natural Resource Protection Act states, "The Legislature finds and declares that the State's rivers and streams, great ponds, fragile mountain areas, freshwater wetlands, significant wildlife habitat, coastal wetlands and coastal sand dunes systems are resources of state significance."[11] In contrast, requirements developed after the listing of the salmon often incorporate provisions that specifically

[11] 38 M.R.S.A. Sections 480 A.

acknowledge salmon protection. For example, the ME DOT Fish Passage Policy was developed in cooperation with various State and Federal resource agencies and lists the salmon as a species to consider when designing a fish passage. These protections are due to the listing of the salmon and were developed prior to the designation of critical habitat.

15. Irrespective of the factors that led to their enactment, many of these requirements currently offer protection to the salmon and its habitat. These requirements will remain in effect regardless of the designation of critical habitat for the species.

6.4 ANALYTIC METHODOLOGY

16. This section discusses the programs and regulations that may constitute a Federal nexus, which determines whether projects may require consultation under section 7 of the Endangered Species Act. It then discusses project modifications that may be requested through the course of these consultations.

6.4.1 PROJECT FUTURE SECTION 7 CONSULTATIONS

17. Most transportation projects taking place within both Maine and New Hampshire are supervised or funded by ME DOT and NH DOT, respectively. As both of these agencies receive Federal government funding, the projects they undertake may have a Federal nexus that could trigger section 7 consultation. In addition, other in-stream construction projects are potentially subject to USACE Clean Water Act or Rivers and Harbors Act permitting, and therefore may require section 7 consultation. Given these circumstances, the analysis assumes that transportation or other in-stream construction projects that take place within the study area will require section 7 consultation.

18. To project future section 7 consultations associated with bridge and road projects, the analysis employs the following steps:

    1. *Determine the number of projects that may be affected (i.e., public bridges and roads that cross streams located within the study area).* The analysis identifies 1,690 major road crossings in the study area.[12]

    2. *To estimate the number of projects that would require consultation within the twenty-year timeframe of the analysis, assume that the State would need to replace, rehabilitate, or repair all bridges or crossings currently considered to be in "fair" or "poor" condition at some point within the next 20 years.* ME DOT estimates that 65 percent of its bridges are in "fair" condition, while nine percent are in "poor" condition. Therefore, the analysis assumes that projects requiring consultation would take place on 74 percent of the bridges and crossings identified in step 1 (i.e., 1,250 crossings).[13]

[12] Maine Department of Transportation, Bureau of Planning GIS data, 2007.

[13] Maine Department of Transportation, *Keeping Our Bridges Safe,* November 26, 2007. Accessed at http://www.maine.gov/mdot/pdf/Keeping Our Bridges Safe.1107.pdf.

3. *Assume that these projects would be evenly spread out across the twenty-year timeframe of the analysis.* ME DOT performs its bridge replacement and rehabilitation projects at a fairly constant annual rate, based on its available budget.[14] Thus, this assumption is consistent with the current approach to bridge replacement and rehabilitation projects within the study area.

19. As noted above, construction or repair of minor stream crossings within the study area, such as culverts, is also likely to be necessary. Spatial data and construction schedules for these smaller projects, however, are not available. As a result, the analysis does not forecast consultations associated with the construction or repair of minor stream crossings. To the extent that projects of this type would trigger section 7 consultations regarding critical habitat for the Gulf of Maine DPS of Atlantic salmon, the analysis is likely to underestimate the potential impact of critical habitat designation.

20. As previously indicated, the construction or repair of docks or piers within the study area may be subject to State or Federal permitting requirements. In Maine, the Natural Resources Protection Act (NRPA) requires permitting for any structure in, on, over, or adjacent to a protected natural resource. This includes any dock or pier in place for more than seven months. These permits are issued by the Maine Department of Environmental Protection, and are subject to review by other State agencies for habitat impacts. In New Hampshire, a wetlands permit must be obtained from the Department of Environmental Services prior to constructing a dock or pier.[15]

21. Docks and piers located in navigable waters are also subject to the Federal permitting requirements established under Section 10 of the Rivers and Harbors Appropriation Act of 1899, as administered by the USACE.[16] In Maine, navigable waters are defined as "waters that are subject to the ebb and flow of the tide and Federally designated navigable rivers (the Penobscot River, Kennebec River, and Lake Umbagog)."[17] Projects located in these rivers are subject to the USACE permitting requirements and may therefore require section 7 consultation.

22. While dock and pier construction activities in certain areas may incur administrative costs associated with consultation, geographically-specific dock and pier permitting data are not available. The analysis is therefore not able to reliably forecast the number or location of such projects, and quantifies neither the administrative costs associated with potential section 7 consultations nor the cost of potential modifications to such projects. As explained below, however, a number of State and

[14] ME DOT currently anticipates replacing approximately 30 to 40 bridges per year. See Maine Department of Transportation, *Keeping Our Bridges Safe,* November 26, 2007. Accessed at http://www.maine.gov/mdot/pdf/Keeping Our Bridges Safe.1107.pdf.

[15] NOAA Residential Dock and Pier Management Database. Accessed at https://www8.nos.noaa.gov/docks/publicview.aspx on January 8, 2008.

[16] 33 U.S.C. § 403.

[17] US Army Corps of Engineers, *Programmatic General Permit: State of Maine*, 2005. Accessed at: http://www.nae.usace.army.mil/reg%5Cmeall.pdf.

Federal standards that are currently in place for the construction of docks or piers are designed to protect salmon habitat. Thus, the incremental impact of critical habitat designation on the cost of dock or pier construction is likely to be minor.

6.4.2 FORECAST PROJECT MODIFICATIONS

23. Review of past section 7 consultations indicates that stakeholders undertaking transportation projects are already implementing conservation efforts for the benefit of the Atlantic salmon and its habitat. In addition, USACE permits typically include NMFS conservation recommendations even absent critical habitat designation.

24. Exhibit 6-3 describes the types of project modifications NMFS might consider in the course of a section 7 consultation and the existing requirements that provide similar protections. This exhibit underscores the assertion that existing requirements for transportation and other in-stream construction activities, as discussed in Section 6.2, may already require the conservation efforts that NMFS would request via section 7 consultations that consider critical habitat. Thus, while consultation is likely to occur on most current and future projects undertaken within the designation, the analysis concludes that most consultations will not result in a request for project modifications beyond those that are typically implemented under current standards.

6.5 FORECAST IMPACTS ACROSS STUDY AREA

25. While a Federal nexus exists for many transportation and other in-stream construction activities, the conservation management practices already in place and required under various State and Federal regulations are in many cases likely to prove sufficient for the conservation of salmon habitat. In such cases, additional project modifications stemming from the designation of critical habitat (i.e., changes above and beyond the types of conservation efforts that are already being requested for these projects) would be unnecessary. Therefore, the analysis projects no additional impact on transportation and in-stream construction activities in the study area.

26. While no further impact on transportation and in-stream construction activities is forecast, action agencies will still be required to consult on such activity within the study area. To account for this impact, the analysis estimates the administrative costs associated with these consultations.[18] The estimated costs represent costs beyond those likely to be incurred to consult on the jeopardy standard for the salmon. Based on the review of past section 7 consultations, most transportation projects undergo informal consultation. A number of projects, however, have required formal consultation. To account for the uncertainty in the type of consultation that may be required, the analysis projects low-end impacts by assuming the need for informal

[18] As previously noted, the data required to quantify the costs associated with consultations on certain types of projects (e.g., minor road culverts or docks and piers) are not available.

consultation on transportation projects, and high-end impacts by assuming the need for formal consultation on such projects.[19]

EXHIBIT 6-3. SALMON HABITAT CONSERVATION EFFORTS ASSOCIATED WITH TRANSPORTATION AND OTHER IN-STREAM CONSTRUCTION ACTIVITIES

CONSERVATION EFFORT/PROJECT MODIFICATION	EXISTING REQUIREMENT
All in-stream work affecting freshwater ecosystems should be done from July 15 to September 30, during periods of low stream flow; in estuaries (which are outside of the study area), all in-stream work should be performed from November 8 to April 9	• ME DOT Fish Passage Policy • ME DOT BMPs • Army Corps Programmatic General Permit
Avoid stream crossings whenever possible and consider using a bridge or bottomless arch culvert if a road crossing is necessary	• ME DOT Fish Passage Policy
Maximum flow through a culvert < 1.6 feet per second to allow passage of salmon parr (maximum sustained swim speed of salmon parr 1.6 - 2.5 fps)	• ME DOT Fish Passage Policy
Minimum depth of 11 inches in culvert to allow passage for adult salmon (1.5 times adult body thickness)	• ME DOT Fish Passage Policy • 38 MRSA Sections 480 Q 2.A and 9 (1993 and 1989)
Stream culvert must satisfy peak flow (or flood) conditions	• ME DOT Fish Passage Policy
Stream crossing must maintain existing stream channel slope above and below crossing	• ME DOT Fish Passage Policy
Materials used in construction must be non-toxic to fish and aquatic life	• ME DOT Fish Passage Policy
Culvert shall not be hanging or perched	• ME DOT Fish Passage Policy
Culvert shall be installed below streambed elevation to allow for natural stream bed through culvert	• ME DOT Fish Passage Policy
Post construction inspections to ensure culvert retains design criteria for the life of the culvert	• ME DOT Fish Passage Policy
Work in the dry - isolation of work area	• ME DOT BMPs
Prepare sediment and erosion control plan	• ME DOT BMPs
Soil stabilization measures and sediment control	• ME DOT BMPs • 38 MRSA Sections 480 Q 2.A and 9 (1993 and 1989)
Riparian buffer and planting	• ME DOT BMPs
Fish evacuation/relocation to avoid take	• Army Corps Programmatic General Permit

[19] Specifically, the analysis employs a low-end estimate of $1,000 per consultation and a high-end estimate of $6,000 per consultation. Both of these figures represent the incremental costs associated with the effort required to address adverse modification in the course of a new consultation, as determined by the analysis of consultation costs described in Chapter 2. The low-end figure corresponds to the lower bound of the range estimated for informal consultations ($1,000 to $3,750), while the high-end figure corresponds to the upper bound of the range estimated for formal consultations ($3,750 to $6,000).

27. As Exhibit 6-4 shows, the present value of the resulting cost estimates ranges from approximately $709,000 to $4.25 million. Exhibit 6-4 also describes the distribution of the forecast impacts by HUC and SHRU. While administrative costs will be incurred for projects throughout the study area, the majority of costs are associated with projects within the Merrymeeting Bay SHRU, with the highest costs associated with projects in HUC 0103000305.

EXHIBIT 6-4. ADMINISTRATIVE COSTS TO TRANSPORTATION AND OTHER IN-STREAM CONSTRUCTION ACTIVITIES BY HUC AND SHRU

DOWNEAST COASTAL			MERRYMEETING BAY			PENOBSCOT BASIN		
	PRESENT VALUE			PRESENT VALUE			PRESENT VALUE	
10 DIGIT HUC	LOW	HIGH	10 DIGIT HUC	LOW	HIGH	10 DIGIT HUC	LOW	HIGH
0105000205	$7,970	$47,800	0103000305	$45,300	$272,000	0102000512	$21,400	$128,000
0105000214	$7,550	$45,300	0104000210	$31,900	$191,000	0102000511	$20,600	$123,000
0105000212	$7,130	$42,800	0104000209	$31,500	$189,000	0102000513	$18,500	$111,000
0105000215	$6,710	$40,300	0103000306	$31,500	$189,000	0102000510	$16,400	$98,100
0105000204	$6,290	$37,700	0103000309	$26,000	$156,000	0102000402	$10,500	$62,900
0105000213	$4,190	$25,200	0103000312	$23,500	$141,000	0105000220	$9,650	$57,900
0105000203	$4,190	$25,200	0103000304	$21,800	$131,000	0102000508	$7,550	$45,300
0105000208	$3,360	$20,100	0105000301	$21,000	$126,000	0102000401	$7,130	$42,800
0105000209	$3,360	$20,100	0104000205	$20,600	$123,000	0102000509	$7,130	$42,800
0105000206	$2,520	$15,100	0103000307	$19,700	$118,000	0102000301	$6,710	$40,300
0105000207	$2,100	$12,600	0105000305	$18,500	$111,000	0102000502	$6,710	$40,300
0105000210	$2,100	$12,600	0104000207	$17,200	$103,000	0105000218	$6,710	$40,300
0105000211	$1,680	$10,100	0104000202	$15,500	$93,100	0102000406	$5,450	$32,700
0105000201	$1,680	$10,100	0104000206	$13,000	$78,000	0102000110	$5,030	$30,200
			0103000308	$12,600	$75,500	0102000501	$4,610	$27,700
			0104000204	$12,200	$73,000	0102000506	$4,610	$27,700
			0103000311	$11,300	$67,900	0102000404	$4,610	$27,700
			0105000302	$10,100	$60,400	0102000306	$4,190	$25,200
			0103000310	$8,390	$50,300	0102000305	$3,360	$20,100
			0104000208	$7,970	$47,800	0102000503	$2,940	$17,600
			0104000203	$6,710	$40,300	0102000403	$2,940	$17,600
			0103000303	$6,290	$37,700	0102000302	$2,520	$15,100
			0105000304	$4,610	$27,700	0105000217	$2,520	$15,100
			0103000301	$4,610	$27,700	0102000307	$2,520	$15,100
			0104000101	$3,770	$22,600	0102000304	$2,100	$12,600
			0103000105	$3,360	$20,100	0102000303	$1,680	$10,100
			0103000103	$3,360	$20,100	0105000216	$1,680	$10,100
			0105000307	$2,940	$17,600	0105000219	$1,680	$10,100
			0105000303	$2,940	$17,600	0102000205	$1,260	$7,550

DOWNEAST COASTAL			MERRYMEETING BAY			PENOBSCOT BASIN		
	PRESENT VALUE			PRESENT VALUE			PRESENT VALUE	
10 DIGIT HUC	LOW	HIGH	10 DIGIT HUC	LOW	HIGH	10 DIGIT HUC	LOW	HIGH
			0103000203	$2,520	$15,100	0102000405	$839	$5,030
			0103000201	$2,100	$12,600	0102000102	$839	$5,030
			0105000306	$1,680	$10,100	0102000106	$839	$5,030
			0103000202	$1,680	$10,100	0102000204	$419	$2,520
			0104000201	$839	$5,030	0102000507	$419	$2,520
			0103000302	$839	$5,030	0102000109	$419	$2,520
			0104000102	$839	$5,030	0102000505	$419	$2,520
			0103000204	$839	$5,030	0102000203	$0	$0
			0103000106	$839	$5,030	0102000504	$0	$0
			0104000103	$419	$2,520	0102000202	$0	$0
			0104000104	$419	$2,520	0102000103	$0	$0
			0103000104	$419	$2,520	0102000105	$0	$0
			0104000106	$0	$0	0102000201	$0	$0
			0103000102	$0	$0	0102000104	$0	$0
			0103000101	$0	$0	0102000101	$0	$0
			0104000105	$0	$0	0102000107	$0	$0
						0102000108	$0	$0
Subtotal	**$60,800**	**$365,000**	**Subtotal**	**$452,000**	**$2,710,000**	**Subtotal**	**$197,000**	**$1,180,000**

	LOW	HIGH
PRESENT VALUE OF IMPACTS ACROSS ALL HUCS	**$709,000**	**$4,250,000**

Notes:

1. Estimates are rounded to three significant digits and may not sum due to rounding.
2. Estimates reflect present value of impacts for the 2008-2027 time horizon of the analysis and were calculated based on a seven percent discount rate.
3. Highlighting denotes HUCs that Atlantic salmon currently occupy.

CHAPTER 7 | SILVICULTURE

7.1 INTRODUCTION

1. This chapter describes the potential effects of critical habitat designation for the Gulf of Maine DPS of Atlantic salmon on the region's silviculture industry. Approximately 7.5 million acres within the study area (59 percent of the total land area) are actively managed as forestland. Approximately 135,000 acres, or two percent of this timberland, is held in industrial ownership by companies who process and mill their own timber. The vast majority of the timberland, however — approximately 6 million acres (79 percent) — is held by non-industrial private forest landowners (NIPF owners).[1] These NIPF owners do not process their own timber, but instead sell their harvest in national and international markets.

2. Silviculture activities have the potential to affect the physical and biological features of critical habitat for the salmon. Where timber harvesting occurs, soil may be loosened, leading to sedimentation of nearby rivers and streams. In addition, herbicides used during forest regeneration may infiltrate streams and rivers, and removal of the forest canopy over waterbodies can affect stream temperature.[2] In most situations, however, the use of Best Management Practices (BMPs) and compliance with State forest management regulations can adequately control the effects of silvicultural activities on salmon habitat. Many silviculture operations within the study area are already managed in a manner consistent with salmon conservation needs, suggesting that the incremental effect of critical habitat designation on silviculture operations will be minor.

3. The likelihood that silviculture activities will be the focus of a section 7 consultation concerning impacts on Atlantic salmon habitat depends upon whether the activities have a Federal nexus. Permitting for silviculture within the study area occurs predominantly at the State level, and most of the laws regulating the industry are written and enforced by the states. At the Federal level, Section 404 of the Clean Water Act provides an exemption for silviculture, and Federal cost-share programs for the management of forest lands are administered through the states, with little or no Federal involvement in the allocation of funds to landowners. Thus, silvicultural activities in the study area are unlikely to have a Federal nexus that would trigger a section 7 consultation for effects on critical habitat. As a result, the designation of

[1] Maine Landownership Information. GIS data layer maintained by J.W. Sewall Company, Old Town, Maine. Last updated December 9, 2005. Received December 22, 2005. The remaining timberland is owned by a combination of Federal (2 percent), State (10 percent), Indian (2 percent), and conservation (2 percent) entities.

[2] Fay, et al. 2006. Status Review for Anadromous Atlantic Salmon (*Salmo salar*) in the United States. Report to the National Marine Fisheries Service and U.S. Fish and Wildlife Service. 294 pages.

critical habitat is not likely to affect the regional silviculture industry, and no economic impacts are estimated.

4. The remainder of this chapter is divided into four sections. The first and second discuss the silviculture industry within Maine and New Hampshire, respectively, as well as the regulations that govern its management. The third discusses in greater detail why silviculture activities are unlikely to have a Federal nexus, and the fourth summarizes the chapter's principal findings.

7.2 PROFILE OF REGIONAL SILVICULTURE INDUSTRY: MAINE

5. The woods of Maine are situated within the 26 million acre Northern Forest, a temperate and boreal woodland that stretches from Maine to Ontario. The Northern Forest comprises the largest contiguous area of wilderness east of the Mississippi.[3] Within Maine's section of the Northern Forest, the northern hardwoods forest type is most predominant, covering approximately 7.1 million acres, or 41 percent of the State's forest. Spruce/fir (32 percent), aspen/birch (13 percent), and white/red pine (eight percent) forests are also common.[4]

6. Over half the commercial timber output from the Northern Forest comes from Maine, including harvests of hardwood, spruce/fir, pine, and hemlock. In 2005, the Maine Forest Service (MFS) reported that 6.3 million cords of wood were harvested from Maine's woods: 2.8 million cords of pulpwood, 2.6 million cords of sawlogs, and 0.95 million cords of biomass chips. This harvest provides the raw materials required by Maine's forest products industry, which accounts for 34 percent ($1.6 billion) of Maine's annual manufacturing output. As the largest manufacturing industry in the State, the forest products sector currently employs over 16,000 individuals. Many of these individuals are employed in the production of pulp and paper. Daily, Maine mills produce 10,000 tons of paper and 7,000 tons of pulp, making Maine the largest producer of printing and writing paper nationwide.[5] This sector combines with others in the forest products industry to contribute $6.5 billion annually to Maine's economy, or 14 percent of the Gross State Product.[6]

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[3] North East State Foresters Association (NEFA). 2002. The Northern Forest Lands. Accessed at http://www.northernforestlands.org/northernforestland.htm on September 25, 2007.

[4] NEFA. 2007. The Economic Importance and Wood Flows from Maine's Forests. Accessed at http://www.nefainfo.org/publications/2007%20Publications/NEFAEconomicImportME.pdf on November 30, 2007.

[5] Rahman, M., and M. Wilson. 1999. Maine Portfolio Of The Forest-Products Industry: A Comparative Analysis Of Performance And Prospects. Accessed at http://www.usm.maine.edu/cber/mbi/winter99/rahman.htm on October 1, 2007.

[6] Maine Forest Service, Department of Conservation. 2005. The 2005 Biennial Report on the State of the Forest and Progress Report on Forest Sustainability Standards. Accessed at http://www.maine.gov/doc/mfs/pubs/pdf/2005sof_full_rpt.pdf on September 26, 2007.

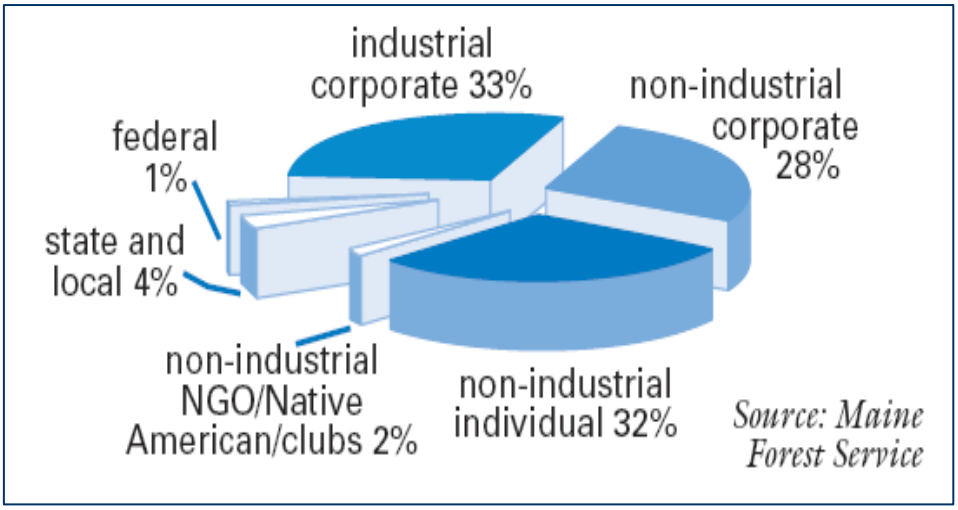
7.2.1 GEOGRAPHY AND OWNERSHIP

7. Of Maine's 19.7 million acres of land area, approximately 17.6 million, or 89 percent, is forested (the highest percentage of forest cover of any State in the nation). The U.S. Forest Service (USFS) deems all but three percent of this land harvestable timberland.[7] Ninety-six percent of these lands are privately owned, both by non-industrial private forest owners (NIPF) and the forest products industry. Notably, 36 percent of the private forestlands are small-scale parcels used as camps, woodlots, or hunting lands. Exhibit 7-1 breaks out forest ownership by landowner class in 2002.

8. Ownership patterns within the study area are consistent with Maine's statewide percentages. Just under two percent of forest lands within the study area are held by industrial owners in parcels of 1000 acres or more, 76 percent are held by non-industrial owners, and 13 percent are held by the State or Federal government. Exhibit 7-2 illustrates the distribution of land ownership within the study area.[8]

9. Production and processing of harvested timber occurs in all areas of Maine. Of the 63 timber processing facilities located in Maine, 28 are associated with sawlogs and wood production and 35 with pulp and paper production.

EXHIBIT 7-1. FOREST OWNERSHIP PATTERNS IN MAINE[9]



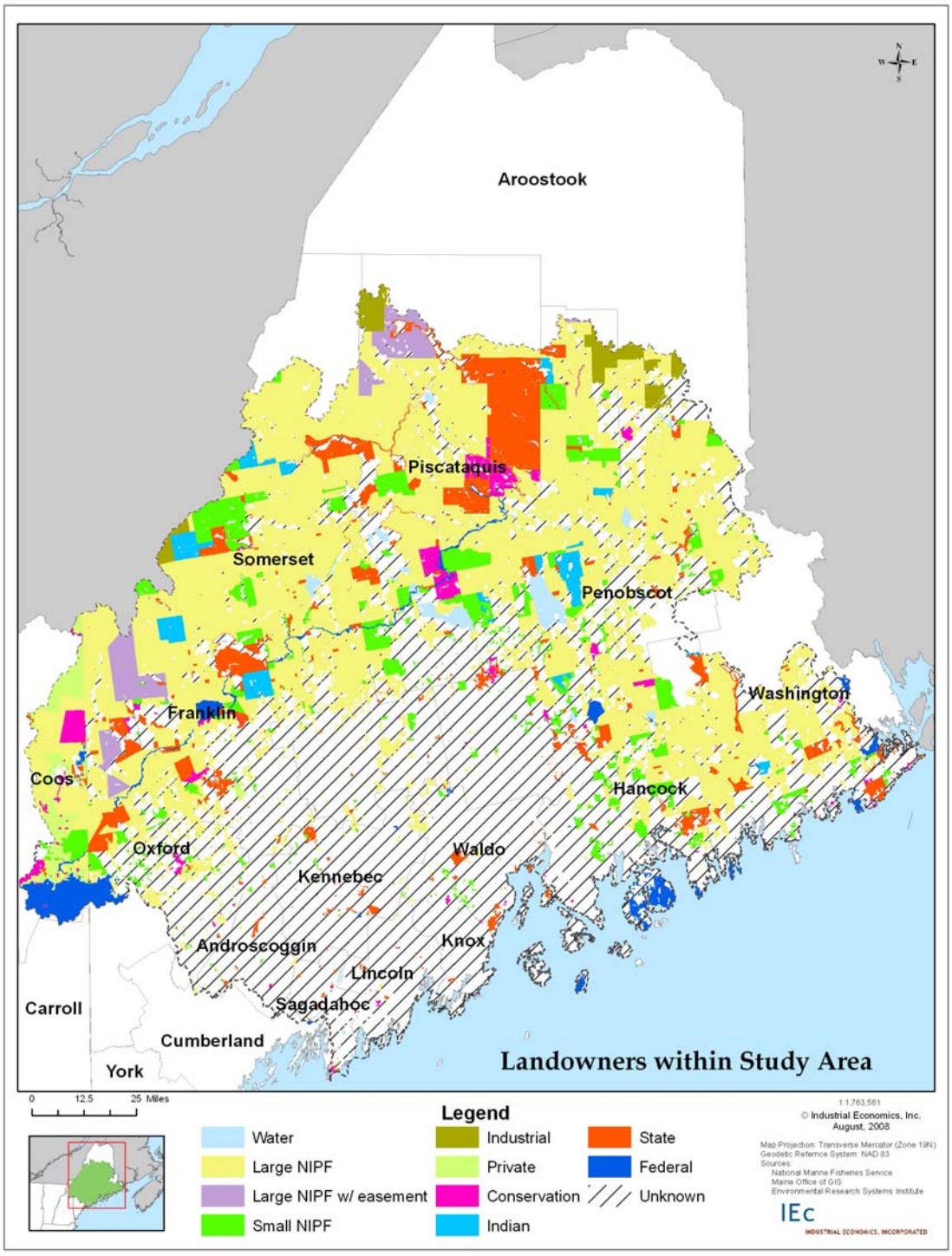
Source: NEFA 2004.

[7] Beetz, Jessica L. 2004. State of Maine 2004, An environmental assessment. Accessed at http://www.colby.edu/environ/ES493/stateofmaine2004/papers/SoM04_forests_paper.htm on September 26, 2007.

[8] Areas without current ownership or parcel information are highlighted with hashmarks. Based on ownership patterns within the State, the majority of these lands are likely to be held by non-industrial private landowners, and forested portions are unlikely to exceed 100 acres per parcel.

[9] Exhibit taken from NEFA. 2004. The Economic Importance of Maine's Forests. Accessed at http://www.nefainfo.org/publications/2004_nefa_ei_me.pdf on September 27, 2007.

EXHIBIT 7-2. FOREST OWNERSHIP WITHIN THE STUDY AREA



7.2.2 STATEWIDE REGULATIONS

10. The State of Maine regulates private forest management through the Maine Forest Service (MFS), a bureau within the Maine Department of Conservation. Additionally, the Land Use Regulation Commission (LURC) is responsible for planning and zoning the State's unorganized areas, townships, and plantations. Areas under LURC's jurisdiction are subject to MFS regulations, and where both regulatory authorities govern land management, the more stringent (with respect to setbacks, environmental quality, etc.) is the legally binding standard.[10, 11]

11. Most statutes applicable to forestry in the State are codified in Title 12, Part 11 of the Maine Revised Statutes Annotated (MRSA). The following sections discuss the existing regulations relevant to silviculture that govern the use of water and water quality in the State. Collectively, these laws call for use of BMPs to ensure appropriate stewardship of water bodies in Maine.

7.2.2.1 Maine Forest Practices Act

12. The Maine Forest Practices Act: a) regulates the extent and proximity of clear-cuts; b) requires landowners to notify the MFS under certain harvesting circumstances; and c) charges the commissioner of the Department of Conservation with identifying regional restocking standards for post-harvest management. The Act was originally written in 1988 and has been updated several times, most recently in 2004.[12] Several rules have been enacted under the authority of the Maine Forest Practices Act, most regulating the nature and extent of clearcuts, but some more broadly requiring that harvest activities be registered with the State. Specifically, the regulations set the following limits on clearcutting in the region:

- No clear-cuts can be larger than 250 acres.
- Clear-cuts between five and 20 acres must be separated by at least 250 feet from any other clear-cut on the property. Separation zones must contain a basal area of greater than 30 square feet per acre or 450 trees per acre.[13]
- For clear-cuts of between 20 and 75 acres, the landowner must apply, with the help of a licensed forester, for a permit in which the reasons for the cut and plans for regeneration are detailed.
- For clear-cuts of between 75 and 250 acres, the permit application must also include summaries of how water quality will be maintained throughout the

[10] "Setbacks" refer to the buffer zones between an activity and a body of water. A setback of 75 feet would indicate that logging could not occur within 75 feet of a river, stream, or other waterbody.

[11] Maine Revised Statutes Authority (MRSA). 38 MRSA, Chapter 3 §438-B.

[12] Maine Revised Statutes Authority (MRSA). 12 MRSA Part 11, Chapter 805, §8867-A.

[13] Basal area refers to the cross-sectional area of trees or stems at breast height (4.5 feet above ground), measured in square feet. It is often used as an indicator of stand density.

site. A Bureau forester must visit the proposed site to inspect and review the harvest plan. Notification of approval occurs after the Bureau forester writes a determination that the harvest plan complies with the appropriate standards. Separation zones for clear-cuts greater than 20 acres must contain 60 square feet of basal area per acre of trees greater than one inch at breast height.

- Exceptions to clear-cut standards are made for cuts less than five acres, or for landowners who own less than 100 acres throughout the State.

13. Under the same statutory authority, MFS has also created rules aimed at stopping the practice of liquidation harvesting. Liquidation harvesting is defined as "the purchase of timberland followed by a harvest that removes most or all commercial value in standing timber, without regard for long-term forest management principles, and the subsequent sale or attempted resale of the harvested land within five years."[14]

7.2.2.2 Timber Harvesting in Shoreland Areas

14. Of particular importance to salmon conservation are the rules governing timber harvesting in shoreland areas.[15] Authorized in 38 MRSA, Chapter 3 §438-B, these regulations are designed to prevent sedimentation, regulate river temperature and shade levels, and maintain consistent flow under stream crossings.[16] Specific setback information, instructions for stream crossings and culvert placement, and road construction standards are included in these rules. These regulations are ultimately the most specific and relevant with respect to salmon habitat conservation, and were designed to ensure that silviculture will have minimal impact. Some of these rules are highlighted below:

- Harvest operations coming within either 75 or 250 feet of a waterbody (depending on the nature of the waterbody) "must leave adequate tree cover and shall be conducted so that a well-distributed stand of trees is retained." These standards are defined through basal area and size of clearings.
- Depending on slope, mineral soil must not be exposed between 25 and 165 feet from the shore of a waterbody.
- Skid trails and stream crossings must be closed out in a way that ensures no residual effect of their presence.
- While BMPs are required to ensure that sedimentation does not occur in shoreland areas, any evidence that sedimentation has occurred must immediately be addressed.

[14] Maine Revised Statutes Authority (MRSA). 12 MRSA Part 11, Chapter 805, §8867-A.

[15] The authorizing statute defines shoreland areas as "those areas within 250 feet of the normal high-water line of any great pond, river or saltwater body, within 250 feet of the upland edge of a coastal wetland, within 250 feet of the upland edge of a freshwater wetland … or within 75 feet of the high-water line of a stream" (Title 38 MRSA §435).

[16] The regulations were originally authorized in 1990, and were last updated in May of 2006.

7.2.2.3 Best Management Practices

15. Under the authority of Maine's Non-point Source Pollution Program (Title 38 MRSA §410), MFS has published a 100-page manual outlining BMPs for "protecting Maine's water quality." The manual details how specific BMPs function to protect water quality in relation to stream crossings, truck roads, log landings, hazardous materials (e.g. pesticides and herbicides), wetlands crossings, trails, and harvesting.[17] In total, over 180 BMPs are discussed. Proper implementation of these practices should bring any harvest operation into full compliance with the Statewide Standards for Timber Harvesting in Shoreland Areas (38 MRSA §438-B).

16. Use of BMPs has increased steadily in the past decade. A November 2006 report by MFS indicated that BMPs to protect water quality were in use for over 75 percent of timberland surveyed in 2005. Exhibit 7-3 summarizes the use of BMPs to protect water quality since 2000.[18]

EXHIBIT 7-3. COMPARISON OF BMP USE FROM 2000-2005

REPORTING PERIOD	NUMBER OF HARVESTS BORDERING WATER BODIES	BMPS USED APPROPRIATELY	BMPS NOT APPLIED
2000-2001	181	41%	25%
2001-2003	288	52%	8%
2005	102	79% at stream crossings 92% at approaches	4% at stream crossings 6% at approaches

17. The MFS report also highlights the following key points about BMP usage in Maine:

- *Timber harvests that extended into riparian areas retained 80 percent average forest canopy crown closure.*
- *At sites where BMP principles and practices were not applied appropriately, sediment reached the water at 25 percent of the approaches and 44 percent of the stream crossings.*
- *Forty-five percent of harvest sites with water present in the immediate harvest area did not have stream crossings. Harvest planning that avoids crossing waterbodies is a valid BMP.*

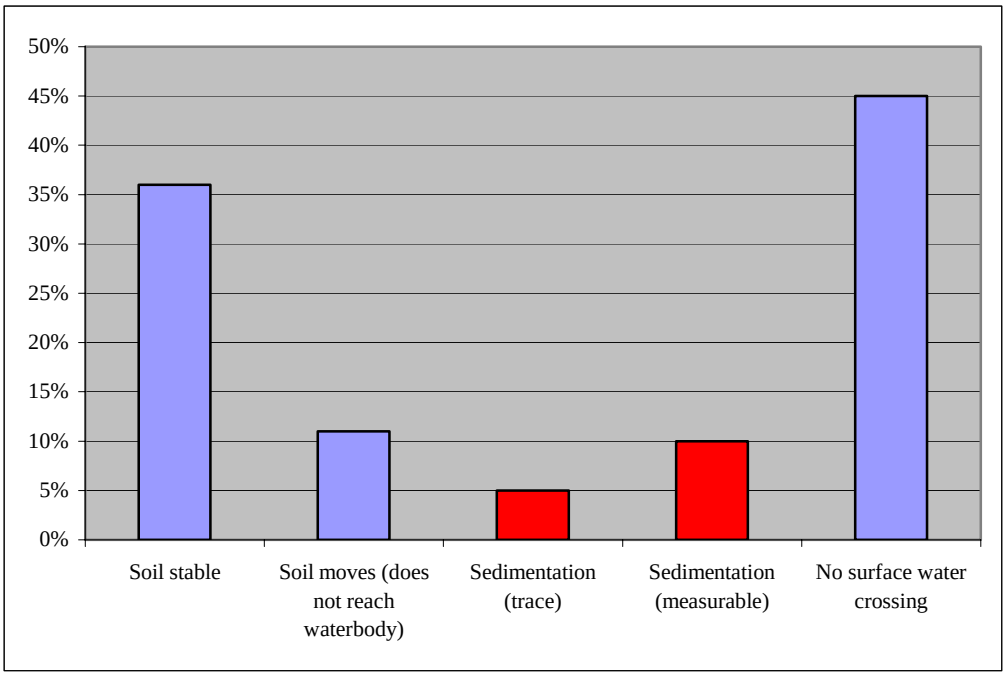
18. Use of BMPs was shown to reduce sedimentation in water bodies. The 2006 report summarizes observations at various points along skid trails in the study areas and found that only 15 percent of observations indicated "either trace or measurable

[17] Maine Forest Service, Department of Conservation. 2004. Best Management Practices for Forestry: Protecting Maine's Water Quality. Accessed at http://www.maine.gov/doc/mfs/pubs/bmp_manual.htm on November 12, 2007.

[18] Maine Forest Service, Department of Conservation. 2006. Maine Forestry Best Management Practices Use and Effectiveness, 2005. Forest Management and Policy Division, November 2006.

amounts of sediment reached the water body." Exhibit 7-4 describes this in greater detail.[19]

EXHIBIT 7-4. PERCENT OF OBSERVATIONS SHOWING SOIL STABILIZATION, MOVEMENT, AND SEDIMENTATION AT ROAD OR TRAIL APPROACHES TO WATERBODIES[20]



Source: Maine Forest Service, 2006

7.3 PROFILE OF REGIONAL SILVICULTURE INDUSTRY: NEW HAMPSHIRE

19. Approximately 462,000 acres of the study area are west of Maine in the State of New Hampshire. Like Maine, New Hampshire's woods are part of the larger Northern Forest, and composed of a mix of northern hardwoods (48 percent), coniferous species (18 percent), aspen/birch (six percent), and other species (28 percent).[21]

20. Eighty-four percent of New Hampshire's land area is forested. While 77 percent of this land is privately owned, New Hampshire's forests are held in a larger proportion by families (68 percent) than by businesses or investors (nine percent).[22] Overall, forestry accounts for $1.2 billion in shipments from the State, or seven percent of annual manufacturing output.

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[19] This figure represents "Observations of soil movement, sedimentation and stabilization as a proportion of total opportunities to observe soil conditions in the protocol (n=408)." Because there were 102 sites inspected, and four places to observe approaches to stream crossings at each, n=408.

[20] Percentages total greater than 100 percent due to sedimentation occurring in areas with no stream crossing.

[21] NEFA. 2007. The Economic Importance and Wood Flows from New Hampshire's Forests. Accessed at http://www.nefainfo.org/publications/2007%20Publications/NEFAEconomicImportNH.pdf on November 30, 2007.

[22] The remaining 23 percent are held by Federal (15 percent), State (5 percent), and local (3 percent) government.

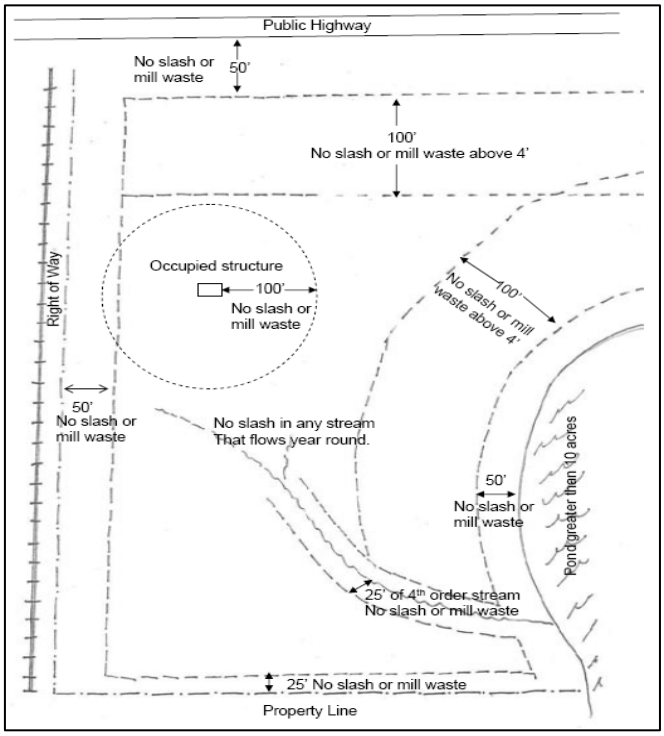
7.3.1 LAND OWNERSHIP IN THE STUDY AREA

21. Ownership patterns for forest land within the New Hampshire portion of the study area are consistent with the distribution of ownership statewide: 71 percent of timberland is privately held, while the balance, 29 percent, is held by Federal, State, or local government. Exhibit 7-2 (shown previously) illustrates the distribution of land ownership in this area.

7.3.2 STATEWIDE REGULATIONS

22. New Hampshire's forestry laws are similar to Maine's. As in Maine, forested areas near streams are governed by special timber harvesting requirements.[23] New Hampshire regulations specify that within 150 feet of the shore of a fourth order stream, no more than 50 percent of the basal area may be removed per year.[24] For smaller streams, this buffer zone is reduced to 50 feet of the shore. Additionally, slash (woody debris left after a harvest operation) may not be left within 25 feet of fourth order streams or in the bed of any perennial stream. Restrictions on slash piles are illustrated in Exhibit 7-5.

EXHIBIT 7-5. GRAPHICAL REPRESENTATION OF NEW HAMPSHIRE'S SLASH RULES



Source: University of New Hampshire Cooperative Extension.

[23] New Hampshire Revised Statutes Authority (RSA). Section 227-J:1.

[24] A fourth order stream is defined through the Strahler Stream Order. A first order stream is not fed by any other stream, a second order stream is formed through the confluence of two or more first orders, a third order by two or more second orders, and a fourth order by two or more third order streams. Within the New Hampshire portion of the study area, the Androscoggin River and several of its tributaries have been identified as fourth order (or higher) streams.

23. The Department of Environmental Services (DES) in New Hampshire has also promulgated a number of rules regarding the assurance of water quality in the State's rivers, streams, and lakes. The standards were developed "to protect surface water quality from degradation resulting from any activity which significantly alters the terrain or occurs in or on the border of the surface waters of the State."[25] Specifically related to timber harvesting, DES mandates that "No person undertaking any activity for which a permit is required shall cause or allow the activity to cause any water quality degradation, including siltation or turbidity in surface water."[26] Significantly, this rule means that depositing sediment in the water, even if permitting and other regulations are followed, is still illegal and subject to fine.

7.3.2.1 Permitting for Shoreland Activities

24. While all harvesting activities require notification, certain activities designated as possible threats to water quality require a permit as well: "Any person proposing to… transport forest products or undertake construction in or on the border of the surface waters of the State… in such a manner as to impede the natural runoff or create an unnatural runoff, shall be directly responsible to submit to the department detailed plans concerning such proposal and any additional relevant information requested by the department, at least 30 days prior to undertaking any such activity. The operations shall not be undertaken unless and until the applicant receives a permit from the department."[27] State foresters are granted right of entry to inspect forest management operations, and inspect anywhere from one-third to one-half of harvesting operations annually.[28] Evidence of sedimentation renders a tract non-compliant with statewide timber laws and is grounds for citation.

7.3.2.2 Best Management Practices

25. DES has mandated that BMPs be implemented in situations presenting the risk of land erosion or sedimentation of waterbodies (i.e., any operation requiring a permit, as referenced above). Effectively, New Hampshire requires the application of BMPs for any stream crossing in a harvest operation.[29] In harvest operations for which no permit is required, BMPs are recommended. New Hampshire's most recent BMP manual is an adaptation of Maine's document, and is substantially identical.[30] Failure

[25] New Hampshire Code of Administrative Rules. Chapter Env-Ws 400 "Protection Of State Surface Waters." 415.04.

[26] ibid.

[27] New Hampshire Revised Statutes Authority (RSA). Section 485-A:17.

[28] Personal Communication with John Accardi, Forest Ranger Captain, NH Northern District, on November 19, 2007.

[29] "Skid trails and truck roads shall be laid out using appropriate erosion control devices, as outlined in the Best Management Practices for Erosion Control on Timber Harvesting Operations in New Hampshire." Code of Administrative Rules, Env-Wt 304.05.

[30] As of December 2007, this document had yet to be finalized and put into formal effect. In the interim, forestry operations are required to abide by the previous document, which was last updated in 2000.

to follow appropriate BMPs or permit requirements is grounds for citation and fines of $2,000 per violation.[31]

26. BMP monitoring is not as extensive in New Hampshire as in Maine. Nonetheless, preliminary analysis of 101 forestry operations in New Hampshire found that BMPs have been widely applied in the State. According to a State official, New Hampshire's most recent evaluation demonstrated that BMPs are being used effectively throughout the State, resulting in soil stability at 74 percent of crossing structures, 82 percent of approaches outside the 50-foot buffer, and 75 percent of approaches inside the buffer. Where sediment did enter the water, closeout and maintenance of the crossing structure were cited as the cause.[32]

7.4 FEDERAL NEXUS AND SECTION 7 CONSULTATION REQUIREMENTS

27. This section discusses the programs and regulations that may constitute a Federal nexus, which determines whether projects may require consultations under section 7 of the Endangered Species Act. As described below, the information available suggests that it is unlikely that a Federal nexus exists for silviculture activity within the study area. Thus, this analysis does not anticipate that consultation related to critical habitat for the salmon will occur.

7.4.1 CLEAN WATER ACT

28. Section 404 of the Clean Water Act establishes a permitting process for the discharge of dredge or fill material into any U.S. waterway. The Army Corps of Engineers (Corps) grants these permits after an applicant proves that no practicable or less damaging environmental alternative to a planned project exists. Section 404 of the Clean Water Act provides an exemption from the permitting process for "normal silvicultural activities" as part of an "established, ongoing operation."[33] According to the Corps, roughly 90 percent of the land harvested in Maine in 2006 was either industrial, timber investment property, State land, or NIPF land held in areas over 100 acres, and thus qualified for the Section 404 exemption.[34] On the remaining ten percent (i.e., NIPF owners holding less than 100 acres), any established management plan or ongoing timber management is included in this exemption.

29. An exception to the silviculture exemption includes "land recontouring activities such as grading, land leveling, filling in low spots or converting to upland." Established operations undertaking such activities are subject to Clean Water Act 404 permitting. These activities, however, are not a common practice in the study area. Officials from the Corps office in charge of issuing permits for Northern New England have

[31] New Hampshire Code of Administrative Rules. Env-C 614.06.

[32] Personal Communication with Sarah Smith, Forest Industry Specialist, UNH Cooperative Extension, on December 3, 2007.

[33] 33 U.S.C. § 1251 et seq.; 40 C.F.R. §§ 104.1 et seq.

[34] Personal Communication with Jay Clement, Maine Project Office of the U.S. Army Corps of Engineers. on September 25, 2007.

indicated that no 404 permits for active silviculture have been sought in New Hampshire or Maine in the last two decades.[35, 36] Additionally, permitting for Section 402 of the Clean Water Act, which requires permits for the discharge of pollutants into water bodies, does not apply to silviculture. Officials at the Maine Department of Environmental Protection and New Hampshire Department of Environmental Services (the permitting agencies) have never been approached for silviculture permits.[37]

30. In light of the above, it is unlikely that silvicultural activity in the study area will be subject to Clean Water Act permitting requirements. Thus, Clean Water Act permitting is unlikely to constitute a Federal nexus that would trigger a section 7 consultation concerning potential adverse modifications of salmon habitat.

7.4.2 FOREST LEGACY PROGRAM

31. The U.S. Department of Agriculture's (USDA) Forest Legacy Program (FLP) was established as part of the Forestry Title in the 1992 Farm Bill. Specifically, the title authorizes the Secretary of Agriculture "to acquire lands and interests in lands in perpetuity for inclusion in the Forest Legacy Program."[38] Acting in this capacity, the USDA provides cost share funds of up to 75 percent toward the purchase of development rights on forest tracts, thus ensuring these lands will remain in timber production and free from development pressure.

7.4.2.1 FLP in Maine

32. Maine is by far the largest beneficiary of FLP funds, and holds more acreage enrolled in FLP than any other state. Of the 1,480,508 acres of land enrolled in FLP nationally, 646,896, over 43 percent, are in Maine. This represents a $45.1 million contribution from the USDA, and almost four percent of Maine's total forestland.[39]

33. Landowners in Maine may apply to enroll a tract of land in FLP through a descriptive application to the State Department of Conservation's Bureau of Parks and Lands (Bureau), which ranks and prioritizes the applications. Within four months of the initial application, the Bureau submits to the USFS a list of the top three projects for which it seeks funding. A committee of USFS and State representatives prioritizes

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[35] Personal Communication with Frank DelGiudice, Chief of Regulatory Division, U.S. Army Corps of Engineers, on December 17, 2007. Mr. DelGuidice reports that no 404 permits for silviculture in Maine or New Hampshire have been requested at any time during his 20+ year tenure with the Army Corps.

[36] Landowners may be required to obtain a section 404 permit if a road constructed for timber harvesting under an exemption is later proposed to be used for recreational purposes or residential access. Such impacts, however, are attributable to development or transportation activities, not silviculture.

[37] Personal Communication with Andrew Fisk, Director of Land & Water Quality, Maine Department of Environmental Protection, on September 25, 2007. Personal Communication with Dan Dudley, NPDES Permit Writer for the New Hampshire Department of Environmental Services, on December 10, 2007.

[38] United States Department of Agriculture. 2003. Forest Legacy Program Implementation Guidelines. Accessed at http://www.fs.fed.us/spf/coop/library/flp_guidelines.pdf on October 5, 2007.

[39] Personal Communication with Mackenzi Keliher, Bureau of Parks and Lands, Maine Department of Conservation, on September 26, 2007.

each tract according to national criteria and recommends the top priorities for inclusion in the President's budget. The projects are then funded through Congressional earmarks.

34. Maine requires applicants for FLP funds to develop a forest stewardship plan before the State will forward the application to USFS. Exhibit 7-6 details the consideration these plans must give to threatened and endangered species and wildlife in general.[40] As the exhibit indicates, Maine's requirements specifically include the development of easement provisions that protect rare and endangered species habitat.

EXHIBIT 7-6. EXCERPT FROM MAINE'S FOREST LEGACY REQUIREMENTS

"Where conservation easements are employed as the method of land protection, a forest stewardship plan will serve as the means for describing specifically how easement provisions will be met. The Bureau of Parks and Lands, working in concert with its land protection partners as well as Department of Inland Fisheries & Wildlife, Maine Natural Areas Program and Maine Forest Service staff, will develop easement provisions that:

a. seek to protect significant recreational, wildlife and ecological values for public benefit (for example, important deer yards and significant hiking trails will be identified in the forest stewardship plan and protected through the terms of the easement);…

b. seek to protect rare and endangered species habitat, rare and exemplary natural communities and other significant wildlife values such as fisheries habitats and deer yards, and natural, scenic, educational, scientific, recreational, historical and archaeological features (for example, as part of the forest stewardship plan, the State will consult with the Maine Natural Areas Program to identify rare, threatened and endangered species habitats and will include special protection provisions for such habitats in the easement);…

c. seek to conserve water quality, wetlands and riparian values and maintain the fertility and quality of its soil (for example, the forest stewardship plan will address how Best Management Practices will be used to protect soils at risk of erosion from timber harvesting; significant wetlands will be identified and an adequate buffer established to ensure their protection; these values will be protected through the terms of the easement)…"

Source: Maine Forest Legacy Program: Modified Assessment of Need. April 17, 2007.

35. When Congress approves an application to enroll land in the FLP, the deed may be held by either the State or the Federal government (USFS). Under either option, the landowner is paid once the deed is transferred. Initially, the USFS held the development rights deed for Maine's FLP lands. Since 1996, however, USFS has

[40] The three most relevant of the seven stewardship plan requirements are presented.

provided funding while allowing the State's Department of Conservation to hold the deed. Currently, deeds for all but three tracts of Forest Legacy-funded projects are held by the State. Of Maine's 646,896 acres of land enrolled in the FLP, the USFS holds development rights for only 9,815 acres.[41]

7.4.2.2 FLP In New Hampshire

36. New Hampshire is second only to Maine in total acres (approximately 213,000) enrolled in the Forest Legacy Program.[42] The State also ranks third (next to Maine and Montana) in total FLP funds allocated, with $28 million spent as of 2007. Within the study area, three tracts of land have been enrolled in FLP, totaling approximately 10,000 acres.[43]

37. Forestland enrolled in FLP in New Hampshire must abide by additional standards written in the management plan of the conservation easement as well as those discussed in the "Good Forestry for the Granite State" manual.[44] This document calls for 25-foot no-harvest zones along fourth order streams, and a 600-foot management zone beyond that. Similarly scaled measures are recommended for smaller streams. Additionally, all FLP lands in New Hampshire are required to abide by the standard management requirements outlined in the previous section (no sedimentation of streams, and BMPs are required). The application to enroll a tract of land in FLP also requires a written stewardship plan, signed by a licensed forester. One of the required elements of the plan is the identification of "management objectives and planned activities for wildlife, and rare, threatened or endangered animal species."[45]

38. As with Maine, New Hampshire holds the majority (all but three) of FLP easements in the State. The Federal government holds the easement for only one FLP tract within New Hampshire's portion of the study area. Consistent with present FLP guidelines, any new easement associated with the program will be held by the State.

7.4.2.3 Forest Legacy Program and Section 7

39. A 2006 USFS report summarizing USFS responsibilities under section 7 of the Endangered Species Act notes that the FLP transactions rarely lead to section 7 consultations:[46]

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[41] Personal Communication with Mackenzi Keliher, Bureau of Parks and Lands, Maine Department of Conservation, on September 27, 2007.

[42] ibid.

[43] The level of GIS data in this portion of New Hampshire does not permit precise estimates of acreages. Two tracts are completely contained by the study area, collectively totaling 8,070 acres. The third is intersected by the study area boundary.

[44] The New Hampshire Forest Sustainability Standards Work Team. 1997. Good Forestry in the Granite State. Society for the Protection of New Hampshire's Forests.

[45] NH Bureau of Forests and Lands. 2006. "NH Forest Legacy Plan Requirements."

[46] United States Forest Service. 2006. A Forest Service Analysis Concerning Endangered Species Act Section 7 Requirements for Cooperative Assistance Programs: Cooperative Forestry, Urban and Community Forestry, Forest Health, and Fire.

"Because the Federal action is a real estate transaction, no land use changes occur as a result of the real estate transaction, and no actions are funded that may adversely affect listed species, Section 7 consultation is not required."

40. The document continues, however, to define how situations in which the Federal government holds the deed may require a consultation:

"First, when the Forest Service owns title to the land, any action that may have direct or indirect effects on Federally listed species and/or their designated critical habitat will require Section 7 consultation. Second, when the Forest Service holds the conservation easement, Section 7 consultation will be required for those management actions required by the conservation easement that may have direct or indirect effects on Federally listed species and/or their designated critical habitat..."

41. This implies that a Federal nexus may exist for FLP tracts for which the USFS holds the title or an easement; however, the USFS has concluded that its activities related to these tracts do not require section 7 consultation. To date, no land enrolled in FLP nationwide has been the subject of a section 7 consultation.[47]

7.4.3 OTHER COST-SHARE PROGRAMS

42. Of the remaining USFS programs utilized in the study area, none appear likely to provide a Federal nexus. For example, the Forest Stewardship Program (FSP) was authorized in 1991 to help increase the acreage of private forestland managed under a multi-use resource management plan. In Maine, the program is administered through the MFS and has helped produce more than 5,000 management plans since 1991. Under this program, however, funding allocations are determined by the State Forester, not the Federal government; thus it is unlikely that section 7 consultation will occur. The same is true for the Forest Land Enhancement Program (FLEP) and the Cooperative Fire Assistance Program. Therefore, the cooperative assistance programs of the USFS are unlikely to provide a Federal nexus requiring section 7 consultation.

7.5 ECONOMIC IMPACTS ON SILVICULTURE ACTIVITIES

43. While no likely Federal nexus has been identified for silviculture activities, and therefore no section 7 consultations are forecast as a result of critical habitat designation, circumstances could arise that would lead to a consultation. It is possible, for example, that the USFS would choose to hold the easement on land newly entered into the Forest Legacy Program, resulting in a Federal nexus that could trigger a consultation on the management actions required by the easement. Because such arrangements are speculative, however, this analysis projects no cost impact for silvicultural activities in the study area.

[47] Personal Communication with Kathryn Conant, Forest Legacy National Program Manager, USFS, on October 5, 2007.

CHAPTER 8 | AQUACULTURE

8.1 INTRODUCTION

1. This chapter describes the economic impacts to the aquaculture industry that may result from the designation of critical habitat for the Gulf of Maine DPS of Atlantic salmon. The discussion includes:

   - An overview of the economic importance of aquaculture in the study area;
   - A description of State and Federal regulations pertaining to the management of aquaculture facilities; and
   - A discussion of the implications of critical habitat designation for the operation of aquaculture facilities.

2. As described in greater detail below, the designation of critical habitat will likely have little impact on aquaculture activities. Aquaculture facilities are presently adhering to permitting requirements that are designed to protect Atlantic salmon. Conservation efforts pursuant to these requirements are expected to continue, and NMFS does not anticipate that the designation of critical habitat will necessitate additional modification of aquaculture operations. In light of these findings, the analysis does not forecast incremental impacts of critical habitat designation to aquaculture operations.

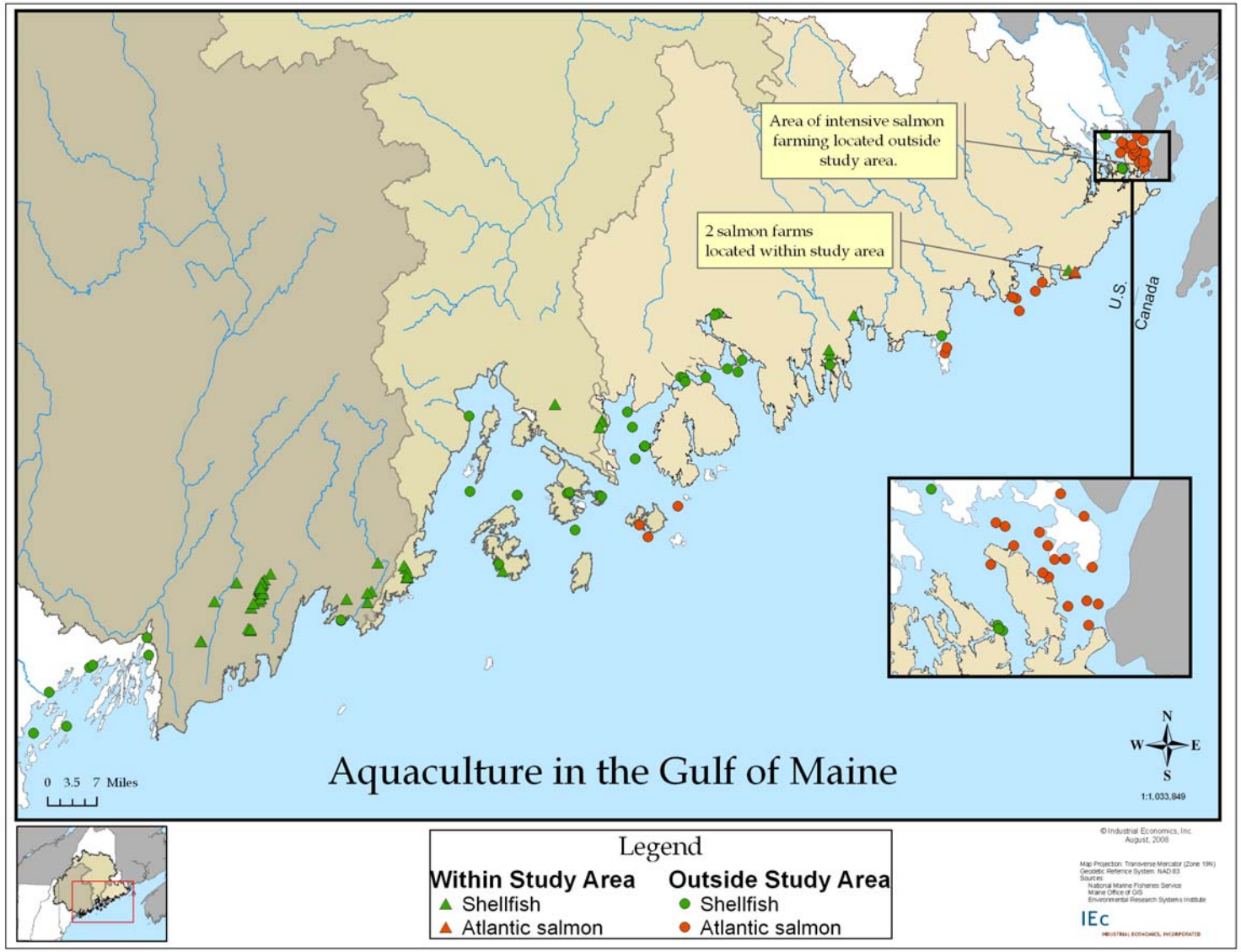
8.2 PROFILE OF REGIONAL AQUACULTURE INDUSTRY

8.2.1 EXTENT OF INDUSTRY

3. Aquaculture operations that are currently within the study area are concentrated along Maine's coast, where aquaculture in various forms has been practiced since the late 1800s (see Exhibit 8-1).[1] The industry as it exists today began to take shape in the early 1970s, when the Maine Department of Marine Resources (DMR) issued the first official permit for a shellfish farm and salmon hatchery in the Damariscotta River. Cultivation of finfish at this location proved unsuccessful, but shellfish thrived, and the area experienced extensive expansion of the shellfish industry over the next two decades. Finfish operations, particularly salmon farms, proved far more successful farther east and north (downeast). In the late 1980s and early 1990s this area developed into the hub of Maine's salmon industry. Most of these operations are located in Cobscook Bay, outside the study area, and are not expected to affect the areas that NMFS may designate as critical habitat.

[1] GIS data provided by Marcy Nelson, Scientist, Ecology and Aquaculture, Maine Department of Marine Resources. Personal Communication on June 22, 2007.

EXHIBIT 8-1. AQUACULTURE SITES IN COASTAL MAINE



4. With the development of both the shellfish and finfish sectors, aquaculture has grown to local significance in many of Maine's coastal communities. According to a State report, the industry generated $57 million in revenue and accounted for 330 jobs in 2003.[2] Nonetheless, the industry remains relatively small, representing only 0.1 percent of Gross State Product in 2003.[3]

5. Shellfish operations outnumber finfish operations in Maine, but finfish aquaculture – and in particular, salmon farming – accounts for the majority of the industry's revenues. The State reported that salmon growers accounted for approximately $54 million in sales in 2003, 95 percent of the industry's total statewide.[4] Analysis in 2001 noted that salmon aquaculture was also responsible for $33 million in "indirect and induced economic activity" annually.[5] In comparison, shellfish farms reported only $2.9 million in sales in 2005, up from $1.5 million in 1998.[6]

8.2.2 INDUSTRY TRENDS

6. While shellfish harvests in Maine have remained fairly consistent over the last decade, harvests of Atlantic salmon have varied widely. Salmon harvests reached a maximum of 36 million pounds in 2000, then fell dramatically in subsequent years to just over 5 million pounds in 2007. The industry also experienced corporate consolidation at the same time, resulting in the number of companies actively managing farmed salmon facilities falling from a high of eight in 2001 to only three in 2007. The merger of companies, along with the implementation of new best management practices, decreased the number of active marine net pen sites from 31 in 2001 to five in 2007.[7] Exhibit 8-2 shows the harvest of farmed salmon in Maine through 2007.

7. Several factors may be responsible for the decline in salmon production after 2000. As noted above, a major industrial consolidation occurred at this time, which resulted in the closure of several aquaculture sites within the Gulf of Maine.[8] Additionally, the listing of Atlantic salmon as an endangered species, in combination with several lawsuits related to the Clean Water Act, resulted in more stringent requirements for permitting of aquaculture (these requirements are described in detail in section 8.3). Finally, a viral outbreak among cultured salmon resulted in a temporary shutdown of

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[2] Governor's Task Force on the Planning and Development of Marine Aquaculture in Maine. 2004. Report and Recommendations.

[3] ibid.

[4] ibid.

[5] Kling, L.J. and T. Dalton. 2003. Atlantic salmon aquaculture in Maine: Current status and challenges. University of Maine College of Natural Sciences, Forestry and Agriculture White Papers.

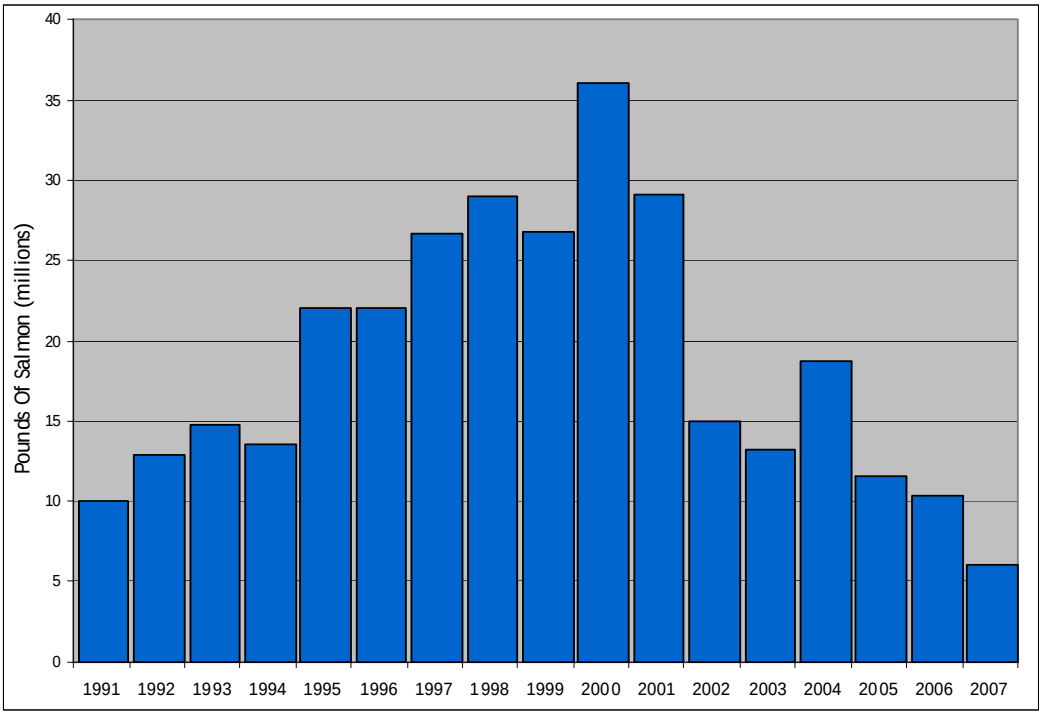
[6] United States Department of Agriculture: National Agricultural Statistics Service. The 2005 Census of Aquaculture.

[7] Note that leases stay active for 10 years whether or not the farm is harvesting salmon, growing salmon, or leaving the site fallow. Exhibit 8-1 shows all active leases. DMR. 2006. Maine Finfish Aquaculture Harvest 1988-2006. Accessed at http://www.maine.gov/dmr/aquaculture/documents/FinfishHarvestChart.pdf on December 15, 2007.

[8] Personal communication with Samantha Horn-Olsen, Aquaculture Policy Director, Maine DMR on December 22, 2007.

all facilities in Cobscook Bay in 2002. With the introduction of improved management practices for containment and disease prevention, DMR anticipates an upward trend in farmed salmon harvest in the next three to five years. In addition, an increase in the number of smolts stocked in 2006 and 2007 is expected to yield larger harvests over the next three years.[9]

EXHIBIT 8-2. HARVEST OF FARMED SALMON IN MAINE, 1991 THROUGH 2007[10]



8.2.3 POTENTIAL IMPACTS ON SALMON HABITAT

8. Currently, 66 aquaculture facilities are located within the study area, including 52 shellfish operations, two Atlantic salmon net pen facilities, 10 salmon hatcheries, and two trout hatcheries. The shellfish facilities produce American oysters, blue mussels, quahogs, clams, or some combination thereof; all of these facilities are located in Maine. Both of the trout hatcheries are state owned and operated. One is located in Maine, on the Sheepscot River, and is operated by the Maine Department of Inland Fish and Wildlife; the other is in New Hampshire, and is operated by the New Hampshire Department of Fish and Game.[11] The ten salmon hatcheries within the study area are all located in Maine; Exhibit 8-3 specifies the location of these facilities. The two salmon net pen facilities are located in Washington County,

[9] Personal Communication with David Bean, National Marine Fisheries Service, on March 3, 2008.

[10] ibid.

[11] Personal communication with Robert Fawcett, Hatcheries Supervisor, New Hampshire Department of Fish and Game on 1/11/08.

Maine, near the mouth of the Little River; together, they comprise 13.2 acres within the study area.[12]

EXHIBIT 8-3. SALMON HATCHERIES WITHIN THE STUDY AREA

HATCHERY NAME	OWNERSHIP TYPE	LOCATION	COUNTY
Craig Brook National Fish Hatchery	Federal	East Orland	Hancock
Green Lake National Fish Hatchery	Federal	Ellsworth	Hancock
USDA Aquatic Research Facility	Federal	Franklin	Hancock
Deblois Hatchery/Fish Culture Facility	State	Deblois	Washington
Gardner Lake Hatchery	Private	East Machias	Washington
Bingham Hatchery	Private	Bingham	Somerset
Solon Hatchery	Private	Solon	Somerset
Oquossoc Hatchery	Private	Oquossoc	Franklin
Pleasant River Hatchery	NGO	Columbia Falls	Washington
East Machias Aquatic Research Center	NGO	East Machias	Washington

9. Aquaculture operations in watersheds that contain critical habitat may have an adverse effect on that habitat due to impacts on water quality, natural flows, or freshwater benthic communities. In addition, farmed salmon spawning in the wild could disrupt spawning habitat; these interactions often result in redd superimposition due to their late maturation period.

10. Biologists at NMFS indicate that the Maine Department of Environmental Protection Pollution Discharge Elimination System (MEPDES) permits currently in place to manage water quality at finfish farms, shellfish farms, and inland hatcheries in Maine are likely to be sufficient to avoid adverse modification of critical habitat, provided existing permit conditions are met; monitoring of these facilities will determine if any additional action is necessary. The same is true of the New Hampshire Department of Fish and Game's trout hatchery. Both State and Federal resource agencies will monitor the impact of aquaculture facilities and inland hatcheries on the receiving water to determine if existing discharge limits are adequate to protect Atlantic salmon. Withdrawal of water by these facilities could also impair salmon habitat by diminishing natural flows and altering established natural aquatic communities. This is of particular concern in certain areas, such as the Sheepscot River directly upstream of the Palermo Fish Culture facility. As of the date of this report, however, it is not possible to determine whether section 7 consultation regarding critical habitat would lead NMFS to request that these hatcheries modify their water supply or use;

[12] Maine Department of Marine Resources (DMR). 2007. List of Finfish Aquaculture Locations. Accessed at http://www.maine.gov/dmr/aquaculture/leaseinventory2006/finfishleases.htm on January 5, 2008.

the information needed to make this determination is not available, and any attempt to estimate the associated economic impacts would be speculative. NMFS will continue to work with all the hatcheries referenced in this analysis to ensure current safeguards are sufficient to conserve critical habitat.[13] If they are not, changes in hatchery practices or water usage may be necessary to avoid destruction or adverse modification.

11. NMFS has identified two issues of particular concern in conserving the physical and biological elements of critical habitat for Atlantic salmon: the potential for farmed salmon to escape from net pens and interfere with the habitat of wild salmon, and the potential that waste material from such operations could adversely affect water quality or alter the local sediment (see Section 8.4.1).[14] In light of these concerns, the remainder of this chapter focuses on the impacts of designation on salmon aquaculture in the study area and the extent to which designation may affect the operation of these facilities.

8.3 REGULATION OF AQUACULTURE IN THE STUDY AREA

12. The State of Maine regulates aquaculture through two mechanisms. First, DMR requires all aquaculture facilities to apply for a lease to access and use State waters.[15] Second, the Department of Environmental Protection (DEP) maintains delegated authority from the U.S. Environmental Protection Agency (EPA) to administer the National Pollution Discharge Elimination System (NPDES), known statewide as the Maine Pollution Discharge Elimination System (MEPDES).[16] These regulations exist concurrently with Federal requirements implemented by the U.S. Army Corps of Engineers (USACE) pursuant to Section 10 of the Rivers and Harbors Act of 1899.[17]

13. Collectively, the leasing and MEPDES requirements govern environmental management of an aquaculture facility in Maine. The following sections address these requirements in more detail, focusing in particular on the requirements for management of salmon net pens.

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[13] Presently, the Department of Inland Fisheries and Wildlife regulates the intake of water for State hatcheries or fish culture facilities. Personal Communication with David Bean, National Marine Fisheries Service, on March 3, 2008.

[14] Personal communication with Dan Kirchies, Fisheries Biologist, NOAA Fisheries on November 3, 2007.

[15] 13-188 Code of Maine Regulations (CMR). Chapter 2.

[16] Memorandum of Agreement Between the Environmental Protection Agency, Fish and Wildlife Service and National Marine Fisheries Service Regarding Enhanced Coordination Under the Clean Water Act and Endangered Species Act. Federal Register Vol. 66, No. 36, Thursday, February 22, 2001.

[17] 33 U.S.C. 403.

8.3.1 STATE REGULATIONS

8.3.1.1 Leasing Regulations

14. To manage an aquaculture facility in the Gulf of Maine, an applicant must apply for one of two types of lease:[18]

- **A limited-purpose ("experimental") lease -** Up to two acres for three years for the culture of finfish and/or shellfish; or
- **A suspended net-pen culture lease ("standard") -** Up to 100 acres for ten years for the culture of finfish.

15. Leases are governed by the DMR, and the processing of a lease application may take anywhere from a few months to over a year.[19] The application process involves several steps, beginning with a pre-application meeting. Exhibit 8-4 summarizes the standard application process.[20]

16. The lease application also serves jointly as the application for two required permits: the MEPDES permits described below, and the USACE permit, required pursuant to Section 10 of the Rivers and Harbors Act of 1899.[21,22]

8.3.1.2 Maine Pollutant Discharge Elimination System (MEPDES) Permits

17. Under a 2001 Memorandum of Agreement (MOA) between EPA and the State, EPA has delegated to Maine the authority to issue NPDES permits.[23] Prior to delegation of the permit program, EPA had issued only one discharge permit for aquaculture sites in Maine. Additionally, Maine aquaculture facilities were exempted from State Water Discharge License requirements.[24]

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[18] DMR. 2007. Aquaculture Lease Applications. Accessed at http://www.maine.gov/dmr/aquaculture/aquaculture_lease_applications.htm on December 27, 2007.

[19] ibid.

[20] Of the approved leases presently operating in the Gulf of Maine, 30 facilities (totaling 615 acres) are finfish sites. Presently, there are no experimental leases for finfish. DMR, 2007. Acreage of Maine Waters Leased for Aquaculture Categorized by Lease Type. Accessed at http://www.maine.gov/dmr/aquaculture/leaseinventory2006/documents/leaseacreagebytype.pdf on December 25, 2007.

[21] Personal communication with Samantha Horn-Olsen, Aquaculture Policy Director, Maine DMR on December 22, 2007.

[22] Maine DEP and DMR. "Cooperative Agreement on a Unified Finfish Aquaculture Administrative Program between the Maine Department of Environmental Protection and Maine Department of Marine Resources." September 2007.

[23] USEPA. 2001. National Pollutant Discharge Elimination System Memorandum Of Agreement Between The State Of Maine And The United States Environmental Protection Agency, Region 1. See also 66 FR 12791 (February 28, 2001).

[24] The exemption was written into the 1987 statute, 38 MRSA section 413 (2-F): "Until the State receives authority to grant permits under the Federal Water Pollution Control Act, 33 United States Code, 1982, a person may not be considered in violation of this section if… the discharge activity is associated with off-shore marine aquaculture operations in the estuarine and marine waters… and as a condition of obtaining a leasehold from the Department of Marine Resources, the Department of Environmental Protection certifies that the aquaculture activities mentioned in this subsection will not have a significant adverse effect on water quality or violate the standards ascribed to the receiving waters' classifications."

EXHIBIT 8-4. PROCESS FOR ACQUIRING A DMR AQUACULTURE LEASE

- *A pre-application meeting is held with the applicant, the Department and a representative of the municipality in which the proposed lease site is located.*
- *An informal community meeting, or scoping session, is held by the applicant to allow interested individuals to learn about a proposed application, ask questions, provide direction to the Department's review process, and understand the leasing process.*
- *The application is submitted and the Aquaculture Administrator determines whether the application is complete.*
- *The riparian landowners, municipalities, and interested government agencies are notified of the complete application.*
- *The Aquaculture Environmental Coordinator conducts a site visit, including a SCUBA dive with an underwater video camera, and prepares a report on the proposed operation.*
- *The riparian landowners, municipalities, interested government agencies, other interested parties and the general public are given 30-days notice of the public hearing.*
- *A public hearing is held.*
- *Following the hearing the Aquaculture Administrator prepares a draft decision for the Commissioner.*
- *The Commissioner is the final decision-maker on proposed leases.*
- *If an application is approved, a lease is granted.*
- *Applicants must post a performance bond with the Department prior to receiving their lease.*

Source: Department of Marine Resources. 2007. "Aquaculture Lease Application Process." Accessed at http://www.maine.gov/dmr/aquaculture/application_process.htm on December 23, 2007.

18. In July of 2000 the U.S. Public Interest Research Group (U.S. PIRG) filed suit against three salmon farm operators in Maine for discharging waste in navigable waters without a permit.[25] Because the EPA had delegated authority to implement the NPDES permitting process to the State of Maine before the suits had settled, the Court's ruling applied to the State of Maine rather than the EPA.[26] The Court held that fish feces and urine, as well as added pigments, antibiotics, chemical pesticides (targeting sea lice), or copper supplements (to suppress marine growth) are pollutants warranting a permit.[27] The court further held that fish escaping from net pens should

[25] Firestone, Jeremy, and Robert Barber. 2003. "Fish As Pollutants: Limitations of Crosscurrents in Law, Science, Management, and Policy." 78 Washington Law Review. 693-756.

[26] 66 FR 12791 (February 28, 2001).

[27] Firestone, Jeremy and Robert Barber. 2003. "Fish As Pollutants: Limitations of Crosscurrents in Law, Science, Management, and Policy." 78 Washington Law Review. 693-756.

be considered a biological pollutant, and thus should also be regulated under the Clean Water Act.[28] As a result of these cases, Maine was required to develop a rule governing the discharges (including escapees) resulting from Atlantic salmon aquaculture facilities.

19. The MEPDES permit was developed through the Maine Board of Environmental Protection (BEP). The rulemaking process included public hearings, an interpretation of the legal opinions and requirements set forth in the three U.S. PIRG cases, and a comment period. The General Rule resulting from this process was a permit designed specifically for salmon aquaculture, pursuant to 38 MRSA section 413(10), Chapter 529 of Maine's Code of Regulations, and Federal Water Pollution Control Act, 33 USC, section 1251, et seq. The General Rule is now administered through the DEP, in cooperation with DMR.[29]

20. The General Rule presents 15 special conditions required to obtain a permit for a salmon aquaculture facility. These conditions address a wide range of issues, including spill responses, toxic impacts, monitoring requirements, and general best management practices. Of particular interest for this analysis is Section I, "Protection of Atlantic Salmon." Below is an overview of the section's pertinent details:[30]

- **Non-native strains prohibited.** The use of Atlantic salmon originating from non-North American stock is prohibited. A three-year phase-out from 2004 to 2006 ensured that all existing facilities would be able to comply with this rule. As of September, 2006, all non-North American stock was completely prohibited.
- **Transgenic salmonids prohibited.** All transgenic salmonids (including species of the genera *Salmo*, *Oncorhynchus* and *Salvelinusare)* containing "novel genetic constructs" are prohibited.
- **Right of inspection.** Inspectors from DEP, DMR, the U.S. Fish and Wildlife Service (FWS), NMFS, EPA, USACE, and the Maine Atlantic Salmon Commission have the right to inspect any facility during normal working hours to ensure that permit conditions have been met.
- **Marking requirement.** All fish introduced into net pens must be externally marked with a site-specific marker. This ensures that any escapees may be correctly identified as commercially reared salmon, and that the farm from which the fish escaped may be held accountable. The marking requirement was phased in over four years, from 2004 to 2007. As of July of 2007, genetic marking was provisionally accepted as a method of marking under this permit; DEP has updated the General Rule to reflect this. The established marking

[28] ibid.

[29] Under a Memorandum of Understanding between the two agencies, DEP and DMR coordinate to ensure that monitoring data, site inventories, and public meetings are shared or held jointly.

[30] Maine DEP. 2003. Maine Pollutant Discharge Elimination System General Permit For Atlantic Salmon Aquaculture.

criterion of 95 percent accuracy must be achieved in order for genetic marking to receive final approval. The quality assurance and quality control measures in place will determine whether genetic marking is able to provide the precision necessary to meet this requirement. The final date of compliance has been extended to 2009.

- **Intentional release prohibited.** The intentional release of commercially reared salmon into open water (outside of a net-pen) is prohibited.
- **Containment management requirements**. All net pens must employ a Containment Management System (CMS) to prevent salmon from escaping into open water. The CMS will be audited by a third party at least once per year and within 30 days of a reported escape. Guidelines for creating a CMS were developed through collaborative work between the Maine Aquaculture Association, the Conservation Law Foundation, Trout Unlimited, the Atlantic Salmon Federation, and three major commercial aquaculture facilities in the area. Through a hazard analysis each site-specific CMS plan identifies a facility's Critical Control Points (CCP's), i.e., areas or fish husbandry practices that pose a risk that fish may escape. The CMS plan implements additional protocols and ensures extra measures are in place at CCP's where the risk of escape is high.

21. The present permit language was developed in consultation with NMFS and through Federal requirements stemming from the three lawsuits discussed above. In 2001, the EPA completed a formal consultation with NMFS and FWS (the Services) addressing its proposed delegation of NPDES requirements to the State of Maine.

22. Additionally, each MEPDES permit is reviewed by NMFS pursuant to a Memorandum of Agreement (MOA) between EPA and the Services. This MOA directs States with NPDES responsibility to share all proposed permits with the Services.

8.3.2 FEDERAL REGULATIONS

23. The Federal government regulates the farming of Atlantic salmon in Maine primarily through the issuance of permits by the USACE pursuant to Section 10 of the Rivers and Harbors Act of 1899, which mandates that "any obstruction… to the navigable capacity of any waters in the United States" must be "recommended by the Chief of Engineers."[31] Prior to the 2000 listing of the Gulf of Maine DPS of Atlantic salmon as an endangered species, USACE authorized shellfish and finfish facilities to operate under the terms of a general permit.[32] A formal consultation between the USACE and both NMFS and FWS followed the listing, and the final biological opinion was released in November of 2003. Subsequently, in April of 2005, the USACE modified

[31] 33 U.S.C. 403.

[32] Personal communication with Jay Clement, Maine Project Office of the U.S. Army Corps of Engineers on January 3, 2008.

and reissued permits to existing finfish aquaculture facilities in the Gulf of Maine.[33] The biological opinion approved changes made by the USACE to permits granted prior to the listing of the species. These changes resulted in a list of special conditions presently required by the USACE on all new permits for finfish aquaculture, including salmon.[34]

24. Because the special conditions for the Section 10 permits were developed concurrently with the special conditions for MEPDES permits, they are substantively similar. In addition to the requirements noted above (i.e., prohibition of non-native strains of salmon and transgenic salmon, right of inspection, marking requirements, prohibition of intentional release, and CMS requirements), the following special conditions apply:

- No alternative salmonid species can be stocked at a facility without prior approval from the USACE.
- Any reported or suspected escape of "25% or more of a cage population and/or more than 50 fish with an average weight of two kg. each or more within 24 hours" must be reported according to a specific protocol.

25. Additionally, USACE modified several conditions from its original general permit to include the following key points related to Atlantic salmon facilities:[35]

- The permittee shall provide environmental monitoring data to the National Marine Fisheries Service (NMFS).
- Only antibiotic chemicals approved by the U.S. Food and Drug Administration (U.S. FDA) shall be applied. All applications must comply with 21 CFR 529, 556 and 558. Prophylactic use of antibiotics is prohibited.
- There shall be no discharge of pollutants from the facility other than fish excrement, ammonia excretions, unconsumed fish food and medications approved by the U.S. FDA.
- All mortalities (dead fish), feed bags, fish food fines and other waste materials, excluding fish excrements and secretions and unconsumed food, shall be removed to the mainland shore and disposed of properly.
- This authorization only allows the raising of Atlantic salmon in the permitted structures. No other species of fish may be raised at this site without prior written approval from the USACE.

[33] NMFS and FWS. 2005. Biological Opinion: Proposed modification of existing ACOE permits authorizing the installation and maintenance of aquaculture fish pens within the State of Maine.

[34] Personal communication with Jay Clement, Maine Project Office of the U.S. Army Corps of Engineers on January 3, 2008.

[35] USACE, New England Division. 2005. Modified Salmon Aquaculture Special Conditions.

- If, based on a review of environmental monitoring data, degradation of environmental resources, to include Federal and State water quality standards, is indicated, this permit may be modified, suspended or revoked.

8.4 IMPACTS OF CRITICAL HABITAT DESIGNATION

26. This section discusses the extent to which the designation of critical habitat for the Atlantic salmon may affect the aquaculture industry in the study area.

8.4.1 ADVERSE MODIFICATION CONCERNS

27. As previously noted, NMFS has identified two primary potential threats to the physical and biological features of critical habitat related to aquaculture: 1) escaped farmed salmon may interfere with the habitat of wild salmon; and 2) the buildup of waste material (e.g., fish feces, ammonia, unconsumed food, etc.) can lead to algal blooms and locally alter sediments.[36] As identified above, however, salmon conservation measures provided through both MEPDES and Section 10 permit requirements address these potential threats to the salmon habitat. In particular, requirements for a containment management system address concerns related to escapees. In addition, the monitoring of discharges from the site according to MEPDES, along with requirements limiting the types of antibiotics and coloring agents used in feed, ensures that waste from these facilities is carefully managed. With these requirements in place, NMFS is unlikely to request additional management measures to avoid adverse modification of critical habitat.

8.4.2 SECTION 7 CONSULTATION

8.4.2.1 MEPDES Permits

28. NMFS reviews all MEPDES permits issued by the State of Maine within the geographic range of Atlantic salmon to determine whether or not they may result in a "more than minor detrimental effect" on endangered salmon. If it determines that issuance of a permit may result in more than a minor detrimental effect, NMFS works cooperatively with DEP to resolve the matter (through modification requests). If the matter cannot be resolved cooperatively, NMFS may recommend that EPA object to and Federalize the permit. Once EPA becomes involved, a section 7 consultation may be required for the permitting action because the activity now has a Federal nexus.[37] Exhibit 8-5 highlights the relevant text of the Memorandum of Agreement between EPA and the Services.

[36] NMFS. May 2007. Draft Habitat Requirements and Management Considerations for Atlantic Salmon (Salmo salar) in the Gulf of Maine Distinct Population Segment (DPS).

[37] Memorandum of Agreement Between the Environmental Protection Agency, Fish and Wildlife Service and National Marine Fisheries Service Regarding Enhanced Coordination Under the Clean Water Act and Endangered Species Act. Federal Register Vol. 66, No. 36, Thursday, February 22, 2001.

EXHIBIT 8-5. TEXT FROM THE MOA BETWEEN THE EPA AND THE SERVICES

EPA and the Services will work with States and Tribes to share information on permits that may raise issues regarding impacts to threatened or endangered species or designated critical habitat. If the Services or EPA are concerned that an NPDES permit is likely to have a more than minor detrimental effect on a Federally-listed species or critical habitat, the Service or EPA will contact the appropriate State or Tribal agency… to discuss [and] provide appropriate information in support of identified concerns…

For those NPDES permits with detrimental effects on Federally-listed species or critical habitat that are minor, [the] Services will work with the State or Tribe to reduce the detrimental effects stemming from the permit. For those NPDES permits that have detrimental effects on Federally-listed species or critical habitat that are more than minor… and where the State or Tribe and the Services are unable to resolve the issues, it is the intention of the Services and EPA that EPA would work with the State or Tribe to remove or reduce the detrimental impacts of the permit, including, in appropriate cases, by objecting to and Federalizing the permit where consistent with EPA's CWA authority.

EPA will use the full extent of its CWA authority to object to a State or Tribal permit where EPA finds (taking into account all available information, including any analysis conducted by the Services) that a State or Tribal permit is likely to jeopardize the continued existence of any listed species or result in the destruction or adverse modification of critical habitat.

Source: Federal Register / Vol. 66, No. 36 / Thursday, February 22, 2001.

29. NMFS does not anticipate that the process or conditions for issuing Clean Water Act permits will be affected by the designation of critical habitat either through section 7 consultation or in its regular review of MEPDES permits. NMFS has conducted formal section 7 consultation for all existing finfish aquaculture facilities in the Gulf of Maine as a result of the 2000 listing of the Gulf of Maine DPS. In addition, a quarterly review process with State (MEDEP, MEDMR) and Federal (NMFS, FWS and USACE) agencies to discuss relevant information regarding compliance with established permits and new or modified permits for aquaculture net pens is in place. Moreover, since 2001, no MEPDES permit has been Federalized or undergone section 7 consultation. NMFS believes that such action is unlikely given the active role NMFS plays in developing the regulations governing the facilities and permits, and the stringency of the current requirements.[38] NMFS does not expect the extent of review, or the type and nature of revisions requested, to increase upon designation. This analysis therefore does not anticipate that the issuance of Clean Water Act permits associated with aquaculture facilities is likely to result in a Federal nexus requiring consultation regarding the salmon and its habitat. No additional consultations are forecast, and no additional administrative costs are anticipated.

[38] Personal communication with Dan Kirchies and Jeff Murphy, Fisheries Biologists, NOAA-Fisheries on December 14, 2007.

8.4.2.2 Section 10 Permits

30. The issuance of Section 10 permits by USACE under the Rivers and Harbors Act constitutes a Federal nexus for aquaculture facilities in Maine; therefore, all new permits are subject to section 7 consultation. For the following reasons, however, the analysis forecasts no additional consultations:

    1. Facilities that are already permitted under an existing USACE Section 10 permit are not required to regularly renew their permit; thus, there is no trigger for section 7 consultations for these operations.[39]

    2. Since the listing of the Atlantic salmon as an endangered species, no new salmon aquaculture permits have been applied for or issued, and no specific information exists identifying potential future applications for new facilities in the study area.[40]

31. If a new facility were to apply for a Section 10 permit, a section 7 consultation between USACE and the Services may be required. According to officials at the Maine Project Office of USACE, however, the vast majority of new permits do not require formal or informal consultations. Rather, any issues are typically discussed and resolved at joint permit processing meetings held every three weeks.[41] In unusual cases, section 7 consultation might be necessary. Even in these cases, however, such consultation would likely be informal, and only administrative costs would likely be incurred.[42] NMFS believes that, as with MEPDES permits, critical habitat designation is unlikely to necessitate additional measures beyond the protective conditions already in place for these permits.[43] In light of these considerations, this analysis projects no cost impacts for aquaculture operations in the study area.

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[39] Once a Section 10 permit is issued, the permit recipient has up to five years to complete the permitted project (i.e., build the net-pen facility). If the project is completed within that time, and no modifications are made to it, the project need not be re-permitted. Therefore, projects already permitted under an existing USACE Section 10 permit will not require a new permit, and section 7 consultations for these facilities will not occur.

[40] Personal communication with Samantha Horn-Olsen, Aquaculture Policy Director, Maine DMR on December 22, 2007. Although officials at DMR have indicated that salmon production may rebound to 2001 levels over the next few years, the lack of specificity regarding if, where, and when these projects may occur makes forecasting future consultations speculative at this time.

[41] Personal communication with Jay Clement, Maine Project Office of the U.S. Army Corps of Engineers on January 11, 2008.

[42] ibid.

[43] Personal communication with Dan Kirchies and Jeff Murphy, Fisheries Biologists, NOAA Fisheries on December 14, 2007.

CHAPTER 9 | MINING OPERATIONS

9.1 INTRODUCTION

1. This chapter describes the potential effect of critical habitat designation for the Gulf of Maine DPS of Atlantic salmon on mining activities in the study area. It includes:

   - an overview of mining activity in the Maine portion of the study area;
   - a description of mining activity in the New Hampshire portion of the study area; and
   - a discussion of the anticipated economic impacts.

2. As discussed in greater detail below, designation of critical habitat for Atlantic salmon will likely have little impact on mining activities in the study area. The sector is dominated by small stone and gravel extraction operations located on private land. The operations are dry (i.e., not performed in-stream) and are governed by performance standards that already seek to reduce impacts on surface water. There is typically no Federal nexus at these sites, and NMFS has conducted no consultations regarding the impact of mining on salmon or any other listed species, either with respect to the jeopardy standard or, in the case of other listed species, with respect to potential adverse modification of critical habitat. NMFS anticipates no additional consultations as a result of this rulemaking.

9.2 ECONOMIC PROFILE OF MINING SECTOR IN MAINE

9.2.1 OUTPUT AND EMPLOYMENT

3. The total value of Maine's mining products in 2005 was $141 million. As shown in Exhibit 9-1, the industry is dominated by sand/gravel and crushed stone extraction. Of the quantities tracked, most of the sand, gravel, and crushed stone is used in paving, either in aggregates or in direct application as road base and covering.[1] Demand for Maine sand, gravel, and crushed stone has grown steadily in recent years, with total quantities shipped increasing from 13.3 million metric tons in 2000 to 15.6 million metric tons in 2005.[2]

[1] U.S. Geological Survey (USGS), 2005 Minerals Yearbook, Maine, see Tables 3 and 4.

[2] USGS, 2005 Minerals Yearbook, Maine; and USGS, The Mineral Industry of Maine, 2001.

4. Other components of Maine's mining sector are minor in scale and development. Tourmaline, amethyst, and other gemstone mines exist, but are small and operated sporadically.[3] Some metals prospecting occurs in eastern regions of the State, but full mining operations are not likely to proceed in the foreseeable future.[4]

EXHIBIT 9-1. SUMMARY OF MAINE MINING SECTORS (2005)

MINERAL	QUANTITY (THOUSAND METRIC TONS)	VALUE ($1,000; 2005)
Clays, common	50	N.A.
Gemstones	N.A.	272
Sand and Gravel	11,100	57,400
Crushed Stone	4,490	30,700
Cement, Peat, Granite	N.A.	52,400
Total		**$141,000**
Source: USGS, 2005 Minerals Yearbook, Maine.		

5. The 2002 Economic Census indicates that Maine's mining sector employs between 100 and 250 individuals.[5] Penobscot and York Counties account for the greatest mining employment, with between 20 and 100 employees each.[6]

9.2.2 PERMITTED MINING SITES AND ASSOCIATED REGULATIONS (MAINE)

6. Data available from the Maine Department of Environmental Protection (DEP) and the Maine Geological Survey (MGS) indicate that there are approximately 1,100 permitted mining sites in Maine. The facilities are permitted under one of three separate authorities: (1) DEP performance standards authorized in 38 M.R.S.A. §§ 490; (2) DEP requirements under the Site Location Law in 38 M.R.S.A. §§ 484; or (3) Land Use Regulation Commission (LURC) regulations. These three categories of facility are discussed below.

[3] USGS, 2005 Minerals Yearbook, Maine.

[4] Personal communication with Mark Stebbins, Maine DEP Bureau of Land and Water Quality, Mining Coordinator, November 15, 2007.

[5] Because of the relatively small number of facilities in the sector, detailed employment data are withheld and only ranges are reported.

[6] 2002 Economic Census, Geographic Area Series; and 2005 County Business Patterns data, downloaded at http://censtats.census.gov. It is possible that Economic Census data underestimate the number of employees associated with mining operations given that many of the facilities are small and may not report under the survey; this seems likely given the number of mining facilities identified below. However, it is also possible that some facilities have no paid employees and simply provide sand and gravel to construction operations that access the pit and load sand and gravel independently.

9.2.2.1 Sites Regulated by DEP

7. Exhibit 9-2 shows the geographic distribution of the DEP-regulated facilities. The facilities tend to be located in the more populous southern reaches of the study area, where demand for sand and gravel is highest. Concentrations of mining facilities are found in and around the towns of Lewiston-Auburn, Augusta, Skowhegan, and Washington. Appendix 9-A provides the approximate count of DEP-regulated facilities by HUC.

Performance Standards Facilities

8. Beginning in 1993, Maine required that all gravel pits between five and 30 acres be registered with the State and regulated by a set of detailed performance standards (38 M.R.S.A. §§ 490-W to 490-EE). Subsequent legislation in 1996 created a similar program for larger gravel pits as well as stone quarries. The programs are based on technical assistance and compliance review by Maine DEP and are funded through license fees collected from facility operators.[7]

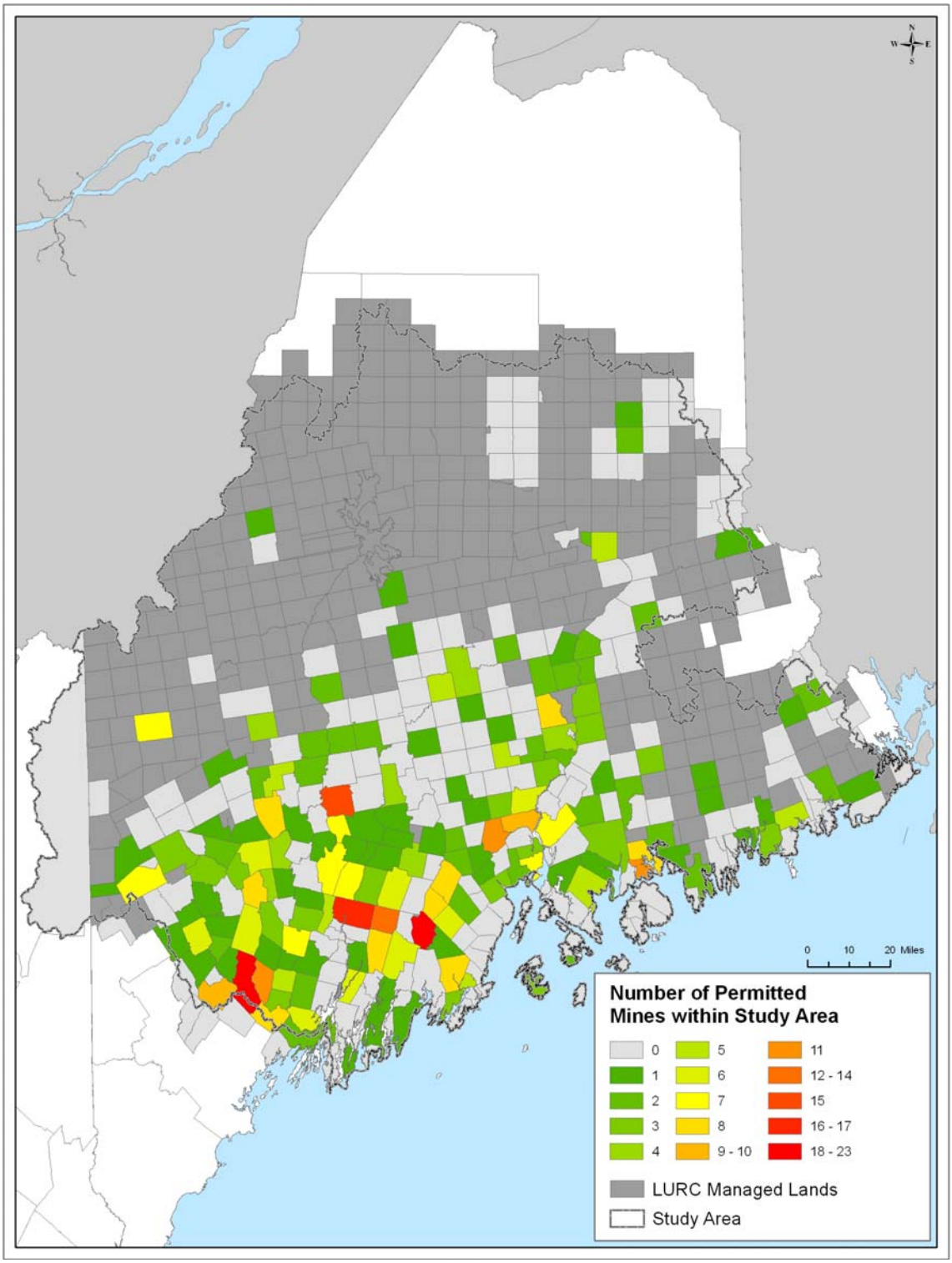
9. To gain approval under the performance standards, pit and quarry operators must meet a series of requirements designed to protect natural resources. The requirements include the following:

   - Mined land may not be located in "significant wildlife habitat," as defined in Maine law (Title 38 §480-B). Significant wildlife habitat includes habitat "for species appearing on the official state or federal list of endangered or threatened animal species…". Furthermore, Maine DEP treats all rivers and streams as significant wildlife habitat, providing the basis for buffer requirements and other aspects of the mining performance standards.[8]
   - A natural buffer strip of 100 feet must be maintained between an excavation site and great ponds or associated rivers; certain segments of the Kennebec River are also subject to this provision. For other rivers and ponds, the law requires a buffer strip of 75 feet.
   - All pits and quarries must be naturally and internally drained to reduce erosion and sedimentation.
   - For areas of facilities that are not internally drained (i.e., areas other than the working pit), State stormwater management standards must be adopted (although a stormwater permit is not required).
   - When a facility is no longer active, a variety of requirements to control erosion and sedimentation take effect. These requirements include restoration of vegetative cover and removal of derelict structures.

[7] Bureau of Land and Water Quality, *Status Report Gravel Pit & Quarry Program*, February 2005.

[8] Personal communication with Stephanie McGarvey, Maine DEP, Bureau of Land and Water Quality, Natural Resources Protection Act Program, December 20, 2007.

EXHIBIT 9-2. DISTRIBUTION OF PERMITTED MINES IN THE STUDY AREA (EXCLUDES MINES ON LURC LANDS)



10. Other aspects of the performance standards govern buffers near roads and adjacent properties; protection of groundwater resources; and control of noise, traffic, and dust.[9]

11. Approximately 704 facilities licensed for the extraction of sand, gravel, crushed stone, clay, and topsoil are permitted under Maine DEP's performance standards regulations. The majority of these sites (88 percent) are sand and gravel extraction operations. Of all the permitted facilities, 446 are located in towns entirely or partially within the study area.

Site Law Facilities

12. Prior to passage of the performance standards in 1993, mining sites were licensed under Maine's Site Location of Development Law (Site Law) regulations. A subset of sites remain under this regulatory authority, generally because the sites are integrated into a larger operation such as a processing plant or major construction operation.[10] The Site Law regulations include assurances to avoid adverse environmental effects from permitted facilities (Chapter 375). Provisions include (but are not limited to) the following:

- Limitation of unreasonable effects on runoff/infiltration relationships;
- Erosion and sedimentation control; and
- Stipulations that gravel pits and other excavation sites must satisfy the buffer requirements of the performance standards regulations under 38 M.R.S.A § 490-Z. As discussed above, these requirements include a natural buffer strip of 75 to 100 feet around all rivers and ponds.

13. Data from Maine DEP indicate that 283 mining operations are licensed under the Site Law statewide, with 165 of the facilities located in towns entirely or partially within the study area.

9.2.2.2 Sites Regulated by LURC

14. LURC provides planning, zoning and development review for the 10.5 million acres of Maine land without organized local government. Mineral extraction is restricted to land with particular zoning designations, and these operations are permitted in compliance with activity-specific standards (see Chapter 10 of Commission Rules and Standards, section 10.27 C). These standards require a vegetative buffer strip of at least 75 feet. In addition, site-specific environmental controls are added to individual permits.[11]

15. A site-by-site listing of mineral extraction operations is not available from LURC. However, LURC provided information from a database of permit actions involving mineral extraction activities. Data on the permitted activity and the geographic unit (e.g.,

[9] State of Maine Department of Environmental Protection, Article 9-A Performance Standards for Quarries, 38 M.R.S.A. §§ 490-W to 490-EE, September 20, 2007.

[10] Personal communication with Robert Marvinney, Maine Geological Survey, November 27, 2007.

[11] Personal communication with Marcia Spencer-Famous, LURC, November 27, 2007.

township, plantation, unorganized territory) suggest that roughly 100 individual operations exist, most of which are gravel pits.

9.3 MINING ACTIVITY IN NEW HAMPSHIRE

16. According to USGS data, minerals extraction in New Hampshire, as in Maine, is dominated by sand, gravel, and crushed stone operations.[12] The total value of all mining products in 2005 was $88.2 million.

17. Only a small portion of mining output is associated with operations in the study area. Contacts with New Hampshire officials suggest that mining activity in Coos County is minimal. No dimension stone or hard rock mining operations exist in the area.[13] The only mineral extraction activities in the region occur at several sand/gravel pits. These include a set of pits owned by the Town of Errol; a pit owned by Wagner Woodlands (a forestry firm); a pit operated by Pike Industries (a large supplier of construction materials) in Gorham; and a pit operated by the Drouin family in Gorham. The Pike and Drouin facilities are actively used, while the others are rarely used.[14]

18. Gravel pits in New Hampshire are regulated by Alteration of Terrain Permits (RSA 485-A:17). The purpose of these permits is to control soil erosion and stormwater runoff from construction projects or other projects involving significant terrain disturbance. The permits require installation of permanent water quality protection measures, to be chosen off a list of state-approved practices. Approved practices include vegetated filter strips (at least 75 feet in width), grassed swales (at least 100 feet in length), detention ponds, and various other commonly implemented stormwater control best management practices.[15] Permits must be renewed every two years.

9.4 ECONOMIC IMPACTS ON MINING ACTIVITIES

19. A variety of factors limit the likelihood that mining activities will be affected by designation of critical habitat for the Gulf of Maine DPS of Atlantic salmon:

- First, the majority of the mineral extraction operations are dry, limiting their potential for surface runoff or groundwater contamination. Although a limited subset of gravel pits in Maine seek variances to extract gravel below the water table, instream gravel removal is not allowed.[16]
- Second, permitting standards governing the facilities limit the potential for water quality impacts. All Maine facilities are subject to buffer requirements that limit

[12] USGS, 2005 Minerals Yearbook, New Hampshire.

[13] Personal communication with David Wunch, State Geologist, New Hampshire Geological Survey, November 28, 2007; and Bob Spoerl, New Hampshire Department of Resources and Economic Development, Forest and Lands Division, November 28, 2007.

[14] Personal communication with Greg Plancy, New Hampshire Department of Transportation, November 28, 2007.

[15] New Hampshire Code of Administrative Rules, Part Env-Ws 415, Permits for RSA 485-A:17 Activities.

[16] Personal communication with Robert Marvinney, Maine Geological Survey, November 20, 2007.

their proximity to surface water bodies. The majority of sites must meet runoff, drainage, and reclamation standards, and are prohibited from operating in areas designated by the State as significant wildlife habitat. Because Maine already treats all rivers and streams as significant wildlife habitat, the designation of critical habitat for salmon would introduce no new requirements for mining sites.

- Third, no Federal nexus exists at the sites. No Federal permits – e.g., surface water discharge permits, wetland permits, or stormwater permits – are typically required of the predominant sand, gravel, and crushed stone operations.[17] None of the operations are located on Federal land or receive Federal funding.
- Since Atlantic salmon were listed, NMFS has conducted no salmon-related consultations with mining facility operators.

20. Given these conditions, it is unlikely that habitat designation would introduce new consultation or project modifications at mining sites.

[17] Note that while the Maine performance standards explicitly state that stormwater permits are not required for mineral extraction operations, stormwater control standards must be adopted for operations that are not internally drained. See 38 M.R.S.A. § 490-Z, part 9.

APPENDIX 9-A. DISTRIBUTION OF MAINE DEP-REGULATED MINING SITES BY HUC

DOWNEAST COASTAL		MERRYMEETING BAY		PENOBSCOT BASIN	
HUC	NUMBER OF SITES	HUC	NUMBER OF SITES	HUC	NUMBER OF SITES
0105000205		0104000210	29	0102000513	22
0105000214	29	0104000206	14	0102000301	4
0105000213	4	0104000207	16	0102000302	1
0105000208	4	0104000209	32	0102000306	
0105000203	1	0103000311	18	0102000510	9
0105000212	5	0103000312	35	0102000303	3
0105000209	2	0103000305	17	0102000305	
0105000206	2	0103000306	26	0102000511	9
0105000204	9	0104000208	31	0105000216	1
0105000211	1	0103000309	17	0102000501	5
0105000201	6	0103000310	16	0102000508	2
0105000207	5	0103000304	9	0102000512	15
0105000210		0103000308	2	0102000304	2
0105000215		0104000202	10	0105000220	9
		0105000305	22	0102000502	5
		0105000301	41	0105000218	4
		0104000205	9	0102000402	9
		0104000204	3	0102000406	1
		0103000303	6	0105000217	5
		0103000307	1	0102000401	
		0105000302	24	0102000204	
		0104000203	1	0102000506	7
		0105000304	7	0102000509	10
		0104000201		0102000205	
		0105000306	3	0102000404	
		0104000103	1	0102000503	2

DOWNEAST COASTAL		MERRYMEETING BAY		PENOBSCOT BASIN	
HUC	NUMBER OF SITES	HUC	NUMBER OF SITES	HUC	NUMBER OF SITES
		0103000302		0102000110	2
		0104000101	7	0102000307	2
		0105000307	2	0102000507	8
		0105000303		0102000203	
		0104000104		0102000405	
		0104000102		0102000109	
		0103000301		0102000505	
		0104000106		0102000403	3
		0103000105	1	0102000504	
		0103000203	2	0102000102	
		0103000103	1	0102000202	
		0103000204		0102000103	
		0103000106		0102000105	
		0103000102		0105000219	
		0103000201		0102000201	
		0103000104		0102000104	
		0103000202		0102000101	
		0103000101		0102000107	
		0104000105		0102000106	
				0102000108	
Subtotal	**68**	**Subtotal**	**403**	**Subtotal**	**140**

Notes:

1. Counts include mining sites in all towns entirely or partially located in the study area.

CHAPTER 10 | IMPACTS ON TRIBAL LANDS

10.1 INTRODUCTION

1. Two Native American Tribes, the Penobscot Indian Nation and the Passamaquoddy Tribe, own and conduct activities on lands within the study area. Among other land uses, these activities may include agriculture; residential, commercial, or industrial development; in-stream construction projects; silviculture; water quality monitoring; or hunting and fishing. As described in previous chapters, some of these activities may be affected by the designation of critical habitat for the Gulf of Maine DPS of Atlantic salmon.[1]

2. This chapter estimates the potential economic impact of critical habitat designation on activities that may occur on Tribal lands. To do so, it first identifies HUCs that include Tribal lands. It then summarizes the economic impacts forecast to occur in previous chapters should NMFS designate the waters within these HUCs as critical habitat for the salmon. Thus, the impacts presented in this chapter are a subset of the impacts previously quantified. They are not additional impacts, and should not be added to the estimates presented previously.

3. The remainder of this chapter is divided into three sections. The first provides background information on Tribal lands, presents socioeconomic data on the two Tribes, and describes selected aspects of their water resource management programs. The second discusses the relationship between NMFS and the Tribes with respect to section 7 consultations. The third summarizes the chapter's principal findings.

10.2 POTENTIALLY AFFECTED TRIBES

4. Approximately 182,000 acres in 27 HUCs of the study area (1.3 percent of the total study area) are Tribal lands, owned by the Penobscot Indian Nation and the Passamaquoddy Tribe (see Exhibits 10-1 and 10-2). The Passamaquoddy own approximately 115,000 acres of the study area, while the Penobscot own approximately 67,700 acres. In addition, a nine-acre Native American Reburial Ground is located within the study area.

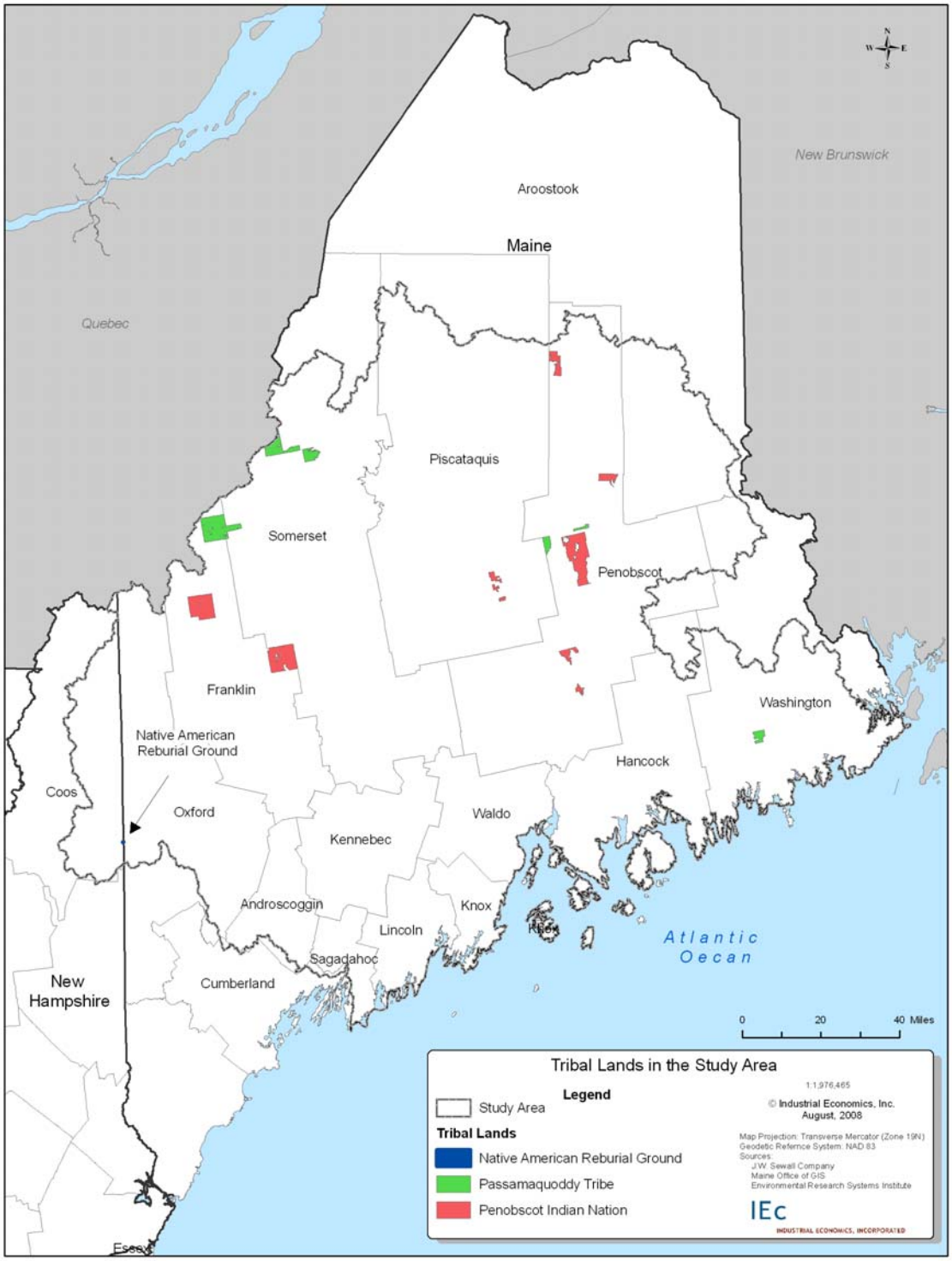
[1] It is important to note that Tribes with lands in the study area are sovereign nations (see Department of the Interior Secretarial Order 3206). To date, NMFS has not specifically consulted on Tribal activities. Nonetheless, Tribal programs may receive Federal funding from the Bureau of Indian Affairs (BIA), and specific activities on Tribal lands may receive other forms of Federal funding or be subject to Federal permitting requirements. Where a Federal nexus exists, activities on these lands are potentially subject to section 7 consultation.

EXHIBIT 10-1. TRIBAL OWNERSHIP BY HUC

HUC	TRIBE	ACREAGE
0102000102	Passamaquoddy Tribe	19,362
0102000109	Passamaquoddy Tribe	1,234
	Penobscot Indian Nation	179
0102000110	Passamaquoddy Tribe	52
0102000202	Penobscot Indian Nation	5,692
0102000203	Penobscot Indian Nation	1,063
0102000204	Penobscot Indian Nation	560
0102000205	Penobscot Indian Nation	1,774
0102000307	Penobscot Indian Nation	87
0102000403	Penobscot Indian Nation	862
0102000404	Penobscot Indian Nation	3,800
0102000405	Passamaquoddy Tribe	4,101
	Penobscot Indian Nation	2,993
0102000501	Penobscot Indian Nation	3,566
0102000502	Passamaquoddy Tribe	377
	Penobscot Indian Nation	29,130
0102000506	Penobscot Indian Nation	1,181
0102000507	Penobscot Indian Nation	3,506
0102000509	Penobscot Indian Nation	1,828
0103000101	Passamaquoddy Tribe	6,218
0103000102	Passamaquoddy Tribe	20,946
0103000201	Penobscot Indian Nation	23,218
0103000203	Penobscot Indian Nation	684
0103000304	Penobscot Indian Nation	25,489
0104000101	Penobscot Indian Nation	55
0104000201	Native American Reburial Ground	9
0105000205	Passamaquoddy Tribe	5,011
0105000207	Passamaquoddy Tribe	68
0105000208	Passamaquoddy Tribe	14
	Subtotal Passamaquoddy Tribe	**57,383**
	Subtotal Penobscot Indian Nation	**105,667**
	Subtotal Native American Reburial Ground	**9**
	Total	**163,059**

Source: IEc GIS analysis applying Maine Landownership (Primary Landowners) data layer. December 2005. Old Town, Maine. J.W. Sewall Company. Received December 18, 2005.

EXHIBIT 10-2. MAP OF TRIBAL LANDS WITHIN THE STUDY AREA



Available data indicate that the Tribes are economically vulnerable. In comparison to the State or national population, their members experience higher rates of unemployment, earn lower incomes, and are more likely to live in poverty (see Exhibit 10-3). In addition, the unique circumstances of communities on Tribal lands may affect re-employment opportunities. For example, Tribal members who lose jobs may be less likely to move away from the community to find work elsewhere. Thus, if the designation of critical habitat reduces local employment opportunities, elevated unemployment may become a chronic problem.

EXHIBIT 10-3. SOCIOECONOMIC INFORMATION BY TRIBE (2000)

DEMOGRAPHIC LEVEL	POPULATION	UNEMPLOYMENT RATE[1]	PER CAPITA INCOME	POVERTY RATE
United States	281,421,906	5.8%	$21,587	12.4%
Maine	1,274,923	4.8%	$19,533	10.9%
New Hampshire	1,235,786	3.8%	$23,844	6.5%
Passamaquoddy Tribe	2,733	12.3%	$12,824	26.8%
Penobscot Indian Nation	2,040	10.1%	$15,980	21.2%

[1] Note that this figure does not include people that are considered to be "not in the labor force."
Source: U.S. Census Bureau, *American Factfinder*. Accessed at: http://factfinder.census.gov/.

10.2.1. PENOBSCOT INDIAN NATION

5. The Penobscot Indian Nation has approximately 2,040 members. Its principal lands are located on twelve islands in the Penobscot River. The Tribe has its own natural resources program, supervised by the Department of Natural Resources (DNR).

6. The Tribe maintains a Memorandum of Agreement (MOA) with the Department of the Interior. According to this MOA, "[i]n fulfilling its duties as required under the Federal Water Pollution Control Act (33 USC §1251 et seq.), the CERCLA, and other federal statutes, the Department [of the Interior] must consult with, and consider the views of, the PIN [Penobscot Indian Nation] in determining its course of action."[2] The Tribe maintains a similar Environmental Agreement with the U.S. Environmental Protection Agency (EPA).[3]

[2] Memorandum of Agreement between the Department of the Interior and the Penobscot Indian Nation, August 1997. Accessed at: http://www.penobscotnation.org/DNR/Water/Legal Resources/Legal Documents/Tribe-Federal Agency Agreements/19708.pdf.

[3] See Penobscot/EPA Tribal Environmental Agreement, July 1999. Accessed at: http://www.penobscotnation.org/DNR/Water/Legal Resources/Legal Documents/Tribe-Federal Agency Agreements/19709.pdf.

7. The Tribe has developed its own water quality standards, stating "[i]t is the official policy of the Penobscot Nation that all waters of the Tribe shall be of sufficient quality to support the ancient and historical traditional and customary uses of such tribal waters by members of the Penobscot Nation."[4] The Tribe's Water Resource Program oversees the maintenance of these standards, and conducts water quality monitoring work that:

   - Ensures that water quality standards are met and that licensed discharges are in compliance with permit conditions;
   - Gathers data needed for the Tribe's role in hydroelectric re-licensing;
   - Identifies and remediates sources of non-point source pollution; and
   - Upgrades river/tributaries classifications.[5]

8. The Tribe also is a participant in the Penobscot River Restoration Project. This project intends to restore 11 species of sea-run fish (including the Atlantic salmon) to the Penobscot River, while maintaining energy production (see Chapter 3 for a discussion).[6]

10.2.2. PASSAMAQUODDY TRIBE

9. The Passamaquoddy Tribe has approximately 2,733 members. The Tribe is divided between two principal locations: Pleasant Point on Passamaquoddy Bay, and Indian Township near the St. Croix River. Like the Penobscot, the Passamaquoddy Tribe maintains its own Environmental Department.[7]

10. The Tribe manages some of its trust lands in Township 19 for agricultural purposes, cultivating wild blueberries and cranberries. In April 2006, the Tribe passed a Tribal Ordinance to govern its water withdrawals for these lands. This ordinance states "[i]t is important to the Tribe that its water withdrawals at T. 19 do not adversely affect the Atlantic Salmon in any of its life stages, or its habitat," and restricts water withdrawals to avoid adverse impact on the Atlantic salmon.[8]

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[4] Penobscot Indian Nation, *Penobscot Nation Water Quality Ordinance.* Accessed at: http://www.penobscotnation.org/DNR/Water/Legal Resources/Legal Documents/Tribal Water Quality Laws/19710.pdf.

[5] Penobscot Indian Nation, *Water Resources Program: What We Do.* Accessed at: http://www.penobscotnation.org/DNR/Water/whatwedo/wqmintro.html.

[6] Penobscot River Restoration Trust, *FAQs.* Accessed at: http://www.penobscotriver.org/content/4011/FAQ/.

[7] The Passamaquoddy Tribe, *Contacts.* Accessed at: http://www.passamaquoddy.com/contacts.htm.

[8] The Passamaquoddy Tribe, Tribal Ordinance on Water Resources Management, April 2006. Accessed at: http://www.penobscotnation.org/DNR/Water/Legal Resources/Legal Documents/Tribal Water Quality Laws/19711.pdf.

10.3 TRIBES AND SECTION 7

11. The Tribes with lands in the study area are sovereign nations; as such, Secretarial Order 3206 recognizes that Tribes have governmental authority and the desire to protect and manage their resources in the manner that is most beneficial to them. Both Tribes have their own natural resource management programs and staff. In addition, as the Trustee for land held by the United States for Indian Tribes, the Bureau of Indian Affairs (BIA) provides technical assistance to the Tribes and oversees a variety of programs on Tribal lands.

12. NMFS has not specifically consulted on Tribal activities in the past and the analysis does not forecast future section 7 consultations with Tribes. This chapter instead highlights the extent to which activities on Tribal lands, which may be undertaken by Tribes or third parties with permission to use these lands, may be affected by critical habitat designation. Activity-specific impacts are analyzed in the previous chapters of this report. The subset of those impacts that are forecast to occur on Tribal lands is presented in Exhibit 10-4. These impacts are not additive with the estimates presented in previous chapters.

10.4 RESULTS

13. The estimated economic impact of critical habitat designation associated with activities on Tribal lands is $377,000. This includes $12,200 associated with activities on Passamaquoddy lands and $365,000 associated with activities on Penobscot lands (see Exhibit 10-4). No activities occurring on the Native American re-burial ground are forecast to be affected by the critical habitat designation. Impacts occurring on Passamaquoddy and Penobscot lands are generated by constraints on agriculture, development, and transportation activities, as described in Chapters 4, 5, and 6 of this report. None of the hydropower projects forecast to experience impacts in Chapter 3 are located on Tribal lands.

EXHIBIT 10-4. DISTRIBUTION OF IMPACTS ON TRIBAL LANDS BY HUC

HUC	TRIBE	PRESENT VALUE IMPACTS
0102000102	Passamaquoddy Tribe	$139
0102000109	Passamaquoddy Tribe	$0
	Penobscot Indian Nation	
0102000110	Passamaquoddy Tribe	$0
0102000202	Penobscot Indian Nation	$17,300
0102000203	Penobscot Indian Nation	$0
0102000204	Penobscot Indian Nation	$0
0102000205	Penobscot Indian Nation	$0
0102000307	Penobscot Indian Nation	$0
0102000403	Penobscot Indian Nation	$0
0102000404	Penobscot Indian Nation	$0
0102000405	Passamaquoddy Tribe	$0
	Penobscot Indian Nation	
0102000501	Penobscot Indian Nation	$0
0102000502	Passamaquoddy Tribe	$0
	Penobscot Indian Nation	
0102000503	Passamaquoddy Tribe	$0
	Penobscot Indian Nation	
0102000506	Penobscot Indian Nation	$5,080
0102000507	Penobscot Indian Nation	$1,200
0102000509	Penobscot Indian Nation	$685
0103000101	Passamaquoddy Tribe	$0
0103000102	Passamaquoddy Tribe	$0
0103000201	Penobscot Indian Nation	$0
0103000203	Penobscot Indian Nation	$32,600
0103000304	Penobscot Indian Nation	$308,000
0104000101	Penobscot Indian Nation	$0
0104000201	Native American Reburial Ground	$0
0105000205	Passamaquoddy Tribe	$12,100
0105000207	Passamaquoddy Tribe	$0
0105000208	Passamaquoddy Tribe	$0
	Subtotal Passamaquoddy Tribe	$12,200
	Subtotal Penobscot Indian Nation	$365,000
	Subtotal Native American Reburial Ground	$0
	Total	$377,000

Notes:
1. Figures are rounded to three significant digits and may not sum to reported totals due to rounding.
2. Estimates reflect present value of total impacts calculated using a 7 percent discount rate.
3. Highlighting denotes HUCs that Atlantic salmon currently occupy.

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APPENDIX A | SENSITIVITY OF RESULTS TO DISCOUNT RATE

1. This analysis employs standard discounting techniques to calculate the present value of economic impacts that are expected to occur at different points in time. The present value figures provided in the main body of the report are calculated using a real discount rate of seven percent. To test the sensitivity of the report's findings to use of an alternative discount rate, this appendix provides estimates of the present value of economic impacts assuming a three percent real discount rate. Consistent with the main analysis, the appendix focuses on quantified estimates of economic impacts to hydropower, agriculture, development, and transportation activities within the study area.

2. Exhibit A-1 summarizes the distribution of estimated economic impacts by species habitat recovery unit (SHRU). The exhibit provides estimates of the present value of impacts employing both a three percent and a seven percent real discount rate. As the exhibit indicates, the present value of estimated impacts is higher when a three percent rate is employed. This is to be expected, all else being equal, because the use of a lower discount rate will assign a higher present value to future costs. Thus, employing a three percent discount rate, the present value of quantified impacts is estimated to range from $569 million to $615 million. In contrast, assuming a seven percent discount rate, the present value of quantified impacts is estimated to range from $340 million to $377 million.

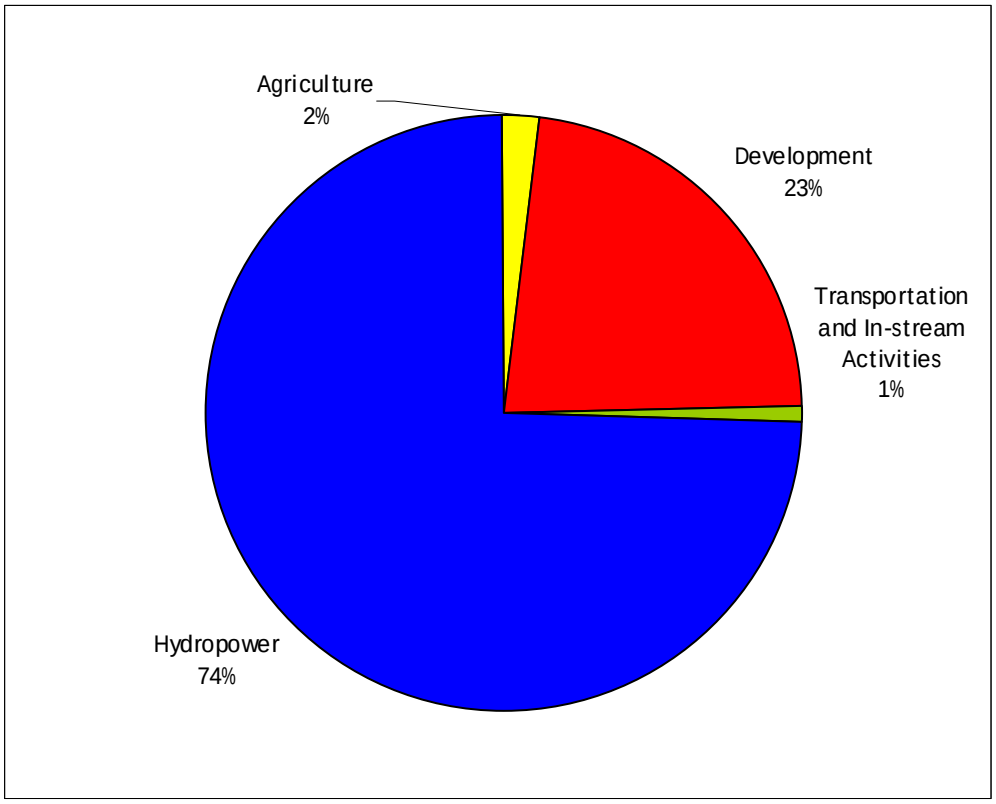
EXHIBIT A-1. IMPACTS OF ATLANTIC SALMON CRITICAL HABITAT DESIGNATION

SPECIES HABITAT RECOVERY UNIT	PRESENT VALUE OF ESTIMATED IMPACTS: 3% DISCOUNT RATE		PRESENT VALUE OF ESTIMATED IMPACTS: 7% DISCOUNT RATE	
	LOW	HIGH	LOW	HIGH
Downeast Coastal	$14,700,000	$19,600,000	$10,600,000	$14,400,000
Merrymeeting Bay	$410,000,000	$440,000,000	$248,000,000	$272,000,000
Penobscot Basin	$144,000,000	$156,000,000	$81,500,000	$91,000,000
Total Impacts	**$569,000,000**	**$615,000,000**	**$340,000,000**	**$377,000,000**

1. Impact estimates reflect a 20-year time horizon for agriculture, development, and transportation impacts, and a 50-year time horizon for hydropower impacts.
2. Entries may not sum to totals reported due to rounding.

3. Exhibit A-2 describes the distribution of quantified impacts by land use activity assuming a three percent discount rate. Approximately 74 percent of the total is attributable to impacts on hydropower projects. Another 23 percent is associated with constraints on development activity. Impacts on agriculture account for approximately two percent of the total, and impacts on transportation and other in-stream activities account for the remaining one percent. This varies from the distribution of impacts suggested when a seven percent discount rate is employed: approximately 63 percent associated with hydropower projects, 34 percent with development, two percent with agriculture, and one percent with transportation and other in-stream activities.

EXHIBIT A-2. DISTRIBUTION OF IMPACTS BY ACTIVITY ASSUMING A 3% DISCOUNT RATE



3. Exhibit A-3 illustrates the distribution of estimated impacts by HUC assuming a three percent discount rate. The exhibit indicates that impacts are greatest in HUCs located in the Merrymeeting Bay SHRU, followed by the Penobscot Basin SHRU. Impacts are lowest in the Downeast Coastal SHRU. This is consistent with the results of the analysis when a seven percent discount rate is employed.

4. Exhibit A-4 provides a detailed summary of estimated impacts by HUC. The HUC forecast to generate the greatest share of total impacts assuming a three percent discount rate is 0104000106 in the Merrymeeting Bay SHRU. Impacts associated with designation of critical habitat within this HUC account for approximately six to seven percent of the total impacts estimated.

5. Exhibit A-4 also identifies the 48 HUCs that the Gulf of Maine DPS of Atlantic salmon currently occupies, and summarizes the estimated impacts of critical habitat designation for these areas. As the exhibit indicates, the present value of estimated impacts in occupied HUCs, assuming a three percent annual discount rate, ranges from $179 million to $208 million. On an annualized basis, the total estimated impact in occupied HUCs ranges from $9.26 million to $11.2 million. These impacts are less than half of the total impacts estimated for the 105-HUC study area.

6. Exhibit A-5 provides a ranking of HUCs from highest to lowest (i.e., from 1 to 105), based on the present value of estimated impacts when a three or a seven percent discount rate is employed. As the exhibit indicates, the use of different discount rates produces some variation in the rankings. The maximum difference in the rankings, however, is only 20 places (HUC 0102000102 ranks 61st assuming a seven percent discount rate and 41st assuming a three percent discount rate), and in most cases the differences, if any, are small. Overall, the rankings appear reasonably well correlated. Thus, the ranking of HUCs by estimated impact is relatively insensitive to the use of a three or seven percent discount rate.

EXHIBIT A-3. DISTRIBUTION OF TOTAL IMPACTS AMONG HUCS IN THE STUDY AREA

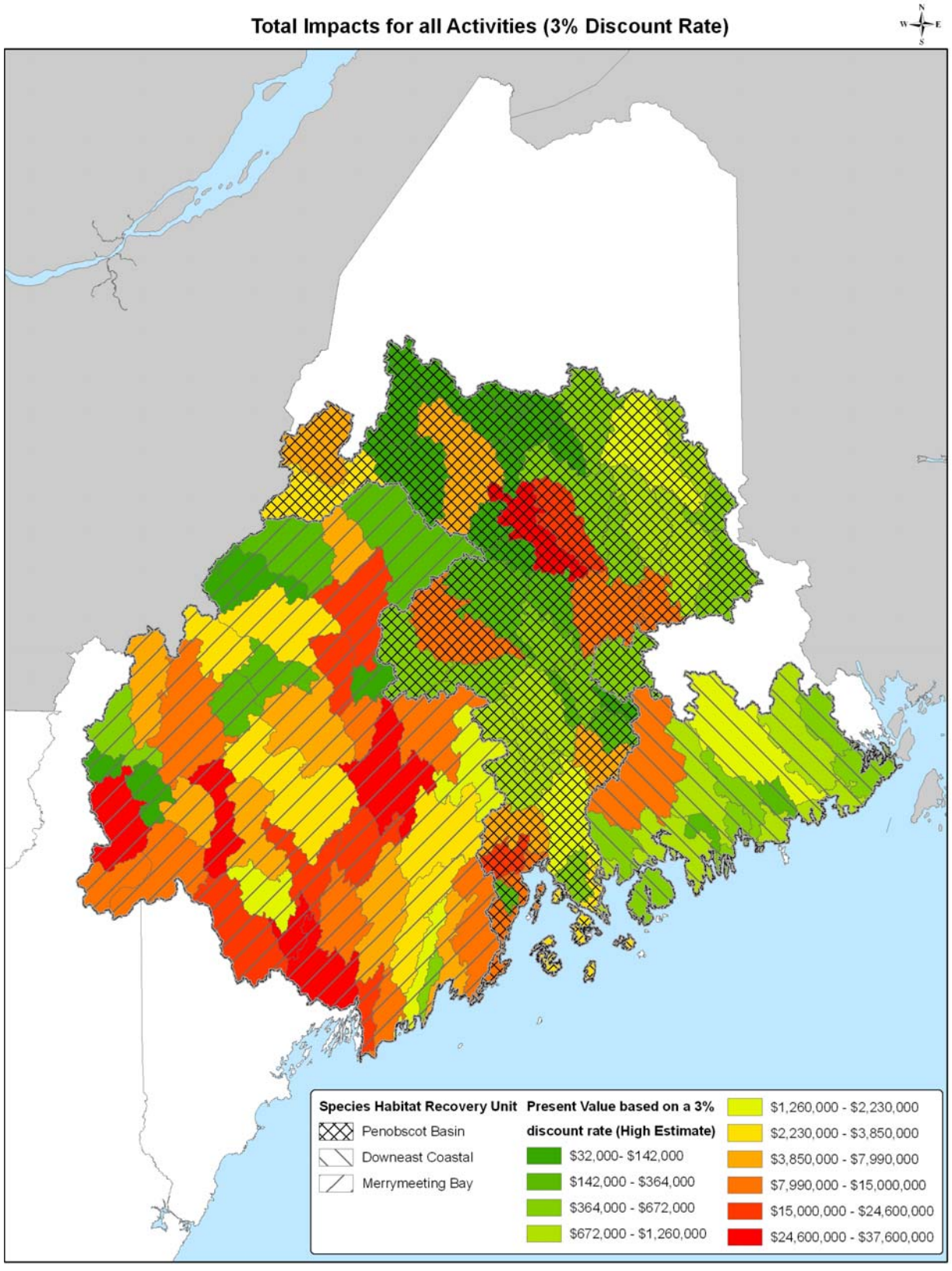


EXHIBIT A-4. SUMMARY OF TOTAL IMPACTS BY HUC ASSUMING A THREE PERCENT DISCOUNT RATE

DOWNEAST COASTAL			MERRYMEETING BAY			PENOBSCOT BASIN		
	PRESENT VALUE			PRESENT VALUE			PRESENT VALUE	
10 DIGIT HUC	LOW	HIGH	10 DIGIT HUC	LOW	HIGH	10 DIGIT HUC	LOW	HIGH
0105000212	$8,880,000	$9,960,000	0104000106	$37,400,000	$37,600,000	0102000109	$29,300,000	$29,400,000
0105000205	$1,130,000	$1,840,000	0104000210	$31,000,000	$37,200,000	0102000110	$21,100,000	$21,300,000
0105000209	$658,000	$1,120,000	0103000306	$31,900,000	$32,400,000	0105000218	$17,200,000	$17,400,000
0105000214	$492,000	$1,070,000	0104000208	$31,700,000	$32,100,000	0105000220	$12,200,000	$13,700,000
0105000204	$498,000	$970,000	0104000204	$27,600,000	$27,800,000	0102000307	$10,300,000	$10,500,000
0105000206	$694,000	$880,000	0103000106	$24,500,000	$24,600,000	0102000403	$9,840,000	$10,200,000
0105000203	$421,000	$634,000	0104000209	$21,900,000	$24,400,000	0102000502	$8,090,000	$8,470,000
0105000208	$399,000	$579,000	0103000301	$21,500,000	$21,600,000	0102000509	$6,200,000	$6,440,000
0105000211	$420,000	$513,000	0104000206	$18,400,000	$19,100,000	0102000512	$5,220,000	$5,650,000
0105000213	$228,000	$509,000	0105000307	$15,500,000	$17,100,000	0102000105	$4,640,000	$4,740,000
0105000215	$158,000	$454,000	0103000310	$16,000,000	$16,600,000	0102000101	$4,640,000	$4,740,000
0105000201	$280,000	$450,000	0104000201	$14,900,000	$15,000,000	0102000102	$3,120,000	$3,220,000
0105000207	$251,000	$335,000	0103000307	$13,000,000	$13,200,000	0105000217	$1,790,000	$2,600,000
0105000210	$166,000	$263,000	0105000301	$7,400,000	$11,700,000	0102000301	$985,000	$1,770,000
			0104000101	$9,290,000	$9,670,000	0102000513	$1,150,000	$1,740,000
			0104000202	$9,330,000	$9,590,000	0102000510	$934,000	$1,250,000
			0103000303	$9,250,000	$9,330,000	0102000306	$569,000	$1,050,000
			0105000306	$8,750,000	$9,110,000	0102000511	$603,000	$940,000
			0103000311	$7,410,000	$8,230,000	0102000302	$504,000	$914,000
			0103000312	$6,870,000	$7,990,000	0102000508	$647,000	$912,000
			0103000104	$6,300,000	$6,370,000	0102000305	$366,000	$805,000
			0103000304	$5,240,000	$5,680,000	0102000401	$481,000	$672,000
			0104000103	$5,100,000	$5,230,000	0102000503	$336,000	$638,000
			0104000205	$4,880,000	$5,220,000	0102000402	$454,000	$633,000
			0105000302	$3,240,000	$5,190,000	0102000205	$376,000	$629,000
			0104000203	$4,520,000	$4,640,000	0102000304	$241,000	$577,000
			0103000201	$3,660,000	$3,850,000	0102000303	$309,000	$553,000

DOWNEAST COASTAL			MERRYMEETING BAY			PENOBSCOT BASIN		
	PRESENT VALUE			PRESENT VALUE			PRESENT VALUE	
10 DIGIT HUC	LOW	HIGH	10 DIGIT HUC	LOW	HIGH	10 DIGIT HUC	LOW	HIGH
			0103000305	$2,870,000	$3,810,000	0102000501	$306,000	$547,000
			0103000204	$2,690,000	$2,850,000	0102000406	$327,000	$454,000
			0103000309	$1,670,000	$2,680,000	0102000506	$291,000	$430,000
			0105000305	$1,620,000	$2,520,000	0102000204	$148,000	$411,000
			0105000304	$1,760,000	$2,230,000	0105000216	$225,000	$410,000
			0104000207	$1,210,000	$1,620,000	0105000219	$239,000	$364,000
			0103000308	$870,000	$1,260,000	0102000404	$207,000	$322,000
			0104000104	$332,000	$496,000	0102000505	$167,000	$295,000
			0105000303	$227,000	$401,000	0102000405	$74,100	$204,000
			0103000105	$94,900	$282,000	0102000507	$132,000	$187,000
			0103000202	$133,000	$273,000	0102000103	$46,100	$132,000
			0103000103	$111,000	$256,000	0102000203	$45,600	$128,000
			0103000203	$72,500	$190,000	0102000504	$60,700	$123,000
			0103000102	$49,200	$142,000	0102000201	$37,500	$108,000
			0104000102	$49,700	$116,000	0102000202	$33,800	$94,600
			0104000105	$35,300	$92,500	0102000104	$26,500	$71,600
			0103000101	$31,000	$89,600	0102000108	$15,200	$43,800
			0103000302	$38,500	$80,700	0102000107	$13,400	$38,500
						0102000106	$10,200	$32,300
Subtotal: All HUCs	**$14,700,000**	**$19,600,000**	**Subtotal: All HUCs**	**$410,000,000**	**$440,000,000**	**Subtotal: All HUCs**	**$144,000,000**	**$156,000,000**
Subtotal: Occupied HUCs	**$13,600,000**	**$17,500,000**	**Subtotal: Occupied HUCs**	**$109,000,000**	**$127,000,000**	**Subtotal: Occupied HUCs**	**$56,100,000**	**$63,500,000**

	LOW	HIGH
TOTAL PRESENT VALUE: ALL HUCs	**$569,000,000**	**$615,000,000**
TOTAL ANNUALIZED IMPACT: ALL HUCs	**$25,200,000**	**$28,400,000**
TOTAL PRESENT VALUE: OCCUPIED HUCs	**$179,000,000**	**$208,000,000**
TOTAL ANNUALIZED IMPACT: OCCUPIED HUCs	**$9,260,000**	**$11,200,000**

Notes:

1. Figures are rounded to three significant digits and may not sum due to rounding.
2. Estimates reflect present value of quantified impacts assuming a three percent discount rate.
3. Highlighting denotes HUCs that Atlantic salmon currently occupy.

EXHIBIT A-5. RANKING OF HUCS BY PRESENT VALUE OF ECONOMIC IMPACTS ASSUMING ALTERNATE DISCOUNT RATES

HUC	RANKING AT 7%	RANKING AT 3%
0104000210	1	1
0104000106	2	2
0105000307	3	10
0104000204	4	5
0104000208	5	6
0102000109	6	4
0103000306	7	13
0104000209	8	8
0103000106	9	3
0105000301	10	28
0103000301	11	7
0105000218	12	12
0102000110	13	18
0105000220	14	11
0105000306	15	21
0104000206	16	9
0104000201	17	25
0103000312	18	30
0103000307	19	15
0102000403	20	20
0103000310	21	16
0104000202	22	19
0102000307	23	17
0104000101	24	23
0105000212	25	14
0103000311	26	24
0103000303	27	22
0103000104	28	26
0105000302	29	38
0102000502	30	27
0103000304	31	31
0102000512	32	32
0104000205	33	40
0103000305	34	45
0104000203	35	29
0104000103	36	34
0105000217	37	48
0102000509	38	35
0103000309	39	47
0105000305	40	49

HUC	RANKING AT 7%	RANKING AT 3%
0105000304	41	50
0103000201	42	43
0105000205	43	51
0102000301	44	52
0102000513	45	42
0104000207	46	53
0103000308	47	63
0102000510	48	55
0103000204	49	39
0105000209	50	37
0102000503	51	56
0102000306	52	33
0102000101	53	44
0102000105	54	54
0105000214	55	60
0105000204	56	61
0105000206	57	57
0102000511	58	58
0102000508	59	59
0102000302	60	41
0102000305	61	46
0102000102	62	62
0102000401	63	64
0102000402	64	65
0105000203	65	36
0102000205	66	66
0105000208	67	67
0102000303	68	71
0105000211	69	70
0102000304	70	69
0102000501	71	68
0104000104	72	74
0102000406	73	72
0105000213	74	73
0105000201	75	77
0102000506	76	80
0105000303	77	79
0105000215	78	76
0105000219	79	78
0105000216	80	81
0102000204	81	75
0105000207	82	82

HUC	RANKING AT 7%	RANKING AT 3%
0102000404	83	83
0102000505	84	84
0105000210	85	85
0103000202	86	86
0103000105	87	87
0103000103	88	88
0102000507	89	90
0102000405	90	91
0103000203	91	89
0103000102	92	92
0102000504	93	94
0102000103	94	95
0102000203	95	93
0104000102	96	96
0102000201	97	97
0102000202	98	98
0104000105	99	99
0103000101	100	100
0103000302	101	101
0102000104	102	102
0102000108	103	103
0102000107	104	104
0102000106	105	105

APPENDIX B | WATER BOTTLING

1. This appendix addresses the potential impact of critical habitat designation for the Gulf of Maine DPS of Atlantic salmon on commercial water bottling activities within the study area. It includes:

   - a brief description of Maine's water bottling industry;
   - information on water bottling facilities within the study area;
   - an overview of State and Federal regulation of water bottling operations; and
   - a discussion of the potential for section 7 consultations concerning water bottling activities.

2. As discussed in greater detail below, the impact of critical habitat designation on water bottling operations is uncertain. To date, there have been no consultations regarding the impact of water bottling operations on the salmon or any other listed species, either with respect to the jeopardy standard or, in the case of other listed species, with respect to potential adverse modification of critical habitat. Moreover, none of the water bottling facilities located within the study area draws directly from surface water sources. Thus, the analysis does not anticipate that water bottling facilities within the study area will affect the physical or biological features of the salmon's critical habitat by drawing water directly from rivers or streams. It is possible, however, that withdrawals of groundwater for the purposes of bottling could reduce volumes and flows of surface water. Were this to occur, it could have an adverse impact on the salmon's habitat.

3. The data and models required to project the impact of water bottling activities and associated groundwater withdrawals on surface water conditions are not currently available. For this reason, the analysis does not attempt to specify project modifications that might be requested to avoid adverse modification, nor does it attempt to quantify the potential impact of critical habitat designation on the water bottling industry. As explained below, however, because there is a potential Federal nexus for these activities, the possibility of future section 7 consultations exists, particularly if growth in water bottling operations raises concerns over potential reductions in stream flows.

B.1 WATER BOTTLING INDUSTRY IN MAINE

4. The water bottling industry is an increasingly important element of Maine's economy. According to the Maine Department of Labor, 672 individuals across the State were

employed in "Bottled Water Manufacturing" in 2005.[1] The largest company, Poland Spring (Nestle Waters North America), employed 572 individuals in its Poland Spring and Hollis bottling plants that year, and was expected to add 40 more workers in 2006.[2]

5. At present, the Maine Drinking Water Program reports that 32 water bottling facilities are located in the State.[3] This is an increase of one from the number identified as proposed or operational in the Maine Water Withdrawal Reporting Program's 2004-2005 Annual Report. Of the 31 facilities identified in that report, only 18 were operational in 2004, withdrawing a total of 448 million gallons of water from Maine aquifers.[4]

B.2 POTENTIAL IMPACT OF WATER BOTTLING ACTIVITIES IN THE STUDY AREA

6. The available data indicate that 22 of Maine's 32 water bottling facilities draw from sources within the study area (see Exhibit B-1).[5] Like water bottling facilities elsewhere in the State, these facilities do not rely on water from surface water sources.[6] Instead, they rely on groundwater. According to State records, 19 of the 22 facilities that draw on sources within the study area bottle "spring water," i.e., water drawn from a spring at its source or from an aquifer that connects to a spring.[7] Of the remaining three facilities, two bottle well water; the source of supply for the third facility is not reported.

7. In light of the information presented above, the analysis does not anticipate that water bottling operations within the study area will affect the physical or biological features of the salmon's critical habitat by drawing water directly from rivers or streams. It is possible, however, that withdrawals of groundwater for the purposes of bottling could reduce volumes and flows of surface water. Were this to occur, it could have an adverse impact on salmon habitat.

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[1] Maine Department of Labor. Labor Market Analysis Tool, see Industry, then Industry Employment and Projections. Accessed at http://www.state.me.us/labor/lmis/ on 28 January 2008.

[2] Poland Spring. Fact Sheet. Accessed at http://www.sprucespring.com/factsheet/index.html on 22 January 2008.

[3] State of Maine, Division of Environmental Health, Drinking Water Program. "Bottled Water Facilities in Maine." Accessed at http://www.maine.gov/dhhs/eng/water/Templates/Rules/BW%20Facilities.htm on 22 January 2008.

[4] Maine DEP, Bureau of Land and Water Quality. February 2006. Water Withdrawal Reporting Program 2004-2005 Annual Report, p. 11.

[5] Operations within the study area were identified using the ArcMap GIS program.

[6] In Maine, only municipal water suppliers extract from surface water sources. Maine Division of Environmental Health. Surface Water Bodies Used to Supply Drinking Water to Maine. Accessed at http://www.maine.gov/dhhs/eng/water/Templates/Rules/surfacewater.htm on 28 January 2008.

[7] Hall, Noah D. December 2007. Federal and State Laws Regarding Bottled Water – An Overview and Recommendations for Reform. Testimony Before the United States House of Representatives Oversight and Government Reform Committee Domestic Policy Subcommittee, Hearing on "Assessing the Environmental Risks of the Water Bottling Industry's Extraction of Groundwater," p. 7.

FIGURE B-1: WATER BOTTLING OPERATIONS WITHIN THE STUDY AREA[8]

ID	NAME	TOWN	SPRING WATER	BULK WATER PERMIT	SOURCE NAME
93000	Crystal Spring Water Co.	Auburn	Y		Crystal Spring
93190	Garelick Farms of Maine (Grant's)	Bangor	Y		Glenwood Springs - Rebottled
93045	Oak Grove Spring Water Co.	Brewer	Y		Well No. 1
93503	NWNA - White Cedar Spring	Dallas Plt.	Y	Y	Spring
93486	Noyes Spring Water Co.	Dixfield	Y	Y	Spring (Bored Holes - Dixfield, Maine)
93511	Freedom Water Company	Freedom	N	Y	Not Available
93020	Glenrock Spring Bottled Water	Greene	Y		Glenrock Spring
93432	Shackley Hill Spring	Livermore	Y	Y	Shakley Hill Spring (Bulk)
93200	Watson Spring Bottled Water	Milo	Y		Drilled 160'
93273	Oxford-Staples Spring	Oxford	Y		Spring
93160	Carrabassett Spring Water Co.	Peru	Y	Y	Spring #1, #2, #3
93476	NWNA - Spruce Spring	Pierce Pond Twp.	Y	Y	Spring
93297	Clifford Bottling Limited	Plymouth	Y		Spring
93170	NWNA - Garden Spring	Poland	Y	Y	Garden Spring Bh #1, #2
93055	NWNA - Poland Spring	Poland	Y		Spring
93313	Pierre-Pont Bottling Co.	Poland	N	Y	6" Gravel Well 92' 4/8/97, 6" Gravel Well 73' 4/14/97
93309	Winterbrook Water Co.	Poland	N	Y	Well #1
93506	Bull Rock Spring Water	Rumford	Y		Spring
93250	Mount Desert Spring Water	Southwest Harbor	Y		Drilled Well

[8] State of Maine, Division of Environmental Health, Drinking Water Program. "Bottled Water Facilities in Maine." Accessed at http://www.maine.gov/dhhs/eng/water/Templates/Rules/BW%20Facilities.htm on 22 January 2008. Operations within the study area were identified using the ArcMap GIS program.

ID	NAME	TOWN	SPRING WATER	BULK WATER PERMIT	SOURCE NAME
93489	NWNA - Glenwood Spring	St. Albans	Y	Y	Glenwood Spring
93040	Crystal Springs - Nezinscot	Turner	Y	Y	Spring
93225	Maine's Best, Inc.	Union	Y		Spring

8. The information currently available is insufficient to characterize the potential effect of water bottling operations and associated groundwater withdrawals on surface water conditions within the study area. In particular, a comprehensive hydrological model would be required to determine whether or how groundwater withdrawals may affect stream flows. Such a model is not currently available. For this reason, the analysis does not attempt to specify project modifications that might be requested to protect critical habitat, and does not attempt to quantify the potential cost of such modifications.[9]

B.3 STATE AND FEDERAL REGULATIONS APPLICABLE TO BOTTLED WATER

9. Regulation of water withdrawals by the bottled water industry in Maine occurs primarily at the State level.[10] Bulk water transport permits are required when water is transported for commercial purposes across municipal boundaries or in containers greater than ten gallons in size. These permits are typically issued to facilities that wish to collect spring water and transport it to a bottling plant. The Maine Department of Environmental Protection, the Public Utilities Commission, the Maine Geological Survey, and the Maine Drinking Water Program review applications for bulk water transport permits to assess the environmental impact of the proposed operation and to ensure compliance with applicable laws. The Commissioner of the Department of Human Services has final statutory authority to approve or deny the permit.[11]

10. While regulation of water withdrawals is primarily a State function, the Federal government also maintains regulatory authority over suppliers of bottled water who enter their products into interstate commerce. Specifically, under the Federal Food, Drug, and Cosmetic Act (FFDCA), the Food and Drug Administration (FDA) regulates bottled water as a food product. Under this statute, manufacturers are responsible for producing safe, wholesome, and truthfully labeled food products.[12]

11. FDA regulations applicable to bottled water impose both quality and identity requirements. Under the quality standards, FDA has established allowable levels of contaminants in bottled water. Under the identity standards, FDA has established

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[9] It is important to note that the possibility of adverse impacts is not necessarily limited to the withdrawal of water from wells or springs within the study area. Although operations within the study area are more likely to have an effect on nearby surface waters, a well or spring outside the study area may draw from an aquifer that has a hydrological connection to a river or stream within the study area. The withdrawal of water from these sources could affect surface waters within the study area. Hydrological modeling would help to reveal whether such linkages exist.

[10] Hall, Noah D. December 2007. Federal and State Laws Regarding Bottled Water – An Overview and Recommendations for Reform. Testimony Before the United States House of Representatives Oversight and Government Reform Committee Domestic Policy Subcommittee, Hearing on "Assessing the Environmental Risks of the Water Bottling Industry's Extraction of Groundwater," pp. 9, 15.

[11] Maine Drinking Water Program, Bulk Water Transport Guidance Document, May 2003.

[12] Posnick, L.M. and H. Kim. "Bottled Water Regulation and the FDA." Reproduced from *Food Safety*, August/September 2002, p. 1.

standards for defining various types of bottled water, including artesian, mineral, purified, sparkling, and spring water. Spring water, the most common variety, is "water derived from an underground formation from which water flows naturally to the surface of the earth at an identified location…[it] may be collected at the spring or through a bore hole tapping the underground formation feeding the spring."[13] Notably, the FDA does not approve bottled water firms or bottled water products. Instead, "it is the responsibility of bottled water manufacturers to ensure that their products in interstate commerce comply with all applicable provisions of the FFDCA and FDA's regulations for bottled water."[14]

12. The Clean Water Act may also incidentally apply to actions taken during the water extraction process. Section 404 of the Federal Water Pollution Control Act (the Clean Water Act) authorizes the U.S. Army Corps of Engineers (USACE) to issue permits for the discharge of dredged or fill material into the navigable waters of the United States. Draining of water from surface waters and wetlands does not fall under the auspices of the Clean Water Act; however, a bottled water facility would need a section 404 permit if some aspect of its extraction process results in the filling of wetlands.[15]

B.4 POTENTIAL FOR SECTION 7 CONSULTATIONS

13. The oversight of the FDA and USACE may constitute a Federal nexus for water bottling facilities. If the operation of these facilities affects stream flows within the study area, it is conceivable that the Federal government would undertake a section 7 consultation. The purpose of such consultation would be to ensure that operation of a water bottling facility would not destroy or adversely modify critical habitat for the Gulf of Maine DPS of Atlantic salmon.

14. In testimony before the House of Representatives Domestic Policy Subcommittee, Professor Noah Hall writes the following with respect to the Endangered Species Act (ESA) and water bottling operations:

> The ESA can be implicated in water withdrawals when additional instream flows are required for an endangered species but water is already in use by private parties with state water rights. Similarly, a new water withdrawal that would diminish the instream flows and aquatic habitat of an endangered species would conflict with the ESA. This application has never

[13] Ibid, p. 2.

[14] Ibid, p. 3.

[15] Hall, Noah D. December 2007. Federal and State Laws Regarding Bottled Water – An Overview and Recommendations for Reform. Testimony Before the United States House of Representatives Oversight and Government Reform Committee Domestic Policy Subcommittee, Hearing on "Assessing the Environmental Risks of the Water Bottling Industry's Extraction of Groundwater," p. 12.

> affected a water bottler, although it has affected other private water users with considerable controversy.[16]

15. Absent information on whether the levels of groundwater withdrawal may qualify as potential adverse modification of salmon critical habitat, this analysis is unable to forecast specific modifications to water bottling activities or economic impacts to the industry. Review of the consultation history for the species suggests that water bottling activities have not specifically been considered an issue with salmon conservation in the past. Nonetheless, the potential for future consultations exists, particularly if growth in water bottling operations leads to reductions in stream flows.

[16] Ibid, p. 14.