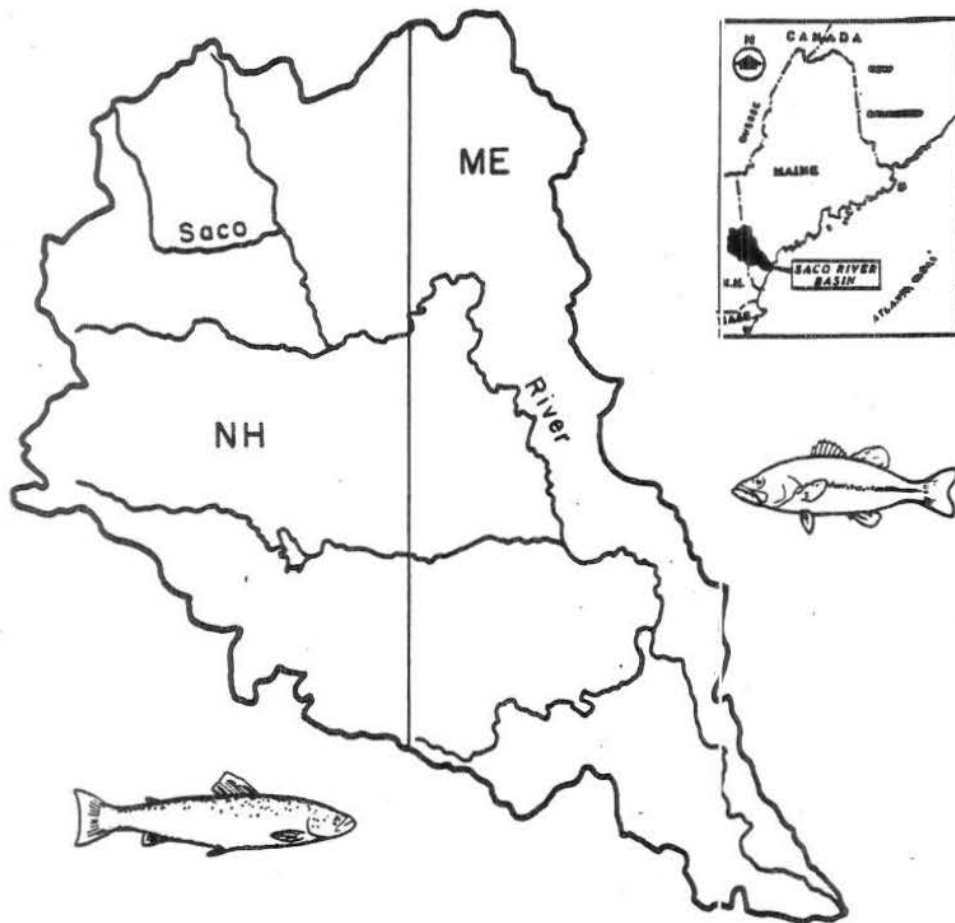


# SACO RIVER

## STRATEGIC PLAN FOR FISHERIES MANAGEMENT



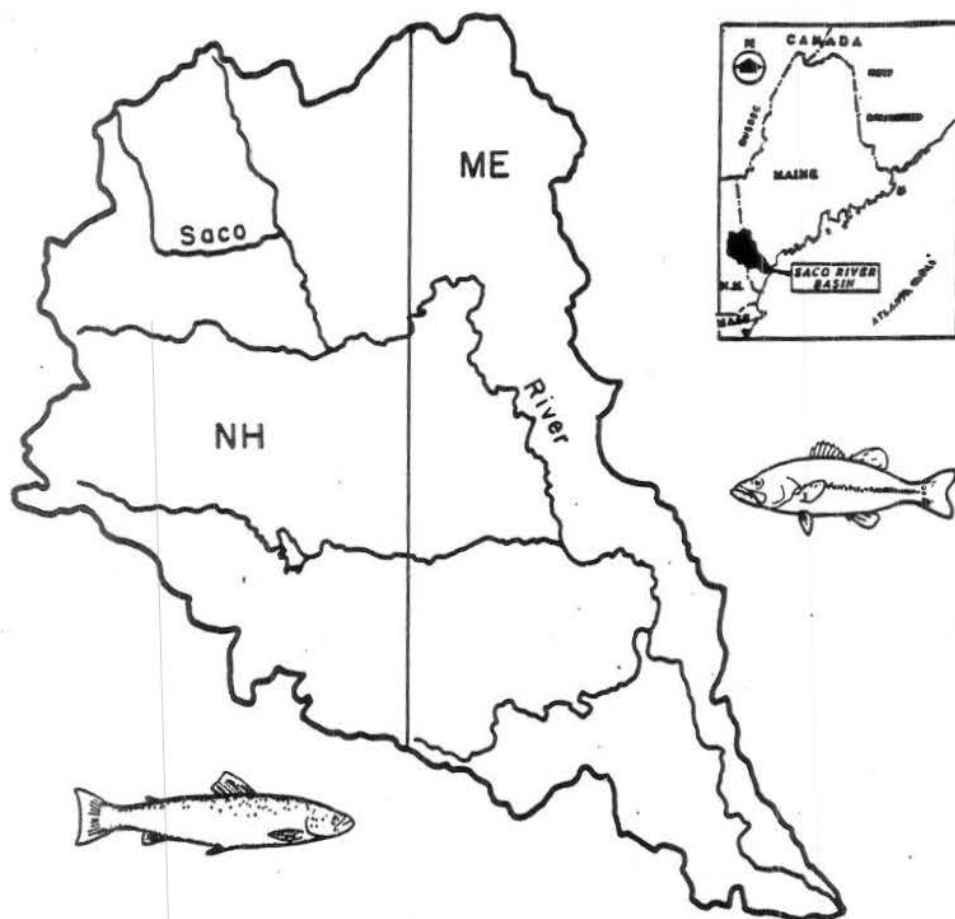
prepared by

**U.S. Fish and Wildlife Service  
Maine Department of Inland Fisheries and Wildlife  
Maine Atlantic Sea Run Salmon Commission  
Maine Department of Marine Resources**

This report funded in part by  
Federal Aid in Fish Restoration  
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SACO RIVER  
STRATEGIC PLAN FOR  
FISHERIES MANAGEMENT

January 1987

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## AGENCY ABBREVIATIONS USED IN THIS REPORT

AMC	Appalachian Mountain Club
CMP	Central Maine Power Company
EPA	Environmental Protection Agency
FERC	Federal Energy Regulatory Commission
MEASRSC	Maine Atlantic Sea Run Salmon Commission
MEBPR	Maine Bureau of Parks and Recreation
MEDEP	Maine Department of Environmental Protection
MEDIF&W	Maine Department of Inland Fisheries and Wildlife
MEDMR	Maine Department of Marine Resources
MEDOC	Maine Department of Conservation
MERC	Maine Energy Recovery Company
MESPO	Maine State Planning Office
NENYIAC	New England New York Inter-Agency Committee
NERBC	New England River Basins Commission
NHF&GD	New Hampshire Fish and Game Department
NHWSPPC	New Hampshire Water Supply and Pollution Control Commission
NOAA	National Oceanic and Atmospheric Administration
SCS	Soil Conservation Service
SMRPC	Southern Maine Regional Planning Commission
SRCC	Saco River Corridor Commission
SREAC	Saco River Environmental Advisory Committee
USACOE	United States Army Corps of Engineers
USDA	United States Department of Agriculture

AGENCY ABBREVIATIONS USED IN THIS REPORT (cont.)

USDASCS	United States Department of Agriculture, Soil Conservation Service
USDC	United States Department of Commerce
USDOIBOM	United States Department of the Interior, Bureau of Mines
USDOINPS	United States Department of the Interior, National Parks Service
USFWS	United States Fish and Wildlife Service (Department of the Interior)
USGS	United States Geological Survey (Department of the Interior)
USGSWDR	United States Geological Survey, Water Data Report



## INTRODUCTION

This document is an inter-agency management plan for important species of fish in the Saco River Watershed. Sources of the data contained within the plan have been appropriately cited throughout the text and should be reviewed where more detailed information is required. Fisheries of primary importance include sea-run Atlantic salmon, American shad, alewives, striped bass, rainbow smelt, American eel, brown trout, brook trout, largemouth bass, and smallmouth bass. Species of lesser importance include chain pickerel, white perch, yellow perch, and landlocked salmon. The Saco River's proximity to urban areas of Massachusetts and southern Maine, and heavily developed recreational areas in and near the White Mountains makes this river popular with a diverse group of anglers.

This plan is based in large part on data collected during an inter-agency habitat inventory in 1983 and 1984. The management objective derived in this document reflects a management policy to manage the fisheries of the Saco River within the physical and biological limits of habitat and its capacity to sustain the various fisheries.

This report is composed of four major divisions: the Saco River Basin Overview; Management Goal and Objectives; Reach Descriptions; and Appendices. The Saco River Basin Overview provides a synopsis of the basin's physical characteristics, its fisheries, and its river recreational use. The Management Goal and Objectives division provides what we believe are the best fisheries management goal and objectives for the Saco River. This division includes existing and/or potential fishery management problems, conflicts, and management strategies appropriate for resolving problem areas and attaining the management goal and objectives.

In the Reach Descriptions division, the watershed is separated into seven reaches. Detailed information on the physical characteristics, fisheries, and river recreational use is provided for each reach. The Appendices provide a single source of supplemental materials and include all available substrate maps of rivers within the watershed.

This plan is not intended to be so rigid as to preclude changes as necessary to better manage the resource. The plan reflects not only the management philosophies and policies of the Maine Atlantic Sea Run Salmon Commission, the Maine Department of Inland Fisheries and Wildlife, the Maine Department of Marine Resources, and the U.S. Fish and Wildlife Service, but also reflects many of the attitudes and sentiments of the resource users. This plan will be modified as new information or more precise data become available, as new fishery management options develop, or as public needs or conditions change.

## SACO RIVER BASIN OVERVIEW

### SECTION 1

#### PHYSICAL CHARACTERISTICS

##### GENERAL

The Saco River Basin (Figure 1-1) occupies an area 1,697 mi<sup>2</sup>, of which 870 mi<sup>2</sup> are located in east-central New Hampshire and 827 mi<sup>2</sup> are in southwestern Maine. The basin extends from New Hampshire's White Mountains southeasterly into Maine, reaching the Atlantic Ocean at the cities of Biddeford and Saco. The entire basin is about 75 miles long and 45 miles across at its widest point.

Over its length of 131.7 miles,<sup>1/</sup> the Saco River drops a total of 1,898 ft (Figure 1-2). In New Hampshire, the Saco River drops 1,515 ft over a 42.2 mile river course. The total drop over the river's 89.5 mile length in Maine is only 383 ft.

##### TOPOGRAPHY AND GEOLOGY

The Saco River originates high in the White Mountains at the outlet of Saco Lake near Crawford Notch, New Hampshire (NERBC

<sup>1/</sup> River mileage was determined by using a rotary map measure and following the center of the Saco River on U.S. Geological Survey Topographic maps. One exception to this occurred in the area from the junction of Route 16, Conway, New Hampshire to a point approximately 1.3 miles above the Conway scenic railroad crossing in Conway, New Hampshire. River mileage from this area was based on actual river measurements at the time of substrate mapping. River mile 0.0 is the eastern tip of the Saco (north) jetty.

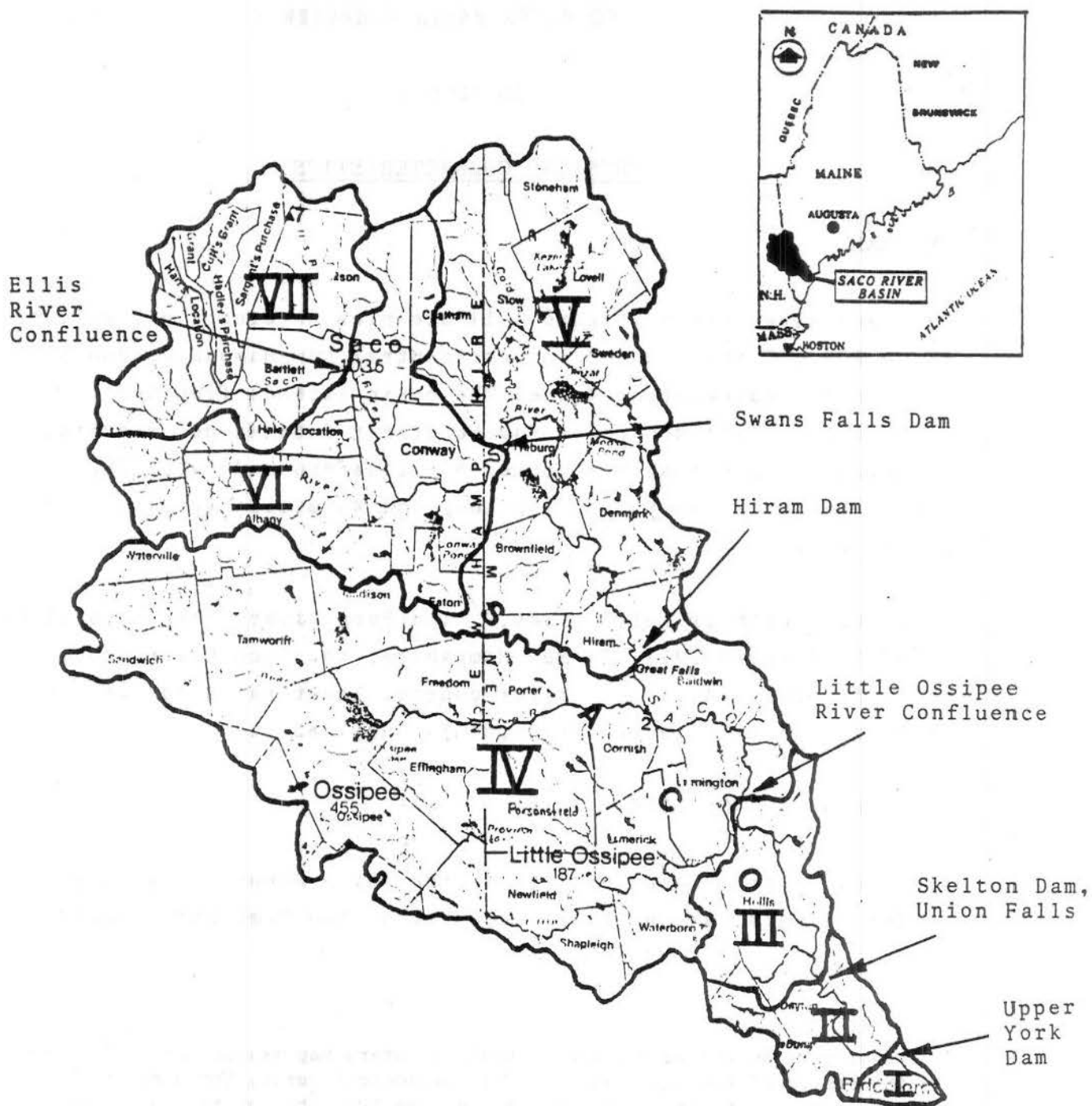


Figure 1-1. The Saco River Basin depicting the seven river reaches (I-VII).

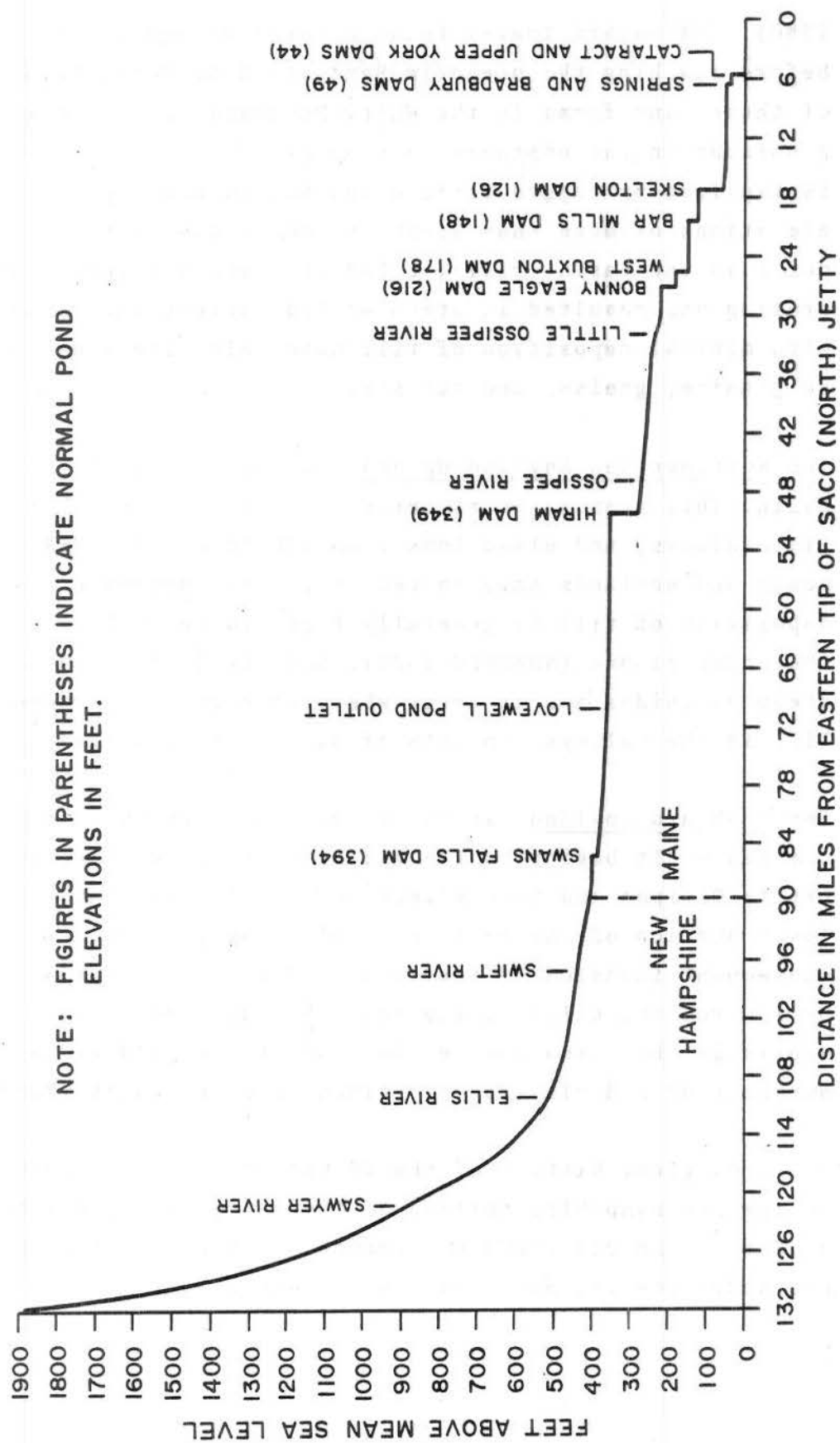


Figure 1-2. Profile of the Saco River.

1980). Its waters travel through three recognizable land forms before reaching the ocean in Saco and Biddeford, Maine. The first of these land forms is the White Mountain land form which is prominent in the northern portion of the basin. This land form is typified by rugged terrain and has mountain peaks reaching elevations of more than 5,000 ft. Mount Washington is the highest point in the basin, rising 6,288 ft above sea level. Glacial erosion has resulted in steep-walled valleys and exposed bedrock with minimal deposition of till materials. The area is underlain by granite, gneiss, and schists.

The Northern New England Upland, composes much of the central basin. This area is characterized as having steep hills, broad flat valleys, and elevations from 500 to 800 ft (NERBC 1980). Many ponds and wetlands have formed in glacial depressions. Glacial deposition of till is generally thick in the valleys, and thin on the upper slopes (NHWSPCC 1975). Bedrock is frequently exposed on steep hillsides and in areas where streams have eroded the till. Till in the valleys consists of sand, silt and gravel.

The Seaboard Lowland is the final land form recognized within the basin. It begins in the vicinity of the confluence of the Little Ossipee and Saco Rivers (mi 32.3). The landscape of this lower portion of the basin was molded by glaciers and the subsequent invasion by the ocean (NERBC 1980). The area is typified by low rolling hills rising above broad, flat plains. Glacial debris in this area was reworked by the sea and deposited as marine sand and clay as far inland as Great Falls, Maine (mi 49.8).

The geological history of the formation of lakes, ponds, and rivers in the New Hampshire portion of the watershed is covered in detail by Earl E. Hoover (1937) in a report entitled "Biological Survey of the Androscoggin, Saco and Coastal Watersheds".

## CLIMATE

The climate of the Saco River Basin varies significantly with respect to elevation and latitude. Weather conditions are often a result of the prevailing westerlies. The southeastern part of the basin in Maine is also influenced by warm moisture-laden maritime air, as well as coastal storms that develop along the Atlantic seaboard.

The summers are relatively cool and the winters quite severe, especially at inland points. The average annual temperature of the basin varies from 27° F on Mt. Washington, New Hampshire to 45° F on the coast as measured at Portland, Maine (NHWSPCC 1975). At Pinkham Notch, New Hampshire, (elevation 2,029 ft) the average monthly temperature varies between 61-63° F in July and August to 16-17° F in January and February, with an average annual temperature of 40° F.

Average annual precipitation in the Saco River Basin is 45 inches; the northern mountains receive 60 inches, and the coastal portion, 42 inches (NERBC 1980). The distribution of precipitation throughout the year is uniform. Average annual snowfall varies from approximately 70 inches at Portland, Maine to over 156 inches at Pinkham Notch to the north.

## RIVER HYDROLOGY

Run-off varies with the physiogeographic and climatic regions of the basin. The average annual run-off of the upper basin is 31 inches, approximately 50% of the annual precipitation in the area (NERBC 1980). The average annual run-off for the central basin is 26 inches and that of the coastal belt is 21 inches. Fifty percent of the basin's annual run-off occurs in March, April, and May when melting snows combine with heavy rains.



Surface waters are the most available form of water storage (NERBC 1980). The total storage capacity of the major surface water bodies of the Saco River Basin is 92,700 acre-feet. Storage in the basin is used principally for power generation, recreation or water supply.

Extensive ground water resources are present in large glacial deposits throughout the basin (NERBC 1980). Although over half of the basin's public water supply systems rely exclusively on ground water resources, little is known about the extent, location, and potential yield of the basin's ground water deposits. Ground water investigations are carried out by the U.S. Geological Survey.

The Saco River has an average annual flow (1916-1982) of 2,705 cfs at its lowermost USGS gaging station at Cornish, Maine (USGSWDR 1982). This gaging station receives the drainage of 1,293 mi<sup>2</sup> which constitutes over 76% of the entire basin's drainage area. Recorded extremes for minimum and maximum discharges are 90<sup>1/</sup> cfs in October 1, 1921 and 45,000 cfs on March 21 and 22, 1936. Median of the mean monthly flows and extremes for the Saco River below the Ossipee River at Cornish, Maine are shown in Table 1-1. A flow-duration curve for the Saco River at Cornish, Maine is shown in Figure 1-3.

The estimated average annual flow at the mouth of the Saco River is 3,550 cfs (Rizzo 1983). Extreme fluctuations occur among the seasons and within a given month. Low flows generally occur

<sup>1/</sup> This minimum flow value was taken from USGSWDR-1963, which was the last year historical minimum values were listed. All subsequent years list minimum daily values.



Table 1-1 Median of the mean monthly flows and extremes for the Saco River below the Ossipee River at Cornish, Maine, 1916 - 1982 (USGSWDR 1982).

Month	Median (cfs)	Minimum (cfs)	Maximum (cfs)
January	1,670	528	5,791
February	1,506	615	6,085
March	2,592	805	16,220
April	7,055	2,593	12,720
May	5,638	789	11,720
June	2,409	243	8,740
July	1,170	229	6,802
August	864	238	2,591
September	942	177	5,073
October	1,125	199	6,887
November	1,761	608	5,689
December	2,050	564	8,630

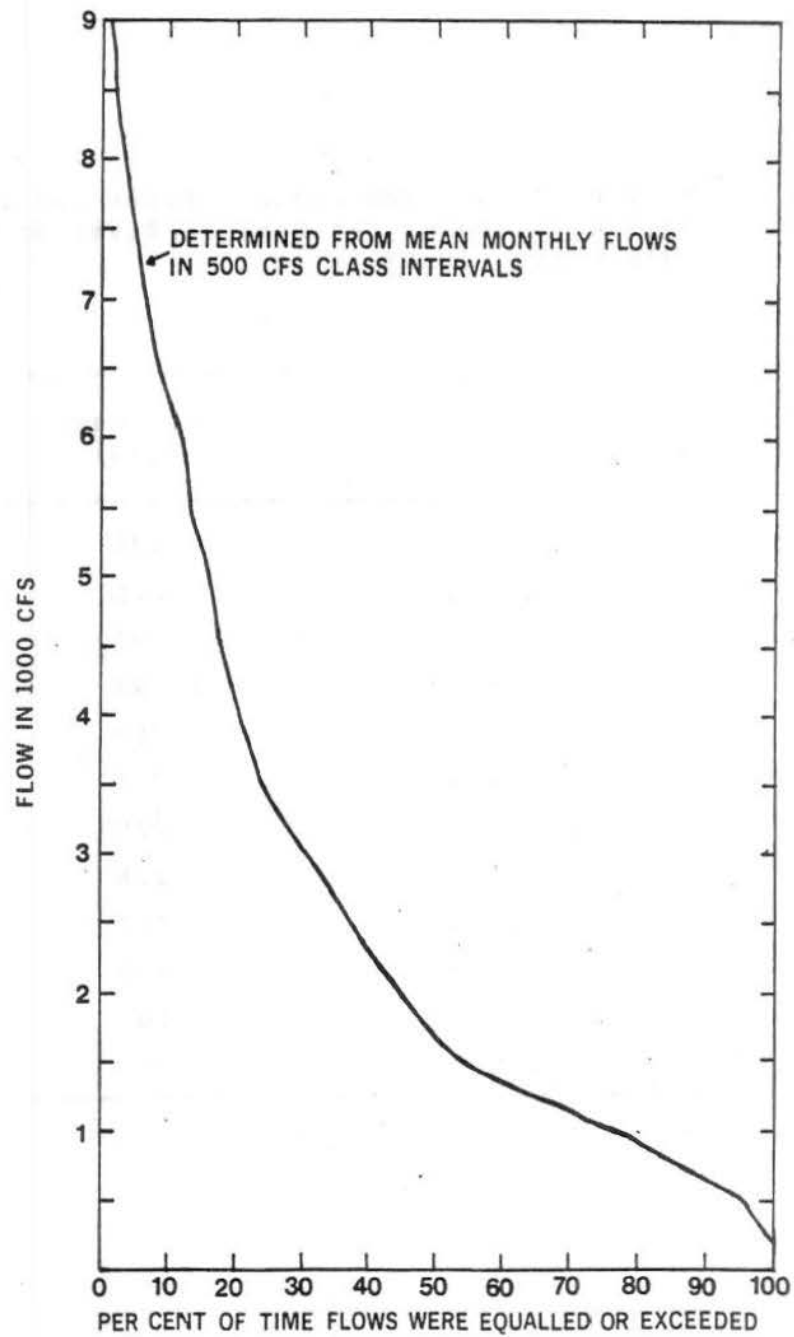


Figure 1-3. Flow duration curve for the Saco River at Cornish, Maine (1962-1982).

during the months of August, September, and October, whereas high flows typically occur from March through May (Table 1-1). Highest flows occur in April (median 8,900 cfs) and lowest flows occur in August (median 1,170 cfs).

The Saco River Basin has three major tributaries; the Swift, Ossipee, and Little Ossipee Rivers, accounting for 43.7% of the total 1,697-mi<sup>2</sup> drainage area. The Swift River originates on the north slope of Mt. Kancamagus and flows easterly for 24½ miles to its confluence with the Saco River at Conway, New Hampshire. It drains an area of 90 mi<sup>2</sup>, entirely in New Hampshire (Newell 1958).

The Ossipee River originates at the outlet of Ossipee Lake at Effingham Falls, New Hampshire and flows in an easterly direction for 18 miles to its confluence with the Saco River at Cornish, Maine (NHWSPPC 1975). It drains an area of 455 mi<sup>2</sup>.

The Little Ossipee River rises in Balch Pond at the New Hampshire-Maine border (NHWSPPC 1975). The river flows in an easterly direction for 33 miles to its confluence with the Saco River at East Limington, Maine. It drains an area of 187 mi<sup>2</sup>, most of which is in Maine.

The natural flow pattern in the Saco River Basin is affected by numerous dams and impoundments. Most of the nearly 200 impoundments are for recreational use; however, major hydroelectric facilities are also present. There are 17 principal obstructions in the Saco River Basin (Figure 1-4). Data regarding each of these obstructions are presented in Table 1-2. Most of the ten dams in the Saco River are used for hydroelectric generation. The hydroelectric facilities in the Saco River have a combined generating capacity of 86.742 megawatts (Mw).



Figure 1-4. Principal obstructions in the Saco River Basin.

Table 1-2. Principal Obstructions in the Saco River Basin.

Site No. (Fig 1-4)	Dam	River	Approx. head	Owner	Present Use	FERC License	Expiration Date	Generating Capacity (Megawatts)	Maximum Turbine Capacity (cfs)	Turbine Types
1	Cataract	Saco	44'	Central Maine Power Co. (CMP)	Hydro	#2528	1987	9.5	2000	Vertical Kaplan
2	Upper York <sup>1/</sup>	Saco	15'	CMP & Finance Authority of Maine	Hydro	(#2528)	--	1.040	525	Double Runner Horizontal Francis
3	Springs	Saco	5'	CMP	Storage	(#2528)	--	--	--	--
4	Bradbury	Saco	5'	"	"	(#2528)	--	--	--	--
5	Skelton	Saco	76'	"	Hydro	#2527	1993	24	3200	Vertical Kaplan
6	Bar Mills	Saco	22'	"	"	#2194	2005	5	3120	Vertical Francis
7	West Buxton	Saco	28'	"	"	#2531	1987	22.5	5016	Horizontal Francis, Vertical Fixed Propeller
8	Bonny Eagle	Saco	36'	"	"	#2549	1993	9	4632	Horizontal Francis
9	Hiram	Saco	77'	"	"	#2530	2022	12.3	2130	Vertical Francis
10	Swans Falls	Saco	13'	Swans Falls Corp.	Hydro	unlicensed	--	0.640	unknown	Vertical Francis
11	Ledgemere <sup>2/</sup> (The Flowage)	Little Ossipee	20'	L. and V. Smith <sup>3/</sup>	Hydro	(State Dep Lic# L-010699)	--	0.330	166	Horizontal Francis, Double Camel Back
12	Shapleigh	Little Ossipee	10'	undetermined	Storage	--	--	--	--	--
13	Balch Pond	Little Ossipee	6-8'	undetermined	Storage	--	--	--	--	--
14	Kezar Falls <sup>4/</sup> Lower	Ossipee	19'	Windham Elec. Co.	Hydro	unlicensed (proposed for license exemption)	--	0.550	371	Vertical Kaplan
15	Kezar Falls <sup>5/</sup> Upper	Ossipee	13'	" "	Hydro		--	0.350	403	Vertical Kaplan
16	Effingham	Ossipee	--	CMP	Hydro	unlicensed	--	0.857	--	--
17	Goodrich Falls	Ellis	--	Goodrich Falls Energy Corp	Hydro	unlicensed	--	0.675	--	--

Sources: Alexander 1984, Dominie 1984, NERBC 1980, 1981, NENYIAC 1954, Dube 1983, 1984, Guinan 1985, Russell 1985, Pierce 1985, and CMP undated.

<sup>1/</sup> Proposed expansion to 3 Mw and 1100 cfs, undetermined turbine type (CMP undated).<sup>2/</sup> Proposed decrease to 0.200 Mw and 154 CFS, new Francis (Pierce 1985).<sup>3/</sup> The Smiths also own a portion of Windham Electric Co. (Guinan 1985).<sup>4/</sup> Proposed expansion of 313 kw and hydraulic capacity of 295 cfs, vertical Kaplan (Dube 1984).<sup>5/</sup> Proposed expansion of 206 kw and 300 cfs, vertical Kaplan (Dube 1984).

The undeveloped hydrologic potential within the basin was reported in the hydropower expansion study by the New England River Basins Commission (1981). An undeveloped dam site exists on the Saco River at Steep Falls in Standish with a potential generating capacity of 2.515 Mw.

#### WATER QUALITY AND USE

The Saco River Basin has passed through the industrial revolution with few lasting impacts on water quality (NERBC 1980). The basin's water quality is generally excellent, primarily due to limited economic development in its middle and upper portions. Local problems exist, particularly in the coastal areas where urban development is concentrated.

Discharges from municipal treatment facilities containing both domestic and industrial wastes are the primary source of pollutants in the basin (NERBC 1980). These point sources are concentrated near the mouth of the Saco River with a few localized problems in the central and northern portions of the basin. It has been calculated that point sources discharge an average flow of 5.2 million gallons per day (mgd) into the Saco River (NERBC 1980). These discharges are monitored by the U.S. Environmental Protection Agency (EPA) which oversees permits under the National Pollutant Discharge Elimination System of the Clean Water Act of 1977.

The coastal towns also have substantial water quality problems due to combined storm and sanitary sewers (NERBC 1980). Several existing municipal wastewater treatment plants experience operating difficulties when combined wastewater and storm water inflow exceed their capacities. The result is untreated or only partially treated discharges. Many of the coastal streams also experience summer low flow conditions and lack the capacity to assimilate municipal waste discharges.

Typical nonpoint sources of pollution include urban and rural run-off, leachates from land disposal of solid and liquid wastes, agricultural run-off, sediment due to silvicultural activities, and road salt (NHWSPCC 1979). The majority of nonpoint sources are short-lived, localized problems and are generally not responsible for continuing water quality problems (NHWSPCC 1982).

Water quality information for the Saco River is available from New Hampshire's Water Supply and Pollution Control Commission and Maine's Department of Environmental Protection. Both states have prepared water quality management plans pursuant to Sections 303 (e) of Public Law 92-217, the Clean Water Act, as amended.

New Hampshire's present "Water Quality Management Plan" was published in 1979 (NHWSPCC 1979). This plan provides information on significant municipal, industrial and governmental discharges including National Pollutant Discharge Elimination System permit limitations and dates, and current discharges.

The Saco River Basin is part of Maine's tripartite "Water Quality Management Plan". It was first published in 1976 with the revised plan slated for release in mid-1980. Due to cutbacks in personnel, the revised plan has been delayed and there is no estimated date for publication (Nunan 1985). The updated plan should provide the same information as described for New Hampshire's plan.

Both Maine and New Hampshire monitor water quality through a network of state and federal stations (NERBC 1980). At the federal level, the EPA maintains a National Water Quality Surveillance System with a station located in the Saco-Biddeford area basin, and a data handling system for water quality monitoring data (STORET). In addition, the USGS conducts water quality analyses at its station on the Saco River at Cornish, Maine. Representative

monthly water temperatures at this station are presented in Figure 1-5.

Water quality of the Saco River Basin in New Hampshire is monitored at approximately 180 locations (NHWSPCC 1979). Many of these stations were established for very localized and specific purposes such as the initial analyses for legal classification. Appendices A through C of New Hampshire's 1979 "Water Quality Management Plan" provide 1975-1977 data collected at many sampling stations in the basin. These stations are part of New Hampshire's Primary Monitoring Network for long-term trend monitoring data. The Maine Department of Environmental Protection established a Primary Monitoring Network in the basin and administers a volunteer water quality monitoring program of lakes in the area.

Present water quality classification of surface waters is legislatively mandated by the Clean Water Act. Maine's fresh water classification system is composed of five standards ranging from poor water quality (D) to excellent (A). New Hampshire's classification system is composed of 3 standards ranging from Class C to Class A. Maine's and New Hampshire's water use classifications and water quality standards are described in Appendices B and C respectively.

Water quality in New Hampshire and Maine is generally designated as Class B waters or above. The few areas with water quality degradation below a classification of "B" are from discharges primarily associated with small village centers. Maine has designated the tidal waters in the Saco-Biddeford area as Class SB-2 or SC (Appendix B).

The water supply in the Saco River Basin is presently able to meet the water demands of its estimated 84,380 residents and its industries (NERBC 1980). Water is also transferred out-of-basin



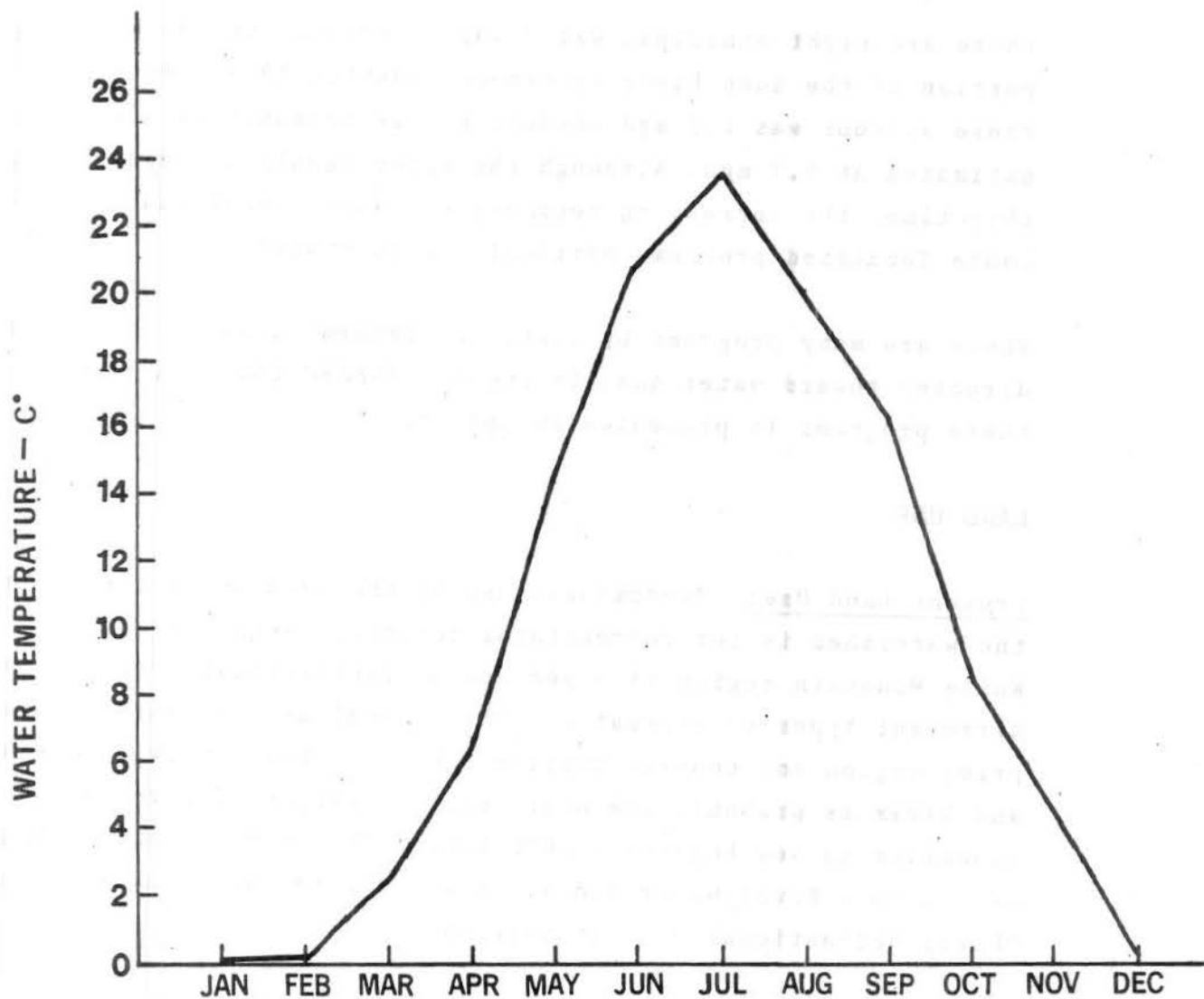


Figure 1-5. Representative monthly water temperatures in the Saco River at Cornish, Maine (1975-1982).

to the Kennebunk, Kennebunkport, and Wells Water Districts of southern Maine. The attractive environment for recreational development throughout the basin, and the coastal belt's favorable conditions for urban and industrial development are expected to generate increased demands for water supply.

There are eight municipal water supply systems in the New Hampshire portion of the Saco River Watershed (NHWSPPCC 1979). Water use from these systems was 2.1 mgd whereas a safe consumptive yield is estimated at 5.7 mgd. Although the water supply is adequate at this time, the increasing recreational development and use may cause localized problems particularly in summer.

There are many programs by state and federal agencies that are directed toward water quality and use (NERBC 1980). A summary of these programs is presented in Appendix D.

#### LAND USE

Present Land Use: Predominant use of the land and waters within the watershed is for recreational purposes (NERBC 1980). The White Mountain region is a year-round recreational area for many different types of recreation. The coastal area is amidst Maine's prime region for coastal tourism. The Saco River between Conway and Hiram is probably the most popular section of river for canoeists in New England (SMRPC 1983). The recreational aspects of the Saco River Watershed are covered in greater detail under "River Recreational Use" in Section 3.

In a cooperative study report completed in 1983 by the United States Department of Agriculture (USDA), land uses within the Saco River Watershed were divided into five categories; cropland, grassland, forestland, urban and built-up, and other land (eg. lakes, wetlands). The percentages of each category of land use

within the watershed is shown in Table 1-3. Categorical use by town is shown in Table 1-4. Large color-coded maps showing land use by town are available for review at the office of the USDA Soil Conservation Service, 44 Main Street, Conway, New Hampshire (Felice 1984).

TABLE 1-3. Categories of Land Use and percent use within the watershed (USDA 1983).

Category	Percent Use
Forest Land	89.2
Other Land	4.6
Urban and Built-up	2.9
Grassland	2.5
Cropland	0.8

Over 89% of the Saco River Watershed is forested (USDA 1983) but the pattern of ownership is an obstacle to increased forest production (NERBC 1980). With the exception of the White Mountain National Forest, much of the forested land is held by private owners whose interest preclude the harvest of timber. Ownership by forest industries is minimal.

Agriculture is prevalent in open areas of the valleys and corridors associated with the flood plains (NHWSPCC 1979). The agricultural center of the watershed is in Fryeburg, Maine, which contains some of the most productive agricultural land in the state (SREAC 1973). Dominant agricultural industries in Fryeburg are dairy farms, poultry farms, vegetable farms, and fruit farms (NERBC 1980). There is also some agricultural land use in the lower portion of the Saco River Basin (SREAC 1973).

TABLE 1-4. Present land use by town for the Saco River Basin(in acres) (USDA 1983).

MAINE	TOWN	CROPLAND	GRASSLAND	FORESTLAND	URBAN & BUILT-UP	OTHER LAND	TOTAL
<b>Cumberland County</b>							
	Baldwin	118	632	21,760	110	206	22,826
	Bridgton	--	250	8,862	--	150	9,262
	Sobase	--	161	4,499	--	36	4,696
	Standish	92	1,101	17,308	800	1,635	20,936
	<b>Subtotals</b>	<b>210</b>	<b>2,144</b>	<b>52,429</b>	<b>910</b>	<b>2,027</b>	<b>57,720</b>
<b>Oxford County</b>							
	Batchelder's Grant	--	--	2,538	--	--	2,538
	Brownfield	68	1,141	28,185	286	128	29,808
	Denmark	38	466	26,439	115	2,605	29,663
	Fryeburg	3,283	601	34,327	733	3,660	42,604
	Hiram	255	943	23,233	206	382	25,019
	Lovell	12	750	26,876	186	3,872	31,696
	Mason	--	--	512	--	--	512
	Porter	98	838	18,626	398	1,126	21,086
	Stow	280	356	15,436	--	--	16,072
	Stoneham	--	95	15,080	--	134	15,309
	Sweden	--	265	11,702	20	405	12,392
	Waterford	--	5	2,443	--	206	2,654
	<b>Subtotals</b>	<b>4,034</b>	<b>5,460</b>	<b>205,397</b>	<b>1,944</b>	<b>12,518</b>	<b>229,353</b>
<b>York County</b>							
	Acton	--	45	2,272	--	139	2,456
	Alfred	--	15	356	--	--	371
	Arundel	81	638	3,536	120	144	4,519
	Biddeford	54	1,701	8,139	2,515	239	12,648
	Buxton	70	1,330	9,704	322	339	11,765
	Cornish	309	688	13,232	119	71	14,419
	Dayton	262	2,107	9,331	52	88	11,840
	Hollis	160	1,519	19,028	396	232	21,335
	Limerick	236	938	15,910	675	420	18,179
	Limington	496	1,218	25,401	240	501	27,856
	Lyman	12	212	9,929	6	430	10,589
	Newfield	15	555	20,325	269	480	21,644
	Personfield	417	1,092	36,329	183	547	38,568
	Saco	215	1,991	6,959	1,545	608	11,318
	Shapleigh	29	206	12,313	167	373	13,088
	Waterboro	74	771	24,691	1,597	681	27,814
	<b>Subtotals</b>	<b>2,430</b>	<b>15,026</b>	<b>217,655</b>	<b>8,206</b>	<b>5,292</b>	<b>248,609</b>
	<b>Maine Subtotals</b>	<b>6,672</b>	<b>22,630</b>	<b>475,481</b>	<b>11,060</b>	<b>19,837</b>	<b>535,680</b>
<b>NEW HAMPSHIRE</b>							
<b>Carroll County</b>							
	Albany	--	50	46,950	230	1,410	48,640
	Bartlett	60	350	41,368	3,030	440	45,248
	Chatham	10	360	35,314	120	1,060	36,864
	Conway	1,210	1,280	35,688	5,840	2,830	46,848
	Easton	230	220	15,530	190	1,110	17,280
	Effingham	10	210	20,924	370	4,150	25,664
	Freedom	50	460	19,180	2,160	2,790	24,640
	Hale's Location	--	--	1,480	60	60	1,600
	Hart's Location	--	--	11,256	40	160	11,456
	Jackson	--	200	40,577	2,350	210	43,337
	Madison	80	180	19,980	2,720	3,280	26,240
	Ossipee	110	130	38,866	2,150	7,100	48,356
	Sandwich	--	410	30,782	120	1,220	32,532
	Tamworth	80	780	35,118	710	2,020	38,708
	Others 1/	20	60	101,197	1,280	2,350	104,907
	<b>New Hampshire Subtotals</b>	<b>1,860</b>	<b>4,690</b>	<b>494,210</b>	<b>21,370</b>	<b>30,190</b>	<b>552,320</b>
	<b>SACO RIVER BASIN TOTAL</b>	<b>8,532</b>	<b>27,320</b>	<b>969,691</b>	<b>32,430</b>	<b>50,027</b>	<b>1,088,000</b>

1/ Includes parts of 15 towns in Carroll, Coos and Grafton Counties with small acreages in the Saco River Basin and 2 towns in Coos County that are within the White Mountain National Forest.

Development is heavy near the mouth of the river and is expanding inland (NERBC 1980). The coastal portion of the watershed is part of the fastest growing region in Maine. With the exception of Conway, New Hampshire, development in the middle and upper portion of the watershed is minimal. Conway is the center for recreational use of the eastern slopes of the White Mountains and is the site of considerable second home and recreational development.

Mineral extraction within the watershed is primarily in sand and gravel (NERBC 1980). Other mineral deposits are either too small or insufficiently concentrated to warrant extraction (USDOIBOM 1976). According to Hitchcock et al. (1878) several mines were active in the New Hampshire portion of the watershed during the mid-to-late nineteenth century; the Eaton lead and silver mine in southwest Madison, a tin mine in Jackson, and an iron mine on Iron Mountain in Bartlett. The Bartlett mine contained the largest deposit of workable iron ore ever found in New Hampshire.

Land Use Controls: Haskell (1969) prepared an extensive report on the Saco River Corridor and expressed the need for management of its resources. The uniqueness of these resources was officially recognized in April of 1971 by the State of Maine (SREAC 1973). The legislature passed an act to create the Saco River Environmental Advisory Committee (SREAC) whose purpose was to prepare a plan for the immediate and long-range protection and development of the Saco River Corridor. Responses to Committee questionnaires by landowners indicated a strong desire throughout the basin for land use controls.

As a result of the Saco River Environmental Advisory Committee's recommendations to the governor, the Saco River Corridor Commission was established (SRCC undated). The Commission is comprised of a member and alternate from each of the twenty communities in the Corridor. The Commission regulates the use of

land abutting the Saco, Ossipee and Little Ossipee Rivers. The land under their jurisdiction is known as The Corridor. It includes all the land within 500 ft of each side of the river or the 100-year flood plain whichever is greater up to a maximum of 1,000 ft. In addition to controls by the Saco River Corridor Commission, there are also controls on wetlands and flood plains by state and local agencies (SMRPC 1983).

New Hampshire does not have an agency like the Corridor Commission (SMRPC 1983). Controls affecting development in the flood plain are under State or local laws. As of 1983, Conway was the only town directly in the river corridor to have a Flood Plain Ordinance.

#### FLOODING

The New England River Basins Commission provides a descriptive summary of flooding in the Saco River Basin (NERBC 1980).

"Riverine flooding in the Saco River basin is strongly affected by topography. The mountainous portion of the upper basin with its narrow valleys produces abundant runoff from snowmelt and heavy rain, primarily in the spring. The Saco River flood plain, from the State border at Fryeburg downstream to Hiram, Maine provides extensive natural valley storage for flood water. The river reaches flood stage very rapidly in this area due to rapid runoff from the steep terrain in the upper basin and the relatively flat river gradient in this area. Broad flood plains in Fryeburg and the narrow, steep-walled valley in Hiram combine to provide storage for nearly 200,000 acre-feet of water, lessening the impact of flood flows on the major population centers downstream in Saco and Biddeford."

Annual flood damages in the Saco River Basin are not large (NERBC 1980). When major flooding does occur, principal damages are in the Saco-Biddeford area and to a lesser degree in Hiram, Kezar Falls in Fryeburg, Ossipee, and along the shoreline of various lakes (USACOE 1967). A study by the United States Army Corps of Engineers in 1967 concluded that costs for flood control structures in the Saco River Watershed were not justifiable (SREAC 1973).

Studies regarding flood plain management in the Saco River Watershed have been made by the U.S. Army Corps of Engineers and the Soil Conservation Service (NERBC 1980). A flood plain study for the Town of Fryeburg, Maine has been completed by the U.S. Army Corps of Engineers (USACOE 1971). The Soil Conservation Service has conducted flood hazard analyses for each of the six towns abutting the Little Ossipee River in Maine, and for the towns of Bartlett and Conway in New Hampshire (NERBC 1980). Reports of their findings for Bartlett and Conway are available at the town offices of the respective towns (USDASCS 1974, USDASCS 1975a).

## EROSION

Cropland and Forestland: The USDA (1983) reports the average annual soil loss that can be sustained in the Saco River Basin without damaging the soil base is three tons/acre/year. The average annual soil losses in the Maine portion of the watershed are below three tons/acre/year. Average erosion figures for New Hampshire exceed three tons/acre/year in some areas. The towns of Bartlett, Conway, Freedom, Ossipee, Effingham, and Chatham, New Hampshire have average annual soil losses ranging from 3.7 to 16 tons/acre/year. Most of this erosion is from cropland.

Streambank: The USDA (1983) estimates that approximately 17.8 miles of riverbanks along the Saco River have erosion problems.



These 17.8 miles of riverbanks contribute between 55,000 and 70,000 tons of sediment annually. Eight of the 17.8 miles of riverbanks are in New Hampshire and they contribute between 25,000 and 30,000 tons of sediment annually (USDASCS 1975b). The remaining 9.8 miles are in Maine and soil losses from these range between 30,000 and 40,000 tons per year (USDA 1983). Specific sites of eroded riverbanks in New Hampshire are available at the office of the USDA, Soil Conservation Service, Conway, New Hampshire (Felice 1984).

#### LAKES (OR PONDS)

General: Based on listings by Cowing and Caracappa (1978) and Hoover (1937), there are 300 ponds within the Saco River Watershed. This text will only address the 171 named ponds that are greater than or equal to ten acres. Although these ponds will be referred to as "great ponds" within this text, this term does not construe a legal definition of a "great pond" for either Maine or New Hampshire. Unless used as a lake name, the terms "lake" and "pond" are used synonymously throughout the text.

Approximately 70% (120) of the great ponds within the basin are shallow warm-water ponds less than 100 acres. Of the remaining 51 ponds, 23 are less than 200 acres and only 15 are over 500 acres. Of the 171 great ponds within the watershed, 111 are in Maine and 60 are in New Hampshire.

Maine: Tables with information on physical characteristics of each of the great ponds in Maine may be seen in Appendix E. These tables also indicate the map numbers for each lake for ordering purposes. Copies of the lake maps are available through the Maine Department of Inland Fisheries and Wildlife, 284 State Street, Station 41, Augusta, Maine 04333. Appendix E also includes a supplementary listing that shows the occurrence of



sport fish in surveyed lakes in the Saco River Watershed in Maine. This supplementary listing includes lakes smaller than 10 acres and does not include all of the great ponds.

New Hampshire: Tables showing physical characteristics of each of the great ponds in the Saco River Watershed in New Hampshire may be seen in Appendix F. Survey maps of New Hampshire lakes were published in 1960 in a report by Arthur E. Newell entitled "Biological Survey of the Lakes and Ponds in Coos, Grafton, and Carroll Counties, Survey Report 8A." This report is out of print but copies are available for viewing at the USFWS office in Laconia, New Hampshire and at the NHF&GD in Concord, New Hampshire. Also available at each of these offices is a report entitled "Biological Survey of the Androscoggin, Saco and Coastal Watersheds by Earl E. Hoover (1937) which contains tabular and verbal descriptions of many of the New Hampshire lakes, including game species present. More recent data on lake surveys within the White Mountain National Forest were compiled by Jerry Marancik of the U.S. Fish and Wildlife Service (USFWS) in the late 1970's. His unpublished data are available at the USFWS office in Laconia, New Hampshire. The New Hampshire Fish and Game Department is now in the process of updating old lake surveys (Wheeler 1985). New surveys for the counties within the Saco River Basin are not available at this time.

#### Water Quality and Use:

General: Responsibilities for the lake programs within the Saco River Watershed lie with various divisions of the Maine Department of Environmental Protection, Augusta, Maine, and the New Hampshire Water Supply and Pollution Control Commission, Concord, New Hampshire. A summary of their responsibilities in lake programs is presented in Appendix D.

New Hampshire: Use classifications for each of the lakes over 20 acres within the New Hampshire portion of the Saco River Basin are presented in Appendix F. All have "B" classifications except Upper Beach Pond (Alpine Pond), Wolfboro; Dan Hole Ponds, Tuftonboro-Ossipee; Mountain Pond, Chatham; and White Lake, Tamworth, which have "A" classifications (NHWSPPC 1979).

The New Hampshire Water Supply and Pollution Control Commission undertook a study in 1976 to determine the trophic status of lakes over 20 acres in size (NHWSPPC 1979). All of the lakes studied within the Saco River Basin were found to be in the oligotrophic to mesotrophic range. The trophic classification of each of the lakes is presented in Appendix F. Due to eutrophication processes, water quality has been affected in several of the lakes in New Hampshire. Those having high priorities for restoration include Pea Porridge Pond, Madison; Loon Lake, Freedom; and Duncan Lake, Ossipee (NHWSPPC 1982).

In a recent study of 171 lakes and ponds throughout the State of New Hampshire, alkalinities were measured to determine vulnerabilities to acid rain (NHWSPPC 1982). Approximately 46% were found to have alkalinities equal to or less than 5.5 mg/l. The alkalinity in White Lake, a 123-acre lake in Tamworth was 1.0 mg/l and registered a pH of 5.5. This lake is on the high priority list of the NHWSPPC for preservation of its water quality.

Maine: There are now two classifications of water quality for Maine lakes; GPA and GPB (Dennis 1985). The GPA classification means the lake has no algal blooms, whereas the GPB classification means the lake has algal blooms. All lakes that have been classified in the Saco River Watershed have GPA classifications. Legislation is now pending to change the number of water quality classifications for lakes from two to one.

## Section 2

### FISHERIES

#### ANADROMOUS FISH

General: The six species of anadromous fish that are known to have utilized the Saco River are listed in Table 2-1. Scientific names are based on Robins et al. (1980). With the exception of the striped bass, all have used the Saco River for spawning (Flagg 1985). Life histories of the six species may be found in "Fishes of the Gulf of Maine" by H. Bigelow and W. Schroeder (1953) and in "An Investigation of Some Environmental Impacts for Possible Discussions of Flows from the Merrimack River" by the U.S. Army Corps of Engineers, Wellseley Hills, Massachusetts (1974).

TABLE 2-1. Anadromous fish of the Saco River (Dube 1983, 1984).

Common Name	Scientific Name
Alewife	<u>Alosa pseudoharengus</u>
American shad	<u>Alosa sapidissima</u>
Atlantic salmon	<u>Salmo salar</u>
Blueback herring	<u>Alosa aestivalis</u>
Rainbow smelt	<u>Osmerus mordax</u>
Striped bass	<u>Morone saxitalis</u>

Historical accounts of anadromous fish in the Saco River are scarce (Dube 1983). By the time the river was appraised by the U.S. Fish Commissioners in the late 1860's, runs of anadromous fish were

severely depleted or extinct. According to Foster and Atkins (1868), alewives, American shad, Atlantic salmon, and striped bass were common to the Saco River but their former levels of abundance were not documented. Chinook salmon (Oncorhynchus tshawytscha) were stocked in the Saco watershed by the New Hampshire Fish and Game Department in the late 1800's (Hoover 1937) but there is no record that they ever reached Maine (Flagg 1985).

Atlantic Salmon: According to Goode (1887) all anadromous fish except Atlantic salmon were stopped at the head of tide (Factory Island, Saco-Biddeford) by the natural falls which occurred there. Atlantic salmon were able to negotiate the falls and they have been reported by Foster and Atkins (1869) to have migrated upriver as far as Hiram Falls where many were taken. Foster and Atkins (1868) noted that some Atlantic salmon were able to negotiate the difficult natural falls at Hiram and Swans Falls and were able to use the spawning habitat in New Hampshire. Salmon were also known to frequent the Ossipee and Little Ossipee Rivers although no estimate of numbers are available (Foster and Atkins 1869). Foster and Atkins (1868) stated that these two rivers were fine salmon streams to their headwaters in New Hampshire.

With the construction of dams along the Saco River main stem and industrial pollution in the Saco-Biddeford area, the demise of the salmon run was inevitable. Dams were listed at seven different locations on the Saco main stem in 1869 by the Commissioners of Fisheries of the State of Maine (Foster and Atkins 1869). They also reported that tar from the refuse of a gas house in Biddeford often washed into the river after a rain causing great numbers of fish to be killed. Although exact dates of the salmon's demise in the Saco River are not available, Foster and Atkins reported:

"It is very sure that salmon have not been plenty for eighty years; and that at no time for the last sixty years have they been so abundant that a man could take more than five or six in a day at the Saco Falls. For many years they have been entirely extinct. The last taken at Salmon Falls was in 1843."

An unsuccessful effort to restore salmon to the Saco River was undertaken in the late 1870's through the early 1880's when fry were released into the Saco River in both Maine and New Hampshire (Stilwell and Stanley 1886). In 1974, 36,500 spring yearling landlocks with furunculosis were stocked into the Saco River, followed in 1975 with 9500 smolts, also with furunculosis (Dube 1983). It was reported that numerous salmon were seen and a few angled in 1977 in the area between the Saco-Biddeford dam and the estuary. Numerous sightings and a few catches also occurred in 1982 but it is unknown whether the salmon observed or caught in that year were progeny of the adults that returned in 1977 or whether they were strays from a record 682,000 smolts released in 1980 throughout eight different river systems in Maine.

Because of public interest in restoring salmon to the Saco River, fall parr releases were made in 1982 in Limington, Steep Falls, Hiram Falls, the Ossipee River, and the Little Ossipee River totaling 47,100 fish (Dube 1983). In 1983, 20,000 smolts were stocked in the Saco River below Skelton Dam, followed in 1984 with an additional 5,100 smolts. In the spring of 1985, 5,100 smolts and 23,600 parr were released into the Saco River. In April of 1986, 35,200 smolts were stocked into the Saco River drainage followed by 10,000 parr in May. The reported rod catch for 1985 was 79 salmon (MEASRSC 1985). Returning adult Atlantic salmon have recently been observed as far upriver as the West Buxton Dam (mi 25.5).

American shad: Historical records show that American shad utilized the lower portion of the Saco River below Biddeford. A commercial gill net fishery for shad existed below the Saco-Biddeford falls in the 1850's and early 1860's (Foster and Atkins 1869) but numbers of shad diminished rapidly in the 1860's due to the pollution of the river with dyes from cotton and woolen mills (Foster and Atkins 1868). In 1950, the Saco River was surveyed for shad and none were found (Taylor 1951). Fisherman in the area stated they had not seen shad in recent years and attributed their absence to pollution from textile mills. American shad have since reestablished themselves and presently reproduce in the lower Saco River (Flagg 1985). They do not constitute a significant resource and are occasionally taken as an incidental catch by alewife fishermen.

Alewives and Blueback Herring: Alewives have historically been common to the Saco River (Foster and Atkins 1868) and were occasionally dip-netted in the late nineteenth century (Goode 1887). There is presently a gill net fishery for alewives near the Saco-Biddeford dams for use as lobster bait (Flagg 1984). Information on blueback herring is lacking but Flagg (1985) noted that with few exceptions alewives predominate in most of Maine's rivers.

Rainbow Smelt: There was a commercial fishery for smelt in the late nineteenth century using hook and line (Goode 1887). Most were taken approximately two miles below Factory Island. In the winter of 1879-1880 an estimated catch of approximately 6,250 pounds of smelt of superior size and quality were taken by 25 men. Anadromous rainbow smelt were known to inhabit the waters below Cataract Dam until the mid-1940's, but their present status is unknown (Flagg 1985). Some anglers still fish for them (Dube 1983).



Striped Bass: Striped bass were plentiful and heavily fished in the 1850's (Foster and Atkins 1869), Goode 1887). However, Foster and Atkins reported in 1869 that no bass had been taken from the Saco River in eight years. The fishery has since been restored and the Saco River is the most extensively fished area along the central Maine coast for striped bass (Otto 1971). The stocks for this fishery originate from the mid-Atlantic states (Flagg 1984). There is no striped bass reproduction in the Saco River (Flagg 1985).

Atlantic and Shortnose Sturgeon: Although the Saco River is within the known geographical distribution of the Atlantic sturgeon (Acipenser oxyrinchus) and the shortnose sturgeon (Acipenser brevirostrum) (Bigelow and Schroeder 1953, Scott and Crossman 1973), there are no verified collections of either species from the Saco River (Flagg 1984). High salinities in the lower reaches of the Saco River and inaccessability to fresh water prohibit the spawning of these species in the Saco River. However, Atlantic sturgeon are occasionally taken by commercial gill net fishermen in winter just outside of the mouth of the Saco River (Flagg 1985).

Sea Lamprey: There are no reports of sea lamprey (Petromyzon marinus) in the Saco River although they are found in numerous rivers north and south of the Saco River (Flagg 1985). Sea lampreys were reported by Cooper (1939) to be in every coastal Maine tributary from the New Hampshire border up to and including Little River which lies approximately three miles south of the Saco River. Flagg (1984) stated that lamprey are now present in the Mousam and Kennebunk Rivers which are less than 10 miles south of the mouth of the Saco River.

### Present and Projected Use by Anadromous Species:

Present: According to Flagg (1985) American shad, alewives, blueback herring, and Atlantic salmon are known to reproduce in the Saco River. With the exception of the Atlantic salmon, these species are restricted to the waters below the Upper York and Cataract Dams in Saco and Biddeford. There are no known spawning populations of striped bass in the Saco River. The striped bass fishery is supported by stocks from mid-Atlantic states. The present status of spawning by rainbow smelt in the Saco River is unknown.

Except for Atlantic salmon, the only tributaries now accessible to anadromous species are Moors, Dungeon, and West Brooks in Biddeford, Maine. The amount of spawning by anadromous fish in these brooks is unknown (Flagg 1985).

Projected: Once fish passage facilities have been provided at existing barriers, anadromous fish will have the opportunity to expand their breeding grounds. Rainbow smelt are not likely to use fish passage facilities. Striped bass are expected to use coastal facilities only. The remaining four species will use passage facilities to varying degrees. Atlantic salmon could migrate into New Hampshire spawning areas.

The anadromous species when considered as a group will use the Saco River Basin throughout the year (Figure 2-1). They use it in their upriver migration to spawn, as a nursery area for their young and for emigration as juveniles and adults.

### CATADROMOUS FISH

American Eel: The only catadromous fish in the Saco River Watershed is the American eel (Anguilla rostrata) (Dube 1983).



Species	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec
Blueback Herring	A					UR	DR					
	J							DR				
Alewife	A				UR	DR						
	J							DR				
American Shad	A					UR	DR					
	J							DR				
Atlantic Salmon	A		DR				UR				DR	
	J			DR						DR		
Rainbow Smelt	A			UR	DR							UR
	J			DR								
Striped Bass	A						Feeding					
	J					None						
Menhaden	A						Feeding					
	J					None						

A = Adult  
J = Juvenile

UR = Upriver  
DR = Downriver

Figure 2-1. Fish migration periods in the Saco River (Squiers 1985).

During the mid-1970's there was a dip-net fishery for juvenile eels (elvers) at the east and west channels of Factory Island (Flagg 1984). The elvers were shipped live to Japan for rearing. This fishery declined in the late 1970's and there is no elver fishery in the Saco River now. Eel pots are presently used both in the estuary (Flagg 1984) and in the impoundment between Springs Island and Skelton Dam (Pierce 1984). The life history of the American eel can be found in "Freshwater Fishes of Canada" by W.B. Scott and E.J. Crossman (1973).

#### ESTUARINE AND MARINE FISHES

General: There have been no comprehensive studies of the flora and fauna of the Saco River estuary (Flagg 1984, Jurgen 1984). Table 2-2 lists the estuarine and marine species of the Saco River system. Scientific names are based on Robins et al. (1980). Life histories of these species can be found in "Fishes of the Gulf of Maine" by H. Bigelow and W. Schroeder (1953).

TABLE 2-2. Estuarine and marine species of the Saco River system (Dube 1983 unless otherwise noted).

Common Name	Scientific Name
American sand lance	<u>Ammodytes americana</u>
Atlantic herring	<u>Clupea harengus</u>
Atlantic mackerel	<u>Scomber scombrus</u>
Atlantic menhaden	<u>Brevoortia tyrannus</u>
Atlantic pollock	<u>Pollachius virens</u>
Atlantic silversides	<u>Menidia menidia</u>
Atlantic tomcod	<u>Microgadus tomcod</u>
Bluefish	<u>Pomatomus saltatrix</u>
Mummichog	<u>Fundulus heteroclitus</u>
Ninespine stickleback	<u>Pungitius pungitius</u>
Threespine stickleback	<u>Gasterosteus aculeatus</u>
White perch <sup>1/</sup>	<u>Morone americana</u>
Winter flounder <sup>2/</sup>	<u>Pseudopleuronectes americanus</u>

<sup>1/</sup> Flagg 1985

<sup>2/</sup> NERBC 1980

## FRESHWATER FISHES

General: Table 2-3 lists the reported freshwater species of fish in the Saco River Watershed. Scientific names are based on Robins et al. (1980). Life histories of the game fishes can be found in "Fishes of Maine" 4th ED., by W. Harry Everhart (1976) and in "Freshwater Fishes of Canada" by W.B. Scott and E.J. Crossman (1973).

TABLE 2-3. Reported freshwater fishes of the Saco River Watershed (Hoover 1937, Seamans 1959, Dube 1983).

Common Name	Scientific Name
Banded killifish	<u>Fundulus diaphanus</u>
Black crappie	<u>Pomoxis nigromaculatus</u>
Blacknose dace	<u>Rhinichthys atratulus</u>
Blacknose shiner	<u>Notropis heterolepis</u>
Bridle shiner	<u>Notropis bifrenatus</u>
Brook stickleback	<u>Culaea inconstans</u>
Brook trout	<u>Salvelinus fontinalis</u>
Brown bullhead	<u>Ictalurus nebulosis</u>
Brown trout	<u>Salmo trutta</u>
Burbot	<u>Lota lota</u>
Chain pickerel	<u>Esox niger</u>
Common shiner	<u>Notropis cornutus</u>
Creek chub	<u>Semotilus atromaculatus</u>
Creek chubsucker	<u>Erimyzon oblongus</u>
Fallfish	<u>Semotilus corporalis</u>
Finescale dace	<u>Phoxinus neogaeus</u>
Golden shiner	<u>Notemigonus crysoleucas</u>
Lake chub	<u>Couesius plumbeus</u>
Lake trout	<u>Salvelinus namaycush</u>
Lake whitefish	<u>Coregonus clupeaformis</u>
Landlocked salmon	<u>Salmo salar</u>
Largemouth bass	<u>Micropterus salmoides</u>
Longnose sucker	<u>Catastomus catastomus</u>
Ninespine stickleback	<u>Pungitius pungitius</u>
Northern redbelly dace	<u>Phoxinus eos</u>
Pumpkinseed	<u>Lepomis gibbosus</u>
Rainbow trout	<u>Salmo gairdneri</u>
Slimy sculpin	<u>Cottus cognatus</u>
Smallmouth bass	<u>Micropterus dolomieu</u>
Threespine stickleback	<u>Gasterosteus aculeatus</u>
White perch	<u>Morone americana</u>
White sucker	<u>Catostomus commersoni</u>
Yellow perch	<u>Perca flavescens</u>

The Saco River Watershed contains a diversity of both coldwater and warmwater species of fish. Generally, the warmwater species predominate shallow lakes and the impoundments, and coldwater species predominate the large, deep lakes and the faster flowing and colder waters of the main stem and its tributaries. Burbot are common in the Saco River and many of the tributaries in Maine (Pierce 1984).

The New Hampshire Fish and Game Department stocks brook, brown, and rainbow trout in lakes, rivers, and streams of the Saco River Watershed and also stocks landlocked Atlantic salmon in several of the major lakes (Bresosky 1984). Stocking by the Department in the Saco main stem are confined to brook and brown trout only.

According to Hoover (1937), Dan Hole Pond in Ossipee and Tuftonboro, New Hampshire was one of four original waters containing Sunapee trout (Salvelinus alpinus). This species is no longer known to occur within the Saco River Watershed (Bresosky 1984). Stocking of Sunapee trout in Dan Hole Pond terminated after 1946 and management of the pond has shifted to landlocked salmon. Although a dead adult Sunapee trout was found in Sawyer Pond, Livermore, New Hampshire in the 1960's, gill netting in 1983 failed to yield any Sunapee trout.

The Maine Department of Inland Fisheries and Wildlife stocks four species of fish in the Saco River Watershed; brook trout, brown trout, lake trout, and landlocked Atlantic salmon (MEDIF&W 1984). Landlocked salmon and lake trout are stocked only in lakes. Many of the colder streams have native populations of brook trout and naturally reproducing populations of brown trout (Boland 1984). The Saco River was stocked with yearling brown trout from the mid-1960's to 1982 (Pierce 1985). Brook trout have been stocked occasionally with

the latest releases made in Fryeburg in 1983. No stocking in the Saco River has occurred since 1983.

Common carp (Cyprinus carpio) are not known to occur in the Saco River Watershed (Pierce 1984). They are, however, found in the Scarborough River Marsh which lies approximately six miles north of the mouth of the Saco River in Scarborough.

#### RIVER HABITAT

Habitat is the environment in which an organism lives or grows. This environment contains many habitat features that are necessary for the organism throughout its various life stages. Habitat features for fish species of the Saco River Watershed include water quality, depth, velocities, substrate types, pools, and cover. Important water quality factors are dissolved oxygen, pH, temperature, turbidity, and salinity. Low pH, low oxygen levels, high temperatures, high turbidity, or high salinity may limit or prohibit a species' growth and reproduction. Water depth is particularly critical after spawning when decreases in depth can result in the dewatering of redds and extensive mortalities of eggs. A decrease in water depth also narrows the area available to fish, thereby increasing predation and competition. Velocity and substrate preferences vary between and within species at different life stages. As an example, alewives spawn in ponds and sluggish sections of the river over a silt or mud bottom, whereas Atlantic salmon require higher velocities and a gravel substrate. As Atlantic salmon parr grow, they prefer even higher velocities and rubble to boulder substrates. Pools are important refuge areas for many species of fish during low water periods. They also provide year-round habitat for species such as the smallmouth bass and are used as holding and resting areas by anadromous species such as Atlantic salmon. Cover is required

by juvenile and adult species of fish to escape predation and adverse environmental conditions. Among the important cover types are overhanging and instream vegetation, logs, boulders, undercut banks, debris piles, deep pools, and surface turbulence.

#### HABITAT ASSESSMENTS

Recent surveys of portions of the Saco River and its tributaries were conducted in a cooperative effort by personnel of the Maine Department of Inland Fisheries and Wildlife (MEDIF&W), Gray, Maine; the Maine Atlantic Sea Run Salmon Commission (MEASRSC), Bangor, Maine; and the U.S. Fish and Wildlife Service (USFWS), Laconia, New Hampshire. Detailed survey data for the Maine portion of the watershed are on file at the Maine Department of Inland Fisheries and Wildlife, 328 Shaker Road, Gray, Maine 04039. The New Hampshire survey data are on file at the U.S. Fish and Wildlife Service, Federal Building, Room 124, Laconia, New Hampshire 03246. Assessments included pools with depths of five feet or more. Substrate types were defined using the bottom type specifications of the U.S. Fish and Wildlife Service's stream survey standards for Regions 3 and 5. Physical characteristics of the Saco River are presented in Table 2-4, and are based on surveys by Hoover (1937), and recent surveys by the MEASRSC, MEDIF&W, and the USFWS. The derivations of these data are detailed in the fisheries section of the respective reach. Available substrate maps of the Saco River and its tributaries are presented in Appendix G.

Water quality data are presented in Section I and in each of the Reach Descriptions, under Water Quality and Use.

Each species of fish that utilizes the Saco River and its tributaries has unique habitat requirements. Of particular importance to fishery managers of the Saco River Watershed are the largemouth bass, smallmouth bass, black crappie, alewives,

Table 2-4. Physical characteristics of the Saco River Watershed by reach.

Reach	Units of Surface Area (100 yd <sup>2</sup> )	Pools		Dominant Substrate Types	Average Gradient over Entire Reach (ft/mile)
		Qty	Units of Surface Area (100 yd <sup>2</sup> )		
SACO RIVER MAIN STEM					
I	31,994	<sup>1/</sup> U	U	U	Tidal
II	21,313	1	97	Almost entirely impounded. Unimpounded waters contain boulder, rubble, and gravel	1.6
III	50,799	0 (except impoundments)	--	Mostly impounded water. Unimpounded waters contain ledge, boulder, rubble, and gravel	6.5
IV	18,756	56	4444	Ledge, boulder, rubble gravel, and sand	2.1
V	42,408	1	4	Predominantly sand, or gravel and sand	0.9
VI	24,134	42	1201	Predominantly sand or gravel	4.6
VII	U	U	U	Predominantly rubble but contains ledge, boulder, gravel, and sand (Hoover 1937)	63.3
Saco River Total	189,404	100	5746	--	14.4
MAJOR TRIBUTARIES					
IV Little Ossipee River	1,025	1	11	Ledge, boulder, rubble, gravel, and sand	11
Ossipee River	9,305	<sup>2/</sup> 50	707	Gravel, boulder, rubble, and sand	7.8
Tributary Total	10,330	51	718	--	--
Grand Total	199,734	151	6464	--	--

<sup>1/</sup> Undetermined<sup>2/</sup> Includes ten pools of undetermined dimensions



blueback herring, white perch, chain pickerel, Atlantic salmon (both sea-run and landlocked), American shad, brook trout, brown trout, and rainbow trout. Information regarding the habitat requirements for most of these species may be seen in Appendix H.

## HABITAT SUITABILITY

The suitability of habitat for important fish species in the Saco River Basin has been based on habitat criteria in Habitat Suitability Index Models, Species Profiles, or Habitat Suitability Information brochures published by the U.S. Fish and Wildlife Service (Appendix H). Quantitative evaluations of habitat suitability have been only applied to the habitat that has been assessed within the basin (see Habitat Assessments). A summary of the available habitat, spawning escapement, and production in the Saco River Watershed for important anadromous and inland species of fish is presented in Tables 2-5 and 2-6 respectively. Locations of the habitat and more detailed information are presented in the Habitat Suitability section of each reach. Availability of suitable habitat for American eels has not been determined.

A summary of the Atlantic salmon habitat in the watershed is presented in Appendix L. Estimates of spawning escapement for Atlantic salmon are based on 220 eggs per habitat unit and 7,400 eggs per female with a 50-50 sex ratio for adults. Smolt production is based on one smolt per unit for the Saco River main stem in Maine and two smolts per unit in the tributaries and in the Saco River in New Hampshire. Excluding the normally dewatered bypass channels at Bar Mills and Bonny Eagle Dams, an estimated 1,492 adult Atlantic salmon could use the assessed habitat throughout the watershed and produce 42,335 smolts. In the Maine portion of the watershed, 878 adult salmon could produce an estimated 21,743 smolts. Downstream mortalities of smolts at dams may range from 5 to 20% (Ruggles 1980). Adult



Table 2-5. Summary of suitable habitat, spawning escapement, and production estimates for important anadromous fish species in the Saco River Watershed.

Reach Description	Atlantic Salmon			American Shad			Alewives		
	Nursery Units (100 yd <sup>2</sup> )	Spawning Escapement (males plus females)	Potential Smolt Production	Units (100 yd <sup>2</sup> )	Spawning Escapement (males plus females)	Potential Adult Production	Units (100 yd <sup>2</sup> )	Spawning Escapement (males plus females)	Potential Adult Production
I. Jetty to Cataract and Upper York Dams	None	--	--	Unknown	--	--	Unknown	--	--
II. Cataract and Upper York Dams to Skelton Dam	163	10	163	21,313	24,510	49,020	20,336	14,706	49,350 to 98,700
III. Skelton Dam to Little Ossipee River confluence	593	36	593	50,799	58,419	116,838	48,800	35,289	118,440 to 236,880
IV. Little Ossipee River confluence to Hiram Dam	12,654	754	19,051	18,756	21,570	43,139	227,722	164,675	552,840 to 1,105,680
V. Hiram Dam to Swans Falls Dam	1,162	72	1,843						
VI. Swans Falls Dam to ME - NH border	93	6	93						
Total for Maine	14,665	878	21,743	90,868	104,499	208,997	296,858	214,670	720,630 to 1,441,260
ME - NH border to Ellis River confluence	10,296	614	20,592						
VII. Ellis River confluence to outlet of Saco Lake	No habitat has been quantified within Reach VII								
Grand Total	24,961	1,492	42,335	90,868	104,499	208,997	296,858	214,670	720,630 to 1,441,260

Table 2-6. Summary of suitable habitat and production estimates for important inland fish species in the Saco River Watershed.

Reach Description	Brown Trout		Brook Trout		Warmwater species (e.g. bass, perch)	
	Units (100 yd <sup>2</sup> )	Production (juveniles)	Units (100 yd <sup>2</sup> )	Production (juveniles)	Units (100 yd <sup>2</sup> )	Production (juveniles)
I. Jetty to Cataract and Upper York Dams	None	--	None	--	Unknown amount of white perch habitat	
II. Cataract and Upper York Dams to Skelton Dam	21,313	Limited. Annual stocking of 4,300 spring yearlings between Bradbury and Skelton Dams	600	Limited. Annual stocking of 750 catchables	21,313	--
III. Skelton Dam to Little Ossipee River confluence	50,799	Limited. Annual stocking of 8,000 spring yearlings between Skelton and Bonny Eagle Dams	810	Limited. Annual stocking of 1,100 catchables	50,799	--
IV. Little Ossipee River confluence to Hiram Dam	29,086	Limited. No stocking	12,654	Limited. Annual stocking of 15,500 fall fingerlings	29,086	--
V. Hiram Dam to Swans Falls Dam	42,408	Limited. No stocking	881	Limited. Annual stocking of 300 fall fingerlings below Swans Falls Dam	42,408	--
VI. Swans Falls Dam to ME-NH border	5,530	Limited. No stocking	93	Limited. No stocking	5,530	--
Total for Maine	149,136	Limited. Annual stocking of 12,300 spring yearlings	15,038	Limited. Annual stocking of 1,850 catchables and 15,800 fall fingerlings	149,136	--
ME-NH border to Ellis River confluence	--	Annual stocking of 2,000 brown trout catchables in Saco River	--	Annual stocking of brook trout catchables	--	--
VII. Ellis River confluence to outlet of Saco Lake	--	No brown trout stocking	--	Annual stocking of brook trout catchables	--	--

returns from smolts from Maine rivers average from 3 to 5%. Based on these figures the estimated salmon run to the mouth of the river could range from 341 to 1,556 adults. The estimated salmon run from the Maine portion of the watershed could range from 211 to 837 adults.

Estimates of spawning escapement for American shad are given as 50% of the adult production. Adult production estimates are based on 2.3 adults per habitat unit. Juvenile shad production is based on 65 to 104 juveniles per spawning adult (Watson 1968). Present management plans are to restore American shad to Hiram Dam, which is believed to be their historical migratory terminus. A spawning escapement of 104,500 adult American shad could utilize the habitat in the Saco River between Cataract and Hiram Dams and produce from 6.6 to 10.7 million juveniles. The estimated American shad return to the mouth of the river is approximately 150,000 adults based on 90% downstream survival of juveniles and 90% upstream fish passage efficiency at each of the dams.

Estimates of spawning escapement for alewives are based on 35 adults per acre. Adult production is based on 117.5 to 235 adults per acre. Present management plans are to restore alewives to Bar Mills Dam. The habitat between Bar Mills Dam and Cataract Dam would require a spawning escapement of 29,284 adults. Excluding mortalities at dams, the estimated return to the mouth of the river from these adults could range from 98,230 to 196,460. Extensive alewife habitat is also available in the impounded sections of the Saco River between Bar Mills Dam and the Little Ossipee River, and in The Flowage (Arrowhead Lake), and Ossipee Lake. In total, 214,670 spawning adults could use the assessed habitat in the Saco River Watershed. Excluding mortalities at dams, production from these adults could result in a return to the river of from 0.7 to 1.4 million alewives.

The Saco River Watershed contains extensive seasonal habitat and limited year-round habitat for trout. Year-round use by trout is dependent on the availability of cool waters to provide refugia from high water temperatures. Only the trout habitat in Maine has been quantified.

Brown trout habitat is available throughout much of the assessed portions of the Saco River Basin in Maine, but under present management plans, brown trout will only be stocked in the Saco River between Bonny Eagle Dam, and Bradbury and Springs Dams. This segment will receive an annual stocking of 8,000 spring yearlings. The only riverine habitat scheduled to be stocked with brown trout in the New Hampshire portion of the watershed is the Saco River (Bresosky 1986). The New Hampshire Fish and Game Department stocks 2,000 brown trout between the Ellis River confluence in Bartlett and the Artist Brook confluence in North Conway (Kidder 1986).

There is extensive brook trout habitat in both the Maine and New Hampshire portions of the watershed. Most of the habitat in Maine is located in the Saco and Ossipee Rivers within Reach IV. The balance of Maine's brook trout habitat is in the tributaries or in the areas immediately below main stem dams. Under present management plans the Maine Department of Inland Fisheries and Wildlife is scheduled to stock 11,500 brook trout in the Saco River and 7,500 in the Ossipee River. The New Hampshire portion of the watershed is managed almost exclusively for brook trout. The Saco River main stem is stocked annually with brook trout (Bresosky 1986) from the headwaters at Saco Lake in Carroll to the Artist Brook confluence in North Conway (Kidder 1986). Some of the tributaries to the Saco River in New Hampshire support natural populations of brook trout. The Ellis River contains a naturally reproducing population of rainbow trout (Marancik 1977) and is stocked annually with brook trout (Bresosky 1986). The only river to receive annual stockings of rainbow trout is the Swift River, which is also stocked with brook trout.

Extensive habitat for warmwater species has been quantified throughout the Maine portion of the basin but no determination has been made for the spawning escapement and juvenile production of any warmwater species (Table 2-6).

Effective fish passage facilities and adequate flows within the Saco River Basin will provide for migration and production of Atlantic salmon, American shad, and alewives. The unimpounded waters and bypass channels at various dams are important components of the fishery habitat in the Saco River Basin. It is critical that continuous adequate flows be provided in these sections. Without adequate flows, access to upriver spawning areas by anadromous fish is not possible. In several segments of the Saco River between dams, the only assessed habitat available for Atlantic salmon and brook trout lies in the unimpounded waters or bypass channels adjacent to the dams. Stocking of brook trout in these areas is contingent on adequate flow releases. It is the U.S. Fish and Wildlife Service policy to recommend that minimum flow releases at dams be equivalent to the aquatic base flow (ABF) or input to the project area, whichever is less. All important ABF recommendations have been noted in the reach descriptions under Habitat Suitability.

#### PRESENT COMMERCIAL FISHERIES

General: Small commercial fisheries are present in the Saco River for American eels, alewives, and menhaden (Flagg 1984). Although no other species are sought commercially within the river, American shad and blueback herring are taken incidental to the alewife fishery. There are no requirements for fishermen to report catches by watershed so data regarding harvests are unknown.

American Eels: Eel pots are set both in the estuary (Flagg 1984), and in the impoundment between Springs Island and Skelton Dam (Pierce 1984). Impoundment sets are usually made around the dark of the moon in mid-August when the eels emigrate.

Alewives: Alewives are sought in May and early June by commercial gill net fishermen near Cataract Dam for use as bait (Flagg 1984).

Menhaden: A commercial gill net fishery for menhaden is present in the estuary of the Saco River below Chase Point (mi 3.0). The menhaden are used for bait by lobster fishermen (Flagg 1984).

## SECTION 3

### RIVER RECREATIONAL USE

#### GENERAL

The predominant use of land in the Saco River Basin is for recreation (NERBC 1980). There are three areas which receive intense recreational use in the watershed: the coastal area; the Saco River between Hiram, Maine and Center Conway, New Hampshire; and the area within and adjacent to the White Mountain National Forest, in New Hampshire. The remaining portion of the watershed is also used by recreationists but to a substantially lesser degree.

The coastal area within and immediately adjacent to the Saco River is heavily utilized by summer tourists (NERBC 1980). The long sandy beaches, easily accessible from Routes 1 and Interstate 95 (I-95), attract tremendous numbers of tourists from the Boston area and Canada. The resident population in this area is also high and the region is the fastest growing area in Maine.

The Saco River between Hiram, Maine and Center Conway, New Hampshire is extensively used by canoeists (SMRPC 1983). This section alone accounted for over 60,000 user days (number of canoeists times the number of days) by canoeists in 1981.

The White Mountain region offers a multitude of recreational activities and is used throughout the year (NERBC 1980). The region includes the White Mountain National Forest, one of only

two National Forests in New England (Pratt 1985). The Forest is located within a day's drive of over 65-million people. The Saco River Valley alone, from Bartlett Village to the New Hampshire-Maine border, draws up to 20,000 people each day (USDASCS 1975b).

There are numerous attractions for recreationists using the White Mountains area. Recreational facilities of all types are readily available. The area contains some of the most popular locations in New England for skiers, kayakers, and canoeists. The lakes and rivers provide fishing and swimming and the numerous campgrounds provide economical accommodations. The Appalachian Trail is a popular attraction to hikers, campers, and foliage viewers.

Second home and recreational development has occurred throughout much of the White Mountain region (NERBC 1980). The area surrounding Conway, New Hampshire has undergone extensive recreational development, and it is anticipated that this development will continue.

A detailed recreational map of the Saco River from its origin at Saco Lake, New Hampshire, to Rotary Park near Route I-95 in Maine is available for \$1.50 from Saco Bound, Box 113, Rt 302, Center Conway, New Hampshire 03813.

## SACO RIVER

### Canoeing and Boating:

Canoeing: The Saco River is one of the most popular rivers in New England for canoeing enthusiasts (AMC 1978) and the most canoed river in Maine (SREAC 1973). It provides expert



boating for whitewater enthusiasts in the headwaters in the spring, and easier flatwater boating below the Maine-New Hampshire border (AMC 1978). The area between Conway, New Hampshire and Hiram, Maine is probably the most popular section of river for canoeists in New England (SMRPC 1983). The Saco River below Hiram receives light use by canoeists. At least 52 boys and girls camps in Maine, New Hampshire, and Vermont used the Saco River for trips in 1977 (Roy 1977).

The river's popularity is attributable to clean water, pleasant scenery, easy access, canoeing qualities for experts and novices, and excellent smooth water canoe-touring (SMRPC 1983). The numerous sandbars found between Center Conway, New Hampshire and Hiram, Maine provide opportunities for camping and swimming, adding to its popularity (NERBC 1980).

Use of the river for canoeing dramatically increased between 1973 and 1983 (SMRPC 1983). In 1981, canoeists alone accounted for 90,000 user days between Bartlett, New Hampshire and Bonny Eagle Dam, Hollis Maine. The major increase in the number of users has not been counterbalanced with a corresponding increase in canoeing facilities. As a result, many problems have developed which are affecting the Saco River environment including trash disposal, human waste disposal, camping, parking, access and egress, and soil erosion. The Southern Maine Regional Planning Commission in its 1983 report on the Saco River proposed the development or improvements of various facilities along the Saco River between Conway, New Hampshire and Hollis, Maine which would help to relieve the problems. The Maine Bureau of Parks and Recreation is presently acting upon many of the recommendations of the Commission (MEBPR 1984).

Boating: Boating is intense in the Saco River estuary below Factory Island (NERBC 1980). This area is not only heavily populated but also receives a tremendous influx of tourists in the summer. Three marinas, two yacht clubs, and several boat launching sites are located within the estuary (Baird and Dow 1966, MESPO 1977).

Fishing: Fishing in the New Hampshire portion of the Saco River and its major tributaries is primarily a put-and-take fishery (Pratt 1985) for brook, brown, and rainbow trout (Bresosky 1984). A copyrighted fishing guide is available which shows the more productive trout fishing locations in New Hampshire on the Saco River and several of its tributaries. It is entitled "Trout Fishing Guide to the Mt. Washington Valley" and may be purchased for \$3.95 through the Riff Cast Company, Intervale, New Hampshire 03845.

Information on fishing in the Maine portion of the Saco River Watershed was reported by Dube (1983). Selected segments of his synopsis are presented below.

"Sport fishery resources in inland waters include Atlantic salmon, landlocked salmon, brown trout, brook trout, rainbow trout, smelt, smallmouth bass, largemouth bass, and black crappie.

The gamefish which perhaps receives the largest management emphasis in inland waters of the Saco drainage by the Department of Inland Fisheries and Wildlife is the brown trout.....and a fishery exists between Hiram Falls Dam and Limington Rips. It is not uncommon for a trophy-size brown trout (5-6 lbs) to be angled in the Saco watershed.

The native brook trout provide good spring fishing in a limited number of small tributaries and the main stem

Saco above Bonny Eagle Dam. Most brook trout are in the 6-10 inch size classes with an occasional larger trout angled.

Landlocked salmon are present in limited numbers and support a small fishery in the Ossipee River and the Saco River near Hiram Falls. Most landlocks are considered to be migrants from Bickford Pond in the Ossipee River drainage and Kezar Lake and Moose Pond on the main stem Saco where the Department of Inland Fisheries and Wildlife has implemented a stocking program over the past several years to increase returns to the angler.

Rainbow trout, migrants from New Hampshire waters, provide a small, spring fishery in the Fryeburg section of the Saco River. Rainbow trout have been introduced into the headwaters of the Saco drainage by the New Hampshire Fish and Game Department.

Most coldwater lakes in the Maine portion of the Saco watershed possess smelt populations. Winter fisheries for smelt have developed in most of these lakes.

There are three major warmwater fish species which anglers seek in the Saco River basin. These are smallmouth bass, largemouth bass, and black crappie.

Two species, smallmouth and largemouth bass, are present throughout the Saco watershed. However, for the most part, fishing for bass occurs in major pools and backwaters.

The black crappie, a member of the sunfish family (Centrarchidae), is the newest fish species to be introduced via New Hampshire in the Saco drainage. Black crappie were illegally stocked in Belleau's Lake, New

Hampshire, around 1972. They have subsequently spread downstream into the Little Ossipee River and main stem Saco to Bonny Eagle Dam. It will not take this species very long to spread downstream of Bonny Eagle."

The chain pickerel and white perch are popular sport fish in the Saco River Basin (Pierce 1985). Bullheads and burbot provide limited angling opportunities (Dube 1983).

Fishing pressure for inland species in the Maine portion of the Saco River is described by Boland (1984) as being light overall, although there are several areas which receive heavy pressure for trout in the spring.

Anglers fishing the estuary seek harbor pollack, Atlantic mackerel, winter flounder, and American eels, but the most intense fishing is for striped bass (NERBC 1980). The Saco River supports the largest striped bass fishery in the State of Maine. Creel census data for striped bass fishing in the Saco River are available in a masters thesis entitled "Design of a Creel Census for the Striped Bass Sport Fishery along the Central Maine Coast" by R.S. Otto (1971). American shad, although present, do not constitute a significant portion of the fishery (Flagg 1985). White perch are taken in the estuary by recreational fishermen primarily upstream of Thunder Island.

Other Water-Related Activities: Swimming in the Saco River is popular in many of the pools above North Conway (Pratt 1985). There are six known popular locations between North Conway, New Hampshire and Limington, Maine; the Iron Bridge in North Conway (SMRPC 1983), Fryeburg Beach in Fryeburg, Brownfield Bridge (Rt 160) in Brownfield, Hiram Town Beach in Hiram, Great Falls Dam Beach in Hiram (MEBPR 1984), and at unknown specific locations

in Steep Falls and East Limington (SREAC 1973). There are also numerous sandbars in the Saco River between North Conway and Hiram that are heavily used by swimmers (Pratt 1985, NERBC 1980).

Other than coastal beaches in Saco and Biddeford (MESPO 1977) and occasionally used swimming areas behind Springs and Bradbury Dams (CMP undated), there are no other known swimming locations in the Saco River. State and local officials in New Hampshire and Maine have expressed the need for more beaches in their regions (SMRPC 1983). State officials in Maine have expressed the need for swimming facilities outside of Saco and Biddeford.

The northern portion of the Saco River is popular for whitewater rafting and kayaking in the spring. Low flows preclude these activities during other seasons (Pratt 1985).

Camping: There are numerous public and private camping facilities on the Saco River from its headwaters to the Brownfield Bridge (Rt 160) in Brownfield (Saco Bound undated, Delorme 1983). Additionally, the numerous sandbars that are exposed during the summer between Center Conway, New Hampshire and Hiram, Maine provide excellent campsites for canoeists (NERBC 1980).

There are only three known campgrounds on the Saco River between the Brownfield Bridge and Saco-Biddeford, a distance of over 50 river miles (SMRPC 1983, Delorme 1984, Pierce 1985). One is a commercial campground in Cornish, the second is a private campground in Hiram, and the third is a primitive campground in Steep Falls. A report completed in 1983 by the Southern Maine Regional Planning Commission (SMRPC) expressed the need for a formal campsite between the Brownfield Bridge and the Hiram Bridge (Rt 113). This area is part of the most heavily used portion of the Saco River. The SMRPC also expressed a need for a primitive campsite just below the Hiram Dam, a campground centrally located between Hiram and

Bonny Eagle Dam in Hollis, a primitive campsite at Bonny Eagle Dam, and further studies regarding recreational needs for the area below Bonny Eagle Dam. These needs are presently being addressed by the Maine Bureau of Parks and Recreation (MEBPR 1984).

There are numerous camping facilities in Saco and Biddeford (Table I-4). Their adequacy in meeting camping needs, and their proximity to the Saco River are unknown.

Access:

Canoe: There are only three access points north of Conway, New Hampshire. Downriver from Conway, canoe access is generally good throughout the rest of the Saco River (Saco Bound undated, DeLorme 1983, 1984), with the exception of the area between the Hiram Dam and Steep Falls. Although there are four access points within this 12.6-mile section of river, one is located at Hiram Dam and two are located at Steep Falls (Saco Bound undated, MEBPR 1984). The only access point between the two is in Cornish nearly nine miles upriver from Steep Falls (Saco Bound undated).

Boat: Boat access to the Saco River is poor. There is only one good boat launching facility above tidewater, located at Rotary Park (mi 8.2) in Biddeford (Pierce 1985). A study by the Maine Bureau of Parks and Recreation revealed the greatest need for boat access sites was in the southern portion of the Saco River (SMRPC 1983). There are presently six boat launching facilities in the combined towns of Saco and Biddeford.



## MAJOR TRIBUTARIES

General: The following is a brief description of the major recreational activities on the three major tributaries to the Saco River; the Swift River, the Ossipee River, and the Little Ossipee River. Further details may be found under the River Recreational Use sections of the respective reaches.

The Swift River in New Hampshire is popular only in the spring for kayaking, rafting (Pratt 1985), and whitewater canoeing (AMC 1978). During this period the river offers one of the most difficult runs in New England (AMC 1978) and is nationally known as an outstanding Class IV (difficult) water (Pratt 1985). The Swift River provides a put-and-take fishery (Pratt 1985) for brook and rainbow trout, stocked by the New Hampshire Fish and Game Department (Bresosky 1984). The only formal swimming area on the Swift River is at Lower Falls, although recreationists use many of the pools throughout the river (Pratt 1985). The four campgrounds located on the river are all in the upriver end (DeLorme 1983). Access points on the Swift River for canoeists are provided at four scattered locations in Albany (AMC 1978).

The Ossipee River from Ossipee Lake, New Hampshire to Kezar Falls, Maine is not a popular stretch of river for canoeists due to its extensive flatwater and developed shorelines. The area below Kezar Falls to the confluence with the Saco River is a popular whitewater stretch in the spring, but low flows preclude its use in the summer (AMC 1978).

Little is known about further recreational activity on the Ossipee River. The Ossipee River was stocked with brown trout by the MEDIF&W from 1951 to 1982. Most trout were stocked downstream of Kezar Falls (Pierce 1985). The Ossipee is not presently stocked

by either the Maine Department of Inland Fisheries and Wildlife (Boland 1985) or the New Hampshire Fish and Game Department (Bresosky 1984). Landlocked salmon migrants from Bickford Pond provide a limited fishery in the Ossipee River (Dube 1983). There are no known swimming areas in the Ossipee. The only campground known to be adjacent to the river is located at Kezar Falls (DeLorme 1984). Known access points for canoeists are at the dam at the outlet of Ossipee Lake and below the lower dam at Kezar Falls (AMC 1978).

The Little Ossipee River is fairly popular with canoeists and fishermen but other recreational uses are unknown. The portion of the river upstream of Route 5 is usually canoeable only in the spring whereas the remainder can usually be canoed throughout the summer (AMC 1978). Fishing on the Little Ossipee is popular for brook trout and brown trout in the spring (Pierce 1982). Brown trout were stocked annually through 1982. Stocking of this species has been discontinued below Ledgemere Dam but the area adjacent to the Newfield Game Management Area is still being stocked with browns. There are no known campgrounds on the Little Ossipee River. Canoe access to the river is available at three locations in Limington and one location in Newfield. There are also two indirect access points; one in Shapleigh and one in Newfield. A portion of the Little Ossipee River is bordered by the Newfield Game Management Area (SREAC 1973). This 2,247-acre parcel of land is owned by the Maine Department of Inland Fisheries and Wildlife, and is managed primarily for waterfowl and upland game species.



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## MANAGEMENT GOAL

Manage all sport and commercial fish species of the Saco River for optimum habitat utilization, abundance, and public benefit.

## MANAGEMENT OBJECTIVES

### A. Reach I

1. Manage Reach I as a migratory pathway for Atlantic sea-run salmon, American shad, sea-run alewives, and American eels.
2. Re-establish a spawning population of rainbow smelt.
3. Manage the striped bass resource in accordance with the Atlantic States Marine Fisheries Commission's Interstate Fisheries Management Plan for the Striped Bass.
4. Promote existing and potential commercial fisheries for alewives, American shad, and American eels.
5. Promote existing and potential recreational fisheries for American shad, Atlantic salmon, rainbow smelt, and striped bass.

### B. Reach II

1. Manage Reach II as a migratory pathway for Atlantic sea-run salmon, American shad, sea-run alewives, and American eels.
2. Manage Reach II for sustained production of Atlantic salmon, shad, alewives, and eels consistent with habitat capabilities.

3. Establish a recreational fishery for salmon and trout consistent with habitat capabilities.
4. Increase recreational utilization of all warmwater fish populations and commercial utilization of American eels.

#### C. Reach III

1. Manage Reach III as a migratory pathway for Atlantic sea-run salmon, American shad, and American eels.
2. Manage this reach for sustained production of trout, Atlantic salmon, shad, alewives, and eels consistent with habitat capabilities.
3. Establish recreational fisheries for trout and Atlantic salmon consistent with habitat capabilities.
4. Increase recreational utilization of all warmwater fish populations and commercial utilization of American eels.

#### D. Reach IV

1. Manage Reach IV, including the major tributaries (Little Ossipee and Ossipee Rivers), for sustained production of Atlantic sea-run salmon, trout, alewives, and eels consistent with habitat capabilities.
2. Establish fisheries for trout and salmon in key high-use areas of the Saco and Ossipee Rivers.
3. Increase recreational utilization of all warmwater fish populations and commercial utilization of American eels.
4. Manage Reach IV as a migratory pathway for Atlantic salmon.

E. Reach V

1. Establish a recreational fishery for trout in the Fryeburg area.
2. Increase recreational utilization of all warmwater fish populations and commercial utilization of American eels.
3. Manage Reach V as a migratory pathway for Atlantic salmon.

F. Reach VI and VII

1. Consult with the New Hampshire Fish and Game Department and U.S. Forest Service to participate in interagency compacts to develop an interstate Atlantic salmon restoration program.
2. Continue interstate agency cooperation to prevent introductions of undesirable species.

MANAGEMENT PROBLEMS AND STRATEGIES

Problem: Inadequate upstream and downstream fish passage for anadromous species precludes restoration.

Existing fish passage facilities at the Cataract and Skelton Projects are inadequate for Atlantic sea-run salmon, American shad, and alewives. No other hydroelectric dams on the Saco have upstream passage facilities. Downstream passage facilities are lacking at all Saco River hydroelectric projects.

Strategy: Negotiate through the Federal Energy Regulatory Commission and Maine Department of Environmental Protection hydropower licensing process for the construction of upstream and downstream fish passage facilities for adult and juvenile Atlantic sea-run salmon, American shad, and sea-run alewives. Follow-up studies should be undertaken to document the effectiveness of facilities.

Problem: Lack of minimum flows needed for migratory pathways and maintenance of habitat integrity.

The Saco River is highly regulated by hydropower generation facilities that have no provision for minimum flows, with the exception of the Hiram Falls Project. Present operating regimes for hydro dams on the Saco result in extended periods with little or no flow to the river. In addition, two bypass channels in Reach III are dewatered for much of the year. As a result, suitable habitat for instream production and a migratory corridor are seriously impaired.

Strategy: Negotiate through the Federal Energy Regulatory Commission and Maine Department of Environmental Protection hydropower licensing process for the provision of suitable minimum flows in the Saco. Follow-up studies should be undertaken to document adequacy of measures taken.

Problem: Control of In-River Exploitation.

Exploitation of Atlantic sea-run salmon through recreational fisheries, commercial fisheries, and illegal harvest could reduce the population below levels required for adequate spawning escapement. Insufficient numbers of adult American shad and alewives negatively impact restoration of these species. Declines in coastal migratory striped bass stocks, due to habitat degradation and commercial and sport fisheries along the U.S. coastline, have contributed to a reduction in the number of striped bass present in Maine waters. As demand for trout fishing increases, especially in designated areas of Reaches II, III, and IV, overall fishing quality could decline.

Strategy: Regulate directed fisheries for Atlantic sea-run salmon, American shad, and alewives in the Saco River to allow adequate escapement of spawning stocks. Minimize incidental catches of non-target species in commercial and recreational fisheries

through restrictions by gear type, seasons, and harvest locations. The State of Maine will continue to participate in the Atlantic States Marine Fisheries Commission, Interstate Striped Bass Plan for the management of migratory striped bass stocks.

Problem: Interception of Saco River Fish Stocks.

Commercial fisheries for Atlantic sea-run salmon along the coasts of Canada and Greenland harvest large numbers of salmon of USA origin. These fisheries may be harvesting in excess of 50% of the salmon produced in Maine waters. American shad and river herring are subject to commercial exploitation in the Gulf of Maine and along the Atlantic Seaboard.

Strategy: Continue regionwide efforts to secure significant reductions in the interception of salmon originating from Maine rivers. The State of Maine will continue to encourage the North Atlantic Salmon Conservation Organization to negotiate for more restrictive regulations and reduced harvest quotas from countries engaged in the commercial harvest of Atlantic sea-run salmon. Provide for interstate management of domestic coastal fisheries through the Shad and River Herring Interstate Fisheries Management Program of the Atlantic States Marine Fisheries Commission. Provide input to negotiations with Canadian fisheries agencies to control shad and river herring fisheries in Canadian waters.

Problem: Obtaining suitable fish stocks to fulfill restoration objectives for Atlantic sea-run salmon, American shad, and alewives.

Current demand for hatchery stocks of Atlantic sea-run salmon exceeds production capabilities. There is a paucity of adult shad and alewife brood stock to augment existing Saco River stocks.

Strategy: Stock available numbers of hatchery-reared Atlantic salmon in the Saco River. Increase allocation of hatchery-reared Atlantic salmon to the Saco River in a manner consistent with statewide priorities. Utilize adult shad, alewife, and Atlantic salmon present in the Saco River as brood stock for restoration of these species in a manner compatible with upstream and downstream passage in the Saco.

Problem: Catchable-size trout are not available in adequate numbers to fulfill freshwater sport fisheries demand.

Strategy: Stock hatchery-reared trout in suitable areas of the Saco River and in numbers sufficient to meet demand.

Problem: Cormorant depredation.

The double-crested cormorant is a potential serious predator of Atlantic salmon smolts and trout, especially in the lower river reaches. The cormorant may also impact other commercial and recreational fisheries. The extent of these depredations and their impact upon population size is uncertain. Although hazing and shooting of cormorants are done each year, their effectiveness as control strategies are unknown.

Strategy: Initiate a comprehensive research program to determine the impact of cormorant depredation upon Saco River fisheries and evaluate the efficacy of control measures.

Problem: Lack of suitable access to the Saco River for recreational uses.

Access to all Reaches for trailered watercraft is severely limited, particularly in Reaches III and IV. Shore-based fishing opportunities are limited by a paucity of public lands available along the Saco River Corridor.

Strategy: Encourage and support efforts by State of Maine agencies, local governments, conservation organizations, and developers in identifying and obtaining land parcels, rights-of-ways, conservation easements, etc., where needed for recreational access to the Saco River. Negotiate through the Federal Energy Regulatory Commission and the Maine Department of Environmental Protection hydropower licensing process for additional access to the Saco River for recreational purposes at hydropower projects.

REACH I. RIVER MOUTH TO UPPER YORK (WEST CHANNEL) DAM, SACO-BIDDEFORD, MAINE.

PHYSICAL CHARACTERISTICS

TOPOGRAPHY AND GEOLOGY

Reach I (Figure I-1) contains 6.0 miles of the Saco River from the easterly tip of the jetty in Saco (mi 0.0), up to the Upper York Dam, Saco-Biddeford (mi 6.0). It lies within the Seaboard Lowland land form, an area where glacial debris was reworked by the ocean and deposited as marine sand and clay (NERBC 1980). Land elevations within the reach range from sea level to 200 feet.

There are three named tributaries to the Saco River within this reach (Appendix K).

CLIMATE

Climate within the reach is influenced primarily by prevailing westerlies but can also be influenced by warm moisture-laden air from the maritimes as well as coastal storms that develop along the Atlantic seaboard (NENYIAC 1954). Normal precipitation and temperatures for Portland, Maine, which lies just outside the Saco River Basin, are shown in Tables I-1 and I-2 respectively (NOAA 1983). Based on twenty years of record, the average snowfall in Portland is 70 inches (NHWSPCC 1979).

RIVER HYDROLOGY

Saco: Reach I receives drainage from the entire 1,697 mi<sup>2</sup> of the Saco River Basin (NENYIAC 1954). The average discharge at the mouth of the river is approximately 3,550 cfs (Rizzo 1983).



TABLE I-1. Normal precipitation - inches (NOAA 1983).

	<u>Portland, Maine</u>
Period of Record	unknown
Elevation (feet above M.S.L.)	65
January	3.78
February	3.57
March	3.98
April	3.90
May	3.27
June	3.06
July	2.83
August	2.82
September	3.27
October	3.83
November	4.70
December	4.51
Annual	43.52

TABLE I-2. Normal temperature - °F (NOAA 1983).

	<u>Portland, Maine</u>
Period of Record	unknown
Elevation (feet above M.S.L.)	65
January	21.5
February	23.0
March	32.1
April	42.8
May	52.8
June	62.2
July	68.1
August	66.6
September	58.6
October	48.4
November	38.4
December	25.8
Annual	45.0

The estimated median monthly flow of the Saco River at the mouth is shown in Table I-3. The mean tide range at Wood Island Harbor at the mouth of the Saco River is 8.7 ft (USDC 1984).

TABLE I-3. Estimated median monthly flow of the Saco River at the mouth (Rizzo 1983).

<u>Month</u>	<u>Median Flow (cfs)</u>
January	1,960
February	1,880
March	3,790
April	8,900
May	6,640
June	2,660
July	1,400
August	1,170
September	1,220
October	1,360
November	1,900
December	2,360

There are two dams within this reach; Cataract Dam, owned by Central Maine Power Co. (CMP), Edison Drive, Augusta, Maine 04330, and the Upper York Dam sometimes referred to as the West Channel Dam, partially owned by CMP and partially leased from the Finance Authority of Maine (CMP undated). Locations of these dams may be seen in Figure I-1. Both are part of the Cataract hydroelectric project (FERC No. 2528). Cataract Dam (Figure I-2) is located on the east side of Factory Island. It is the lowermost dam (mi 5.7) and has a 44-ft head which is variable with the tide (CMP undated). Upper York Dam (Figure I-3) is located in the west channel of Factory Island. This dam has a 15-ft head and contains a notched weir and orifice fishway that is considered inadequate for fish passage because of poor attraction water (Dube 1983). A trapping facility is presently being evaluated for installation at the fishway in Upper York Dam. The Upper York Dam receives the

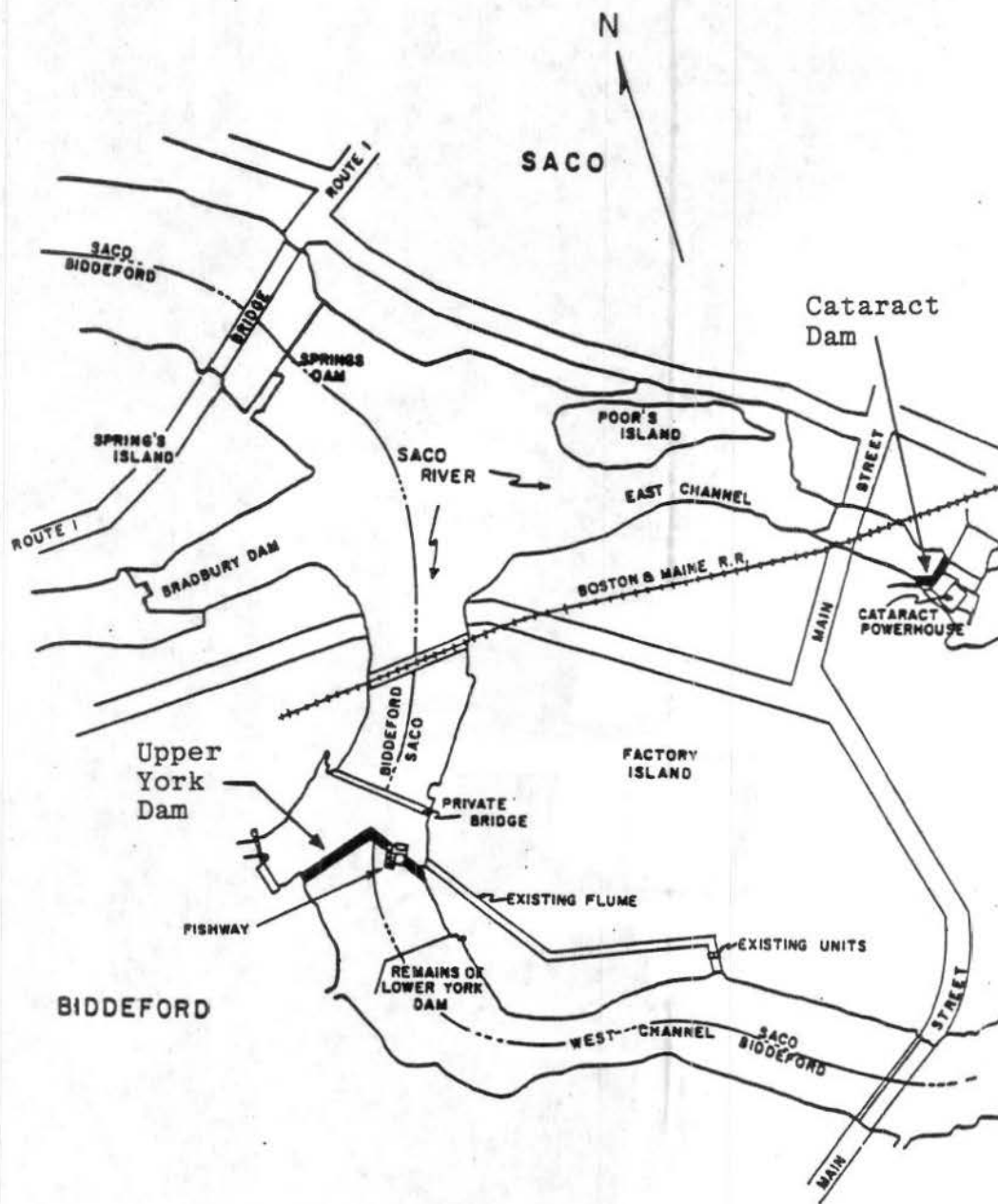


Figure I-1. Locations of Cataract and Upper York Dams in the Saco River in Saco and Biddeford, Maine (CMP undated).



Figure I-2. Cataract Dam, Saco.



Figure I-3. Upper York Dam, Saco-Biddeford, showing fishway and remains of Dam 2-A (Lower York Dam)



drainage from approximately 1,689 mi<sup>2</sup> (Cowing and Caracappa 1978). Further information on the Cataract and Upper York Dams can be seen in Table 1-2.

Dam 2-A (Lower York Dam) is a partially breached dam that lies approximately 100 yds below the Upper York Dam and presently does not impede fish passage (Dube 1983). The upstream limits of tidal water are just below Dam 2-A (CMP 1971a).

Salinities in the Saco River estuary were reported by Larsen and Doggett (1978). During high tide the salinity at the bridge at Factory Island ranged from 0.1 ppt at the surface to 7.8 ppt at a depth of 4.5m.

Tributaries: A dam is present at the outlet of Wilcox Pond, a five-acre pond drained by West Brook, a minor tributary to the Saco River in Biddeford (MEDEP 1976).

#### WATER QUALITY AND USE

Saco: The Saco River between the head of tide and the Camp Ellis breakwater is classified as Class SC. The remaining tidal waters within the reach are classified as Class SB-2 (Maine Revised Statutes Annotated, Title 38, Chapter 3).

Municipal wastewater discharges into the Saco River within this reach are made by the towns of Saco and Biddeford (NERBC 1980). Saco has two treatment facilities; one at Factory Island, a primary treatment facility which discharges 50,000 gpd of treated sanitary wastes (Mower 1985), and the Saco Proper Plant, a secondary facility which discharges 1.57 mgd of treated principal wastewater (MEDEP 1984b). The Biddeford treatment plant is a secondary facility (NERBC 1980) which discharges an average of 2.64 mgd of treated municipal-industrial wastewater (MEDEP 1983).

A coastal study conducted under Section 208 of the Clean Water Act concluded that discharges into the Saco River within this reach from private septic systems, wastewater treatment facilities and solid wastes had significant water quality impacts (NERBC 1980). Storm water run-off from urban development has moderate impact.

The Saco River is the water supply source for the Biddeford and Saco Water Company (SMRPC 1983). This company is also contracting to supply 25% of the water needs for the Kennebunk, Kennebunkport and Wells Water District.

Tributaries: There are three tributaries within Reach I; West Brook, which is designated as Class C, and Moors and Dungeon Brooks which carry Class B-2 designations (MEDEP 1976).

#### LAND USE

Saco: The land adjacent to the Saco River in Reach I is used for urban development (SREAC 1973). Land use by town is given in Table 1-4.

## FISHERIES

### HABITAT ASSESSMENTS

The entire Saco River within Reach I was surveyed in August of 1984 by personnel of the Maine Department of Inland Fisheries and Wildlife, Gray, Maine. The surface area was estimated at 31,994, 100-yd<sup>2</sup> units. Depths were recorded on survey maps which are available at the Gray office, MEDIF&W. Substrate types and pools were not delineated in the tidal portions of the river. A 1/3 mile segment of the river from just downriver of Main Street (Rt 9) to Upper York Dam is entirely ledge.

### HABITAT SUITABILITY

Saco River: The amount of suitable reproductive habitat available for fish species in the Saco River in Reach I is unknown. American shad, alewives, rainbow smelt, and white perch are all known to reproduce in this section of the river. Effective fish passage and adequate flows at the four dams that compose the Cataract Project will enable large numbers of American shad, alewives, and Atlantic salmon to use the river as a migration route. The U.S. Fish and Wildlife Service has recommended a minimum flow release of 851 cfs (aquatic base flow) or inflow to the project area, whichever is less (USFWS 1986). The apportionment of the 851 cfs between the four dams and two tailraces has yet to be determined.

### UNIQUE REACH FEATURES

Small commercial fisheries are present in the Saco River for American eels, alewives, and menhaden. American shad and blueback herring are taken as incidental catches to the alewife fishery



(Flagg 1985). Further information is given under "Present Commercial Fisheries" in Section 2.

The most significant area in Maine for concentrations of migratory shorebirds occurs in Biddeford Pool, a tidal bay estuary at the mouth of the Saco River (NERBC 1980). Bird nesting areas are located nearby on Negro, Stage, Wood, Gooseberry, Eagle, and Beach Islands (MESPO 1977).

## RIVER RECREATIONAL USE

### SACO RIVER

General: There is intensive recreational use of the Saco River within Reach I, particularly by boating and fishing enthusiasts (NERBC 1980). A list of the known recreational facilities in Saco and Biddeford in Reach I may be seen in Table I-4.

Boating: Intensive boating use occurs in the estuary below Factory Island Dam (NERBC 1980). The intensity of use can be inferred by the more than 1,250 boat registrations issued to residents of Saco and Biddeford in 1976. There are three marinas and two yacht clubs within the reach, as well as several boat launching facilities (Table I-4).

Fishing: Harbor pollock, winter flounder, and American eels are actively sought by anglers, but fishing is most intense for striped bass (NERBC 1980). The Saco River supports the largest striped bass fishery in the State of Maine. Fishing for stripers primarily occurs in the lower third of Reach I (Pierce 1984). Sport fishing pressure for Atlantic mackerel and bluefish is often heavy at the mouth of the river. According to Flagg (1985) white perch are sought by recreational fishermen primarily upstream of Thunder Island (mi 4.6). Anglers also fish for American shad during the spring run. Historically, rainbow smelt have been sought by recreational fishermen but the present status of this fishery is unknown. A fishery has developed for returning Atlantic salmon as a result of recent stockings of juvenile salmon.

Other Water-Related Activities, Camping, and Access: Parks and beaches, campgrounds, and access sites within the reach are shown in Table I-4.

TABLE I-4. Recreational facilities in Saco and Biddeford in Reach I (MESPO 1977 unless otherwise noted).

Type of Facility	Name	Town	Ownership
Marina	Rumery's Boat Yard	Biddeford	private
	Riverside Anchorage	Saco	private
	Riverland Marina	Saco	private
Yacht Club	Biddeford Pool Yacht Club	Biddeford	private
	Saco Yacht Club	Saco	private
Park	Biddeford Pool Mini-Park	Biddeford	municipal
	Clifford Park	Biddeford	municipal
	Pepperrel Park	Saco	municipal
Park and Beach	Ferry Beach State Park	Saco	state
Beach	Hills Beach	Biddeford	municipal
	Camp Ellis, Bay View, Kinney Shores	Saco	mun/pvt
Camping	Red Barn Farm Campground	Biddeford	private
	Ferry Beach Park Association	Saco	private
	Cascadia Park	Saco	private
	Willey Farms Hide-a-Way	Saco	private
Launching Sites	Biddeford Pool <sup>1/</sup>	Biddeford	municipal
	Meeting House Eddy	Biddeford	state
	Saco Yacht Club <sup>1/</sup>	Saco	private
	Riverside Anchorage <sup>1/</sup>	Saco	private
	Camp Ellis <sup>1/</sup>	Saco	municipal

<sup>1/</sup> Baird and Dow 1966.

REACH II. UPPER YORK (WEST CHANNEL) DAM, SACO-BIDDEFORD TO  
SKELTON DAM, UNION FALLS, MAINE.

### PHYSICAL CHARACTERISTICS

#### TOPOGRAPHY AND GEOLOGY

Reach II (Figure 1-1) contains 11.1 miles of the Saco River and is located between the Upper York (West Channel) and Cataract Dams, Saco-Biddeford (mi 6.0), and the Skelton Dam at Union Falls in Buxton, Hollis, and Dayton (mi 17.1). This reach lies within the Seaboard Lowland land form and is surrounded by low hills, most of which are less than 200 feet above sea level. One hill has an elevation of 372 feet.

There are five named minor tributaries which enter the Saco River in Reach II (Appendix K).

#### CLIMATE

Climate within Reach II is similar to that of Portland, Maine which lies just outside of the Saco River Watershed. Normal monthly precipitation and monthly temperatures for Portland can be seen in Tables II-1 and II-2, respectively. Based on twenty years of record, the average annual snowfall for Portland is 70 inches (NHWSPCC 1979).

#### RIVER HYDROLOGY

Saco: The average gradient within Reach II is approximately 1.6 ft per mile, based on a normal tailwater elevation at Skelton Dam of 51.0 ft (CMP 1971b) to a normal pond height behind Upper York Dam of 44 ft (CMP 1971a).

TABLE II-1. Normal precipitation-inches (NOAA 1983).

<u>Portland, Maine</u>	
Period of record	unknown
Elevation (feet above M.S.L.)	65
January	3.78
February	3.57
March	3.98
April	3.90
May	3.27
June	3.06
July	2.83
August	2.82
September	3.27
October	3.83
November	4.70
December	4.51
Annual	43.52

TABLE II-2. Normal temperature - °F (NOAA 1983).

<u>Portland, Maine</u>	
Period of record	unknown
Elevation (feet above M.S.L.)	65
January	21.5
February	23.0
March	32.1
April	42.8
May	52.8
June	62.2
July	68.1
August	66.6
September	58.6
October	48.4
November	38.4
December	25.8
Annual	45.0

There are three dams located within this reach beyond the Upper York Dam: Springs Dam, Biddeford (mi 6.2); Bradbury Dam, Saco-Biddeford (mi 6.2); and Skelton Dam, Union Falls (mi 17.1). All three dams are owned by Central Maine Power Company, Augusta, Maine.

Just upriver of Factory Island, the Saco River divides into an east and west channel as it skirts Springs Island. Bradbury Dam in the west channel and Springs Dam in the east channel (Figure II-1) are both flow regulation dams included in the Cataract hydroelectric project (FERC No. 2528). Each dam has a five-foot head (Dube 1983). The water impounded between the Cataract and Upper York Dams, and the Bradbury and Springs Dams has a surface area of approximately 14 acres (CMP undated). Normal pond elevation behind Bradbury and Springs Dams is 49.2 ft.

The remaining dam within this reach is Skelton Dam (FERC No. 2527, Figures II-2 and II-3), a hydroelectric facility located in Union Falls, 10.9 miles upriver from the Springs and Bradbury Dams. The dam has a head of approximately 76 ft (CMP 1971b). It is equipped with a steep pool-and-weir type fishway with poor attraction water which negates its effectiveness for fish passage (Dube 1983). A trapping facility is presently being evaluated for installation at the fishway. Based on 1984 surveys by personnel from the Maine Department of Inland Fisheries and Wildlife, Gray, Maine, the water between Skelton Dam, and Bradbury and Springs Dams has an estimated surface area of 426 acres. Normal full pond elevation behind Skelton Dam is 126.5 ft and normal tail-water elevation below the dam is 51.0 ft (CMP 1971b). Skelton Dam receives the drainage from 1622 mi<sup>2</sup> (Cowing and Caracappa 1978). Further information on the dams in Reach II can be seen in Table 1-2.

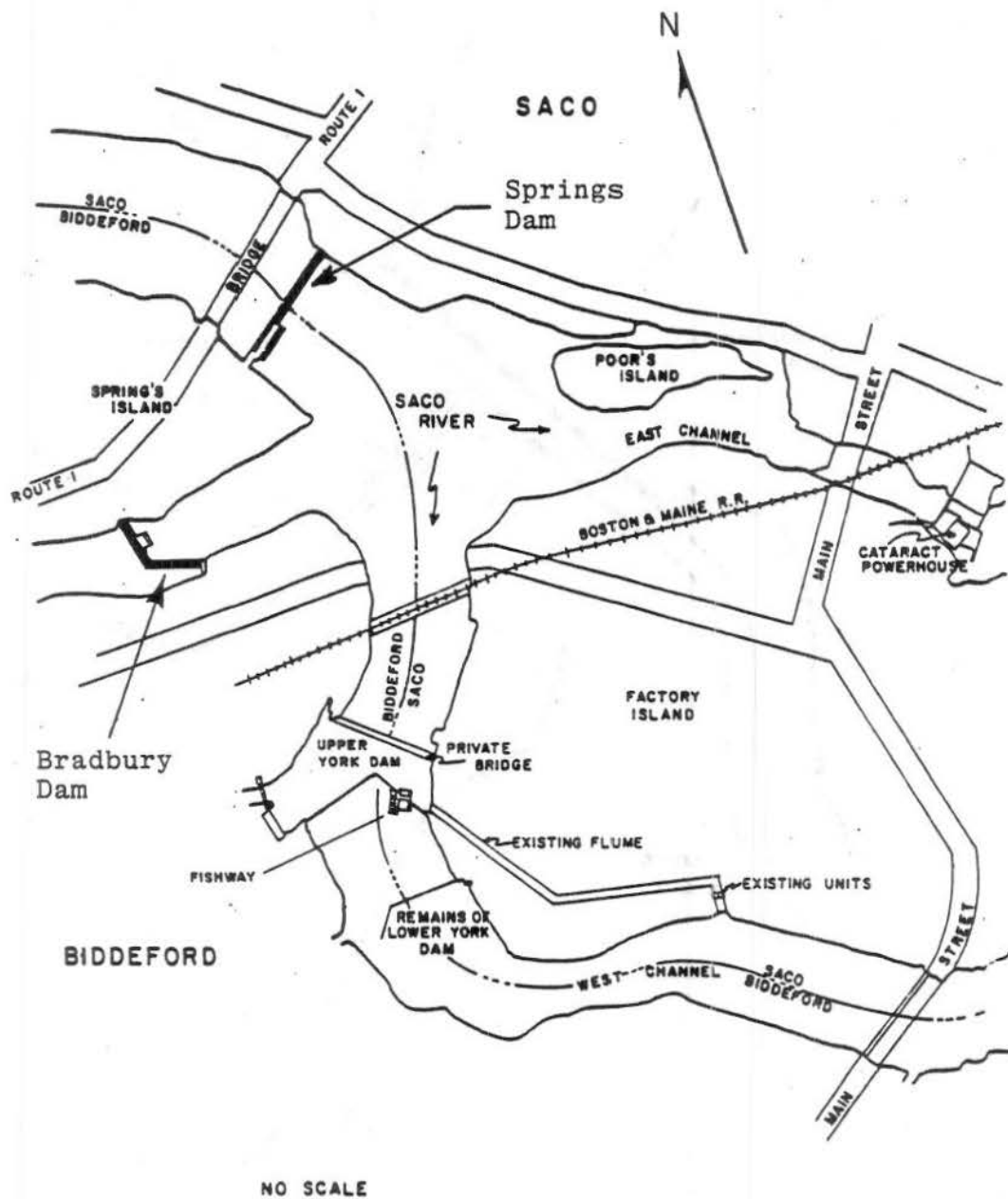


Figure II-1. Locations of Bradbury and Springs Dams in Saco and Biddeford, Maine (CMP undated).

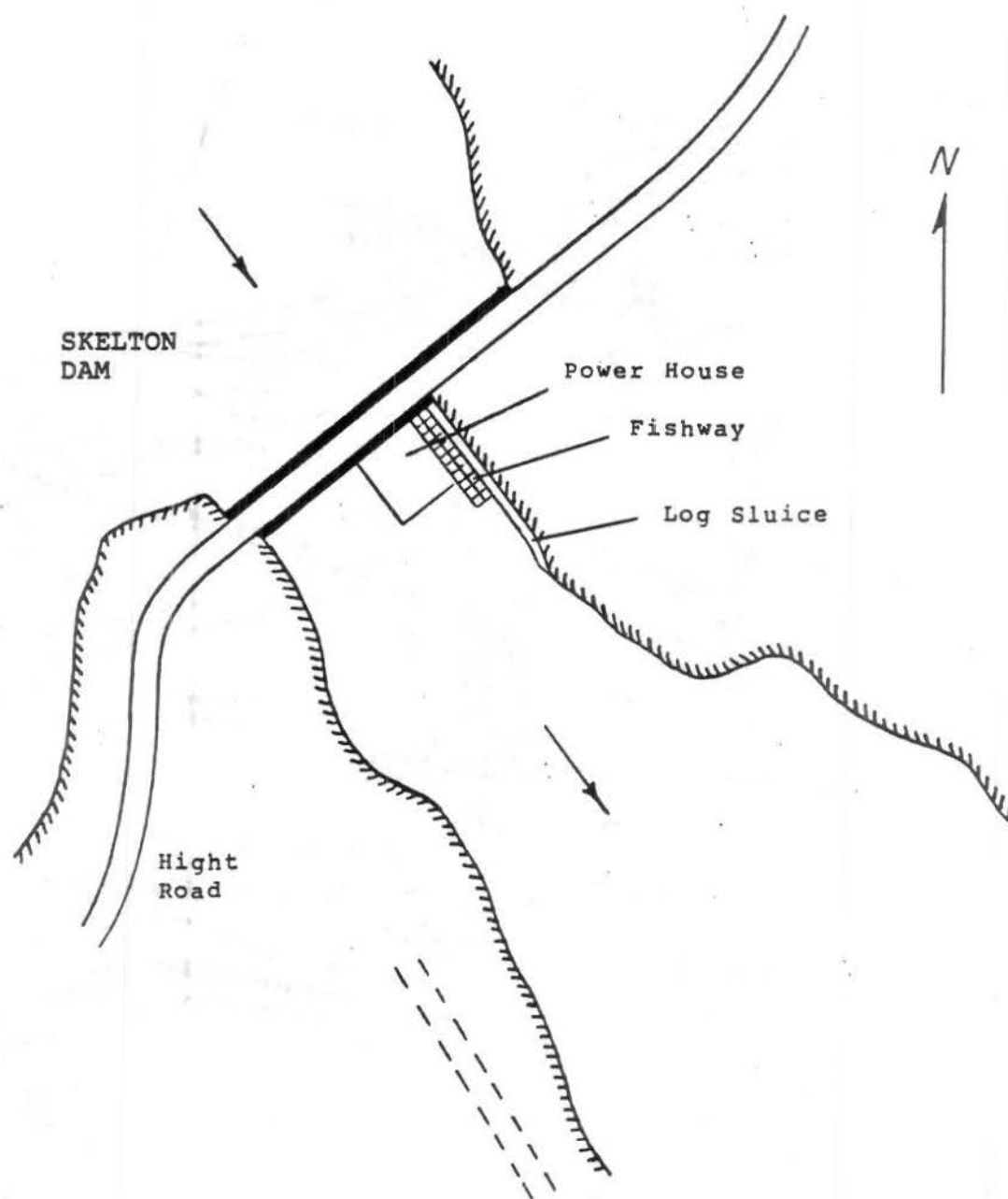


Figure II-2. Layout of Skelton Dam on the Saco River at Union Falls, Maine.



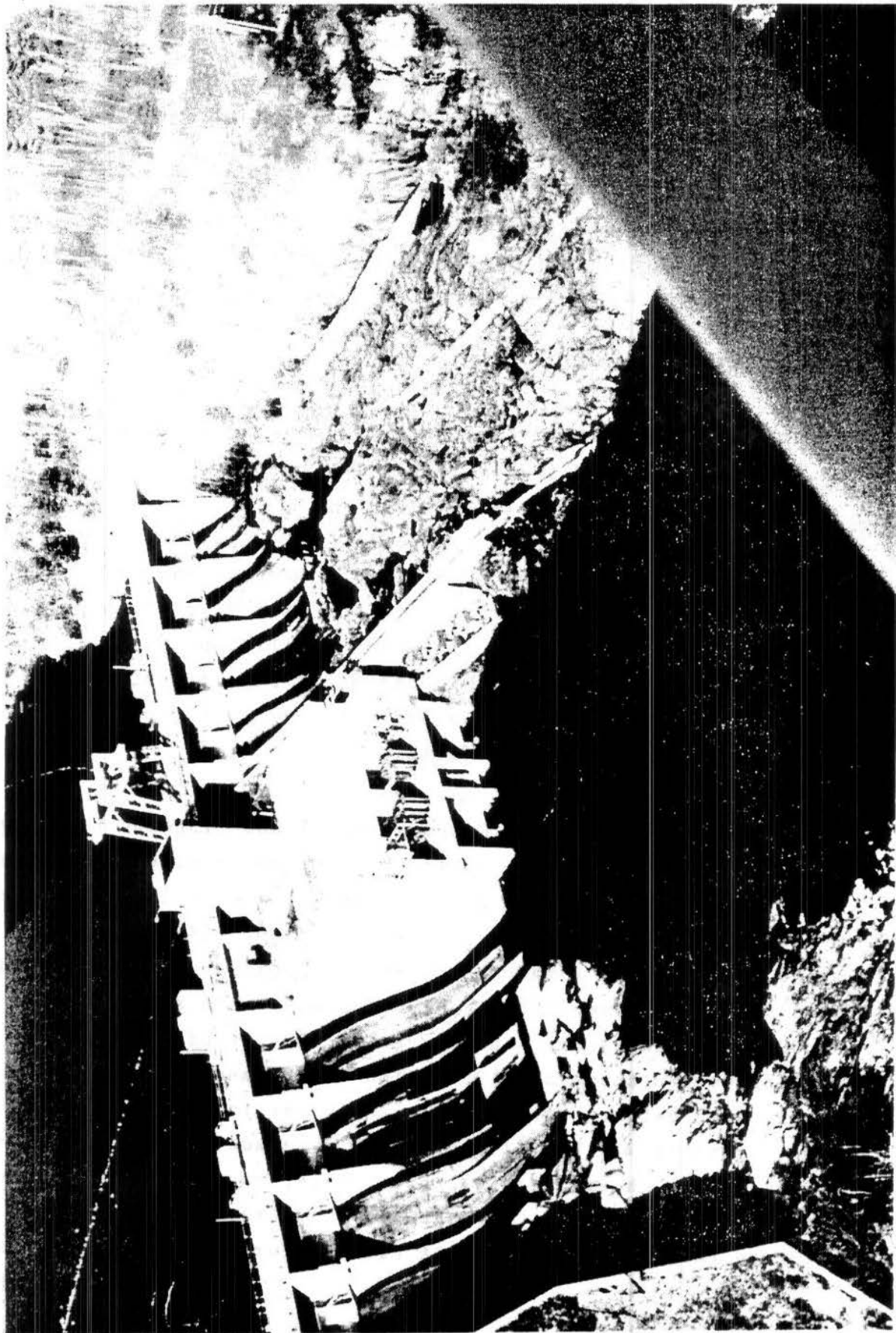


Figure II-3. Skelton Dam, Dayton-Buxton.

Tributaries: The drainage area of Deep Brook at its confluence with the Saco River is 5.83 mi<sup>2</sup> (Cowing and Caracappa 1978). Drainage areas of other direct and indirect tributaries within the reach were not determined for this report. There are three dams on Swan Pond Brook, one of the direct tributaries to the Saco within Reach II (MEDEP 1976). One of these dams is a small hydro facility with a 10-ft head (DeRoche 1967). No further information is available on any of these dams.

#### WATER QUALITY AND USE

Saco: The Saco River from Thatchers Brook to tidewater is designated as Class C (MEDEP 1976). The rest of the Saco River within this reach is designated as Class B-2.

A coastal study conducted under Section 208 of the Clean Water Act concluded that discharges into the Saco River from private septic systems, wastewater treatment facilities and solid wastes from the towns of Saco and Biddeford had significant effects on water quality (NERBC 1980). Storm water run-off from urban development had moderate effects.

The Maine Energy Recovery Company (MERC) has proposed building a resource recovery project on the Saco River in Biddeford (Mower 1985). This company would convert combustible solid waste to steam for the generation of electricity (Energroup 1984). The State of Maine has approved a request by MERC to utilize the Saco River for cooling water (Mower 1985). The approval covers a maximum of 61,000 gpm intake, and a discharge of 135 cfs of non-contact cooling water (Energroup 1984). The intake and discharge sites are located between Bradbury Dam and Upper York (West Channel) Dam (Figure II-4). The discharge will be made through a diffuser system into a thermal mixing zone. This zone includes all the water impounded by the Cataract and Upper York Dams and is referred to by MERC as Cataract Pond (Figure II-4). The discharge

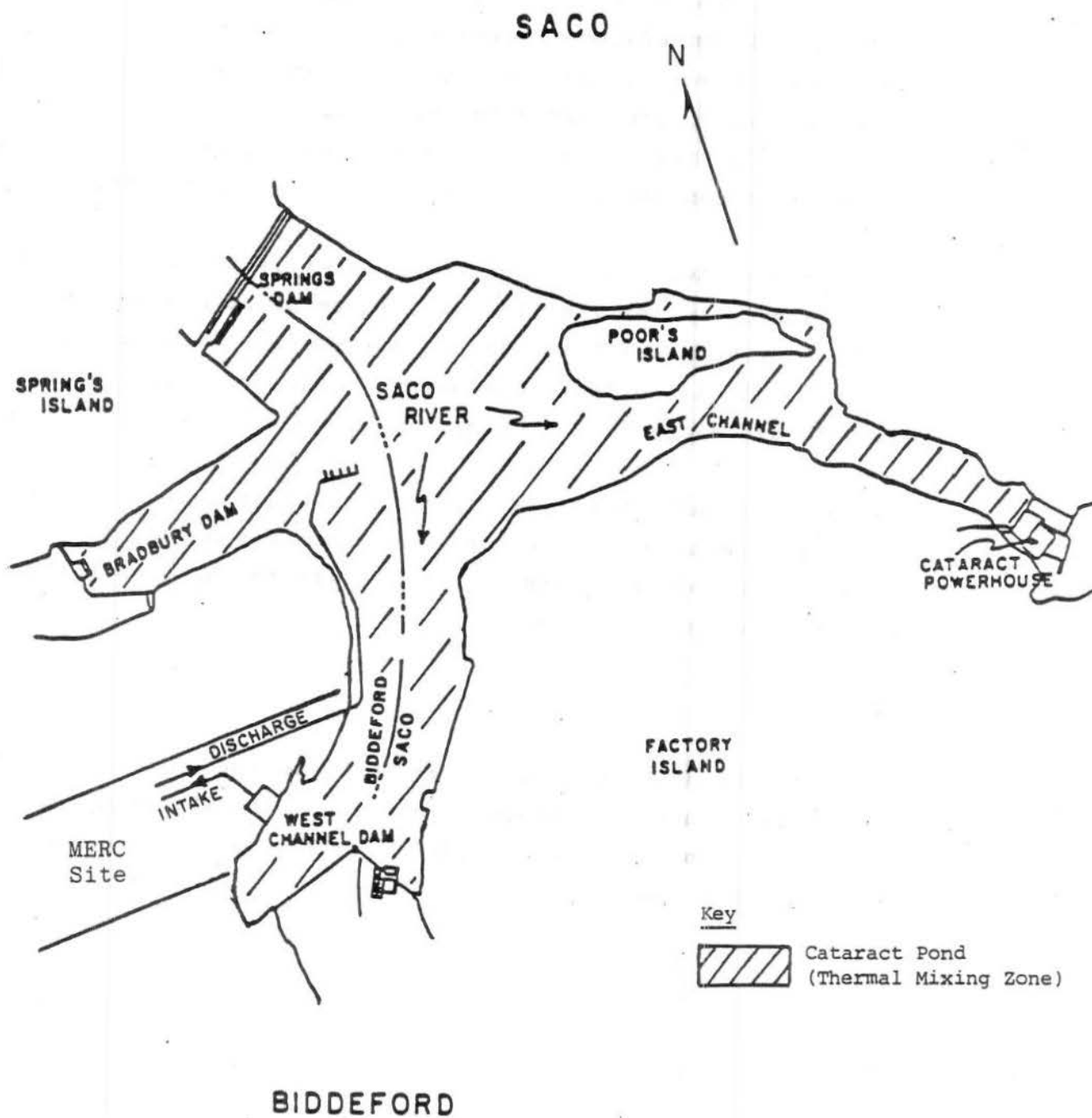


Figure II-4. Proposed location of the Maine Energy Recovery Company showing the intake and discharge sites and Cataract Pond (Energroup 1984).

will be returned at a maximum of 5°F higher than the intake temperature. Under the most adverse conditions Cataract Pond would have a temperature increase ( $\Delta T$ ) of 1.5 to 2.0°F. These conditions, however, would occur less than 1.5% of any year. For 75% of the year, the change in temperature would be less than 0.4°F. The Central Maine Power Company has agreed to provide MERC with minimum continuous flows of 250 cfs (Hutchins 1985).

Tributaries: Swan Pond Brook (Goodwin Mills Brook) from a point  $\frac{1}{2}$  mile above its intersection with Route 35 at Goodwins Mills, to its confluence with the Saco River is classified as Class B-2 (MEDEP 1976). All other tributaries to the Saco River within Reach II are classified as Class B-1.

The Southern Maine Metal Finishing Company in East Waterboro discharges metals into the ground water. This has caused contamination of Cooks Brook, a tributary to the Saco River at Skelton Flowage (Mower 1985).

#### LAND USE

Saco: The land between the Upper York Dam and Rotary Park at Route I-95 is used for urban development, and the remainder of the reach is mostly farmland (SREAC 1973). Land use by town is given in Table 1-4.

## FISHERIES

### HABITAT ASSESSMENTS

Personnel of the Maine Department of Inland Fisheries and Wildlife, Gray, Maine surveyed the entire Saco River within Reach II in August of 1984. The surface area was estimated at 21,313, 100-yd<sup>2</sup> units. Depths are recorded on survey maps available at the MEDIF&W office in Gray. Substrate types under impounded waters were not delineated. The only unimpounded water was a  $\frac{1}{4}$  mile section of the Saco River immediately below Skelton Dam which contains primarily boulder, rubble, and gravel substrates (Appendix G). It also contains one pool with a surface area of 97 units. Depth of the pool is unknown.

### HABITAT SUITABILITY

Saco River: The Saco River within Reach II provides suitable habitat for both anadromous and inland fish species. Table II-3 summarizes the habitat capabilities of Reach II. Effective fish passage facilities and adequate flow releases at the Skelton and Cataract Dam projects will enhance the migration and production of Atlantic salmon, American shad, and alewives.

The entire reach contains brown trout habitat; however, under present management plans, only the area between Skelton Dam, and Bradbury and Springs Dams will be stocked with brown trout. This section will receive an annual allotment of 4,300 spring yearlings. The only habitat for brook trout available in the Saco River within the reach is in the area immediately below Skelton Dam. Once adequate flow releases are provided at Skelton Dam, this area will be stocked annually with 750 catchable brook trout. Groundwater seeps that could be used by salmonids during periods of warm water temperatures are present on the southwest bank of the river below Skelton Dam (Appendix G).

Table II-3. Suitable habitat, spawning escapement, and production estimates for important fish species in the Saco River within Reach II.

Fish Species	Habitat		Spawning Escapement (males plus females)	Potential Production
	Number of Units (100 yd <sup>2</sup> )	Location		
Atlantic salmon	163	Immediately below Skelton Dam	10	163 smolts
American shad	21,313	Entire reach	24,510	1.5 to 2.5 million juveniles
Alewives	20,336	Impounded sectors	14,706	49,350 to 98,700 adults
Brown trout	21,313	Entire reach	--	Limited. Annual stocking of 4,300 spring yearlings between Skelton Dam, & Bradbury & Springs Dams
Brook trout	600 (seasonal, temperature limiting)	Immediately below Skelton Dam	--	Limited. Annual stocking of 750 catchables
Warmwater species (e.g. bass, perch, pickerel)	21,313	Entire reach	--	--

The unimpounded water immediately below Skelton Dam is a critical component of the Saco River habitat in Reach II. All three anadromous fish species will use this area as a migratory pathway. This unimpounded section also represents the known suitable reproductive habitat for Atlantic salmon within the reach and all known suitable brook trout habitat for seasonal stockings. It is therefore critical that continuous minimum flows be released at Skelton Dam to protect the suitability of the habitat in this area. A minimum flow release of 811 cfs (ABF) or inflow to the project area, whichever is less, has been recommended at Skelton Dam (USFWS 1986).



## RIVER RECREATIONAL USE

### SACO RIVER

General: Recreational activity in Reach II is confined to waters upriver of Bradbury and Springs Dams. The Cataract head pond is not used for recreational purposes because of poor access and strong currents (Energroup 1984). There are three parks within the reach; Diamond Riverside Park, Rotary Park (MESPO 1977), and Poors Island Jubilee Park (Alexander 1984). Rotary Park is located on the south bank of the Saco River just downriver of the Route I-95 bridge. The locations of the other two parks and information on canoeing in Reach II, were not determined for this report.

Fishing: There has been recent additional interest by anglers in fishing the Saco River in Reach II. More fishermen are pursuing the warmwater species (e.g. bass, perch, pickerel) in the impoundment and coldwater species (salmonids) in the tailrace below Skelton Dam. Recently there has been a significant amount of fishing for Atlantic salmon below Skelton Dam at the tailrace.

Other Water-Related Activities: The Saco River provides the only source of fresh water swimming in Biddeford and is a site for swimming instruction programs (SREAC 1973).

Camping: There is at least one campground on the Saco River within Reach II, located in Biddeford just above the Route 5 bridge (DeLorme 1984).

Access: There are five known canoe access points within Reach II (Appendix J). One of these points is an excellent boat ramp at Rotary Park, Biddeford (mi 8.2). It is the only good boat access point on the Saco River above tidewater (Pierce 1985).



REACH III. SKELTON DAM, UNION FALLS, TO THE CONFLUENCE OF THE  
LITTLE OSSIPEE RIVER, EAST LIMINGTON, MAINE.

PHYSICAL CHARACTERISTICS

TOPOGRAPHY AND GEOLOGY

Reach III (Figure 1-1) contains 15.2 miles of the Saco River, originating at Skelton Dam, Union Falls (mi 17.1) and ending just downstream of the confluence of the Little Ossipee River in Limington and Standish (mi 32.3). The land within this reach is composed of Seaboard Lowland and Northern New England Upland land forms. Hills adjacent to the Saco River throughout most of the reach have elevations less than 250 feet and lie in the Seaboard Lowland land form. In the western portion of this reach the Northern New England Upland land form begins, and elevations there commonly exceed 450 feet.

There are eight minor tributaries to the Saco River within this reach (Appendix K).

CLIMATE

Climate within the reach is based on data recorded at West Buxton. Mean precipitation and temperatures for each month are shown in Tables III-1 and III-2 respectively. No snowfall data was available for West Buxton.

RIVER HYDROLOGY

Saco: The average gradient of the Saco River within Reach III is approximately 6.5 ft per mile based on a normal pond height behind Skelton Dam of 126.5 ft (CMP 1971b) and a USGS contour of 236 ft at the confluence of the Little Ossipee River.

TABLE III-1. Mean precipitation-inches (NOAA 1974-1983)

	<u>West Buxton</u>
Period of record	1974-1983
Elevation (feet above M.S.L.)	150
January	4.49
February	3.07
March	4.63
April	4.54
May	3.84
June	3.55
July	3.27
August	3.33
September	3.28
October	4.51
November	4.56
December	3.87
Annual	47.56

TABLE III-2. Mean temperature - °F (NOAA 1974-1983)

	<u>West Buxton</u>
Period of record	1974-1983
Elevation (feet above M.S.L.)	150
January	17.3
February	20.6
March	31.2
April	41.9
May	53.2
June	55.6
July	67.6
August	64.8
September	56.9
October	43.8
November	36.7
December	23.9
Annual	43.2

There are three dams within this reach beyond Skelton Dam; Bar Mills Dam in the village of Bar Mills (mi 20.4), West Buxton Dam, West Buxton (mi 25.5), and Bonny Eagle Dam in Hollis and Standish (mi 27.1). All of these dams are owned by Central Maine Power Co., Augusta, Maine (Dube 1983). All waters within Reach III are impounded except for a short segment below the Little Ossipee River and a short segment below each of the dams. The surface areas of the waters within the reach as noted in the following paragraphs are based on 1984 river surveys by personnel from the Maine Department of Inland Fisheries and Wildlife, Gray, Maine.

Bar Mills Dam (FERC No. 2194) is located 3.3 miles upriver of Skelton Dam. The water between these dams has a surface area of approximately 428 acres, 199 of which are contained in the Skelton Flowage, a large arm of the Saco River which begins approximately 1.1 miles upriver of the Skelton Dam. Bar Mills Dam (Figure III-1) is a two-section hydroelectric dam with a head of approximately 22 ft (CMP 1968). The generating facility is at the lower dam (Figure III-2) which lies approximately 200 yds below the upper dam (Figure III-3). Most of the flow is directed to the lower dam but in periods of high water levels, there are sufficient flows over the upper dam to attract fish (Dube 1983). Normal full pond elevation behind Bar Mills Dam is 148.5 ft, and normal tailwater elevation below the dam is 127.0 ft. (CMP 1968). Bar Mills Dam receives the drainage from 1,591 mi<sup>2</sup> (Cowing and Caracappa 1978).

West Buxton Dam (FERC No. 2531) is a hydroelectric dam with a head of approximately 28 ft (CMP 1970). It is located approximately 5.1 miles upriver of Bar Mills Dam. The water between Bar Mills Dam and West Buxton Dam has a surface area of approximately 232 acres. The West Buxton facility contains two intake areas and two powerhouses (Pierce 1985). The first intake area directs flows through a powerhouse at the dam, and the second intake area

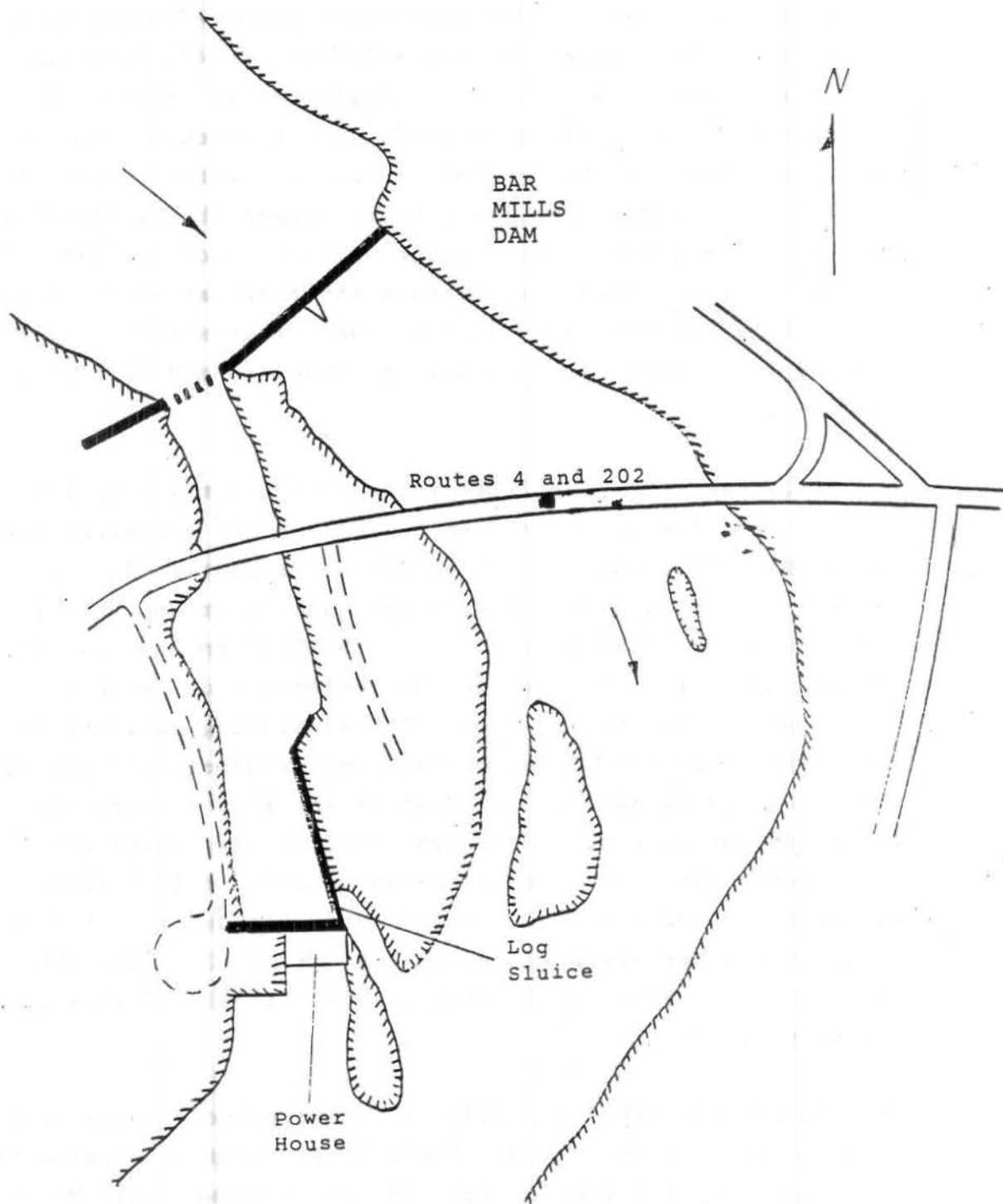


Figure III-1. Layout of Bar Mills Dam on the Saco River in Bar Mills, Maine.

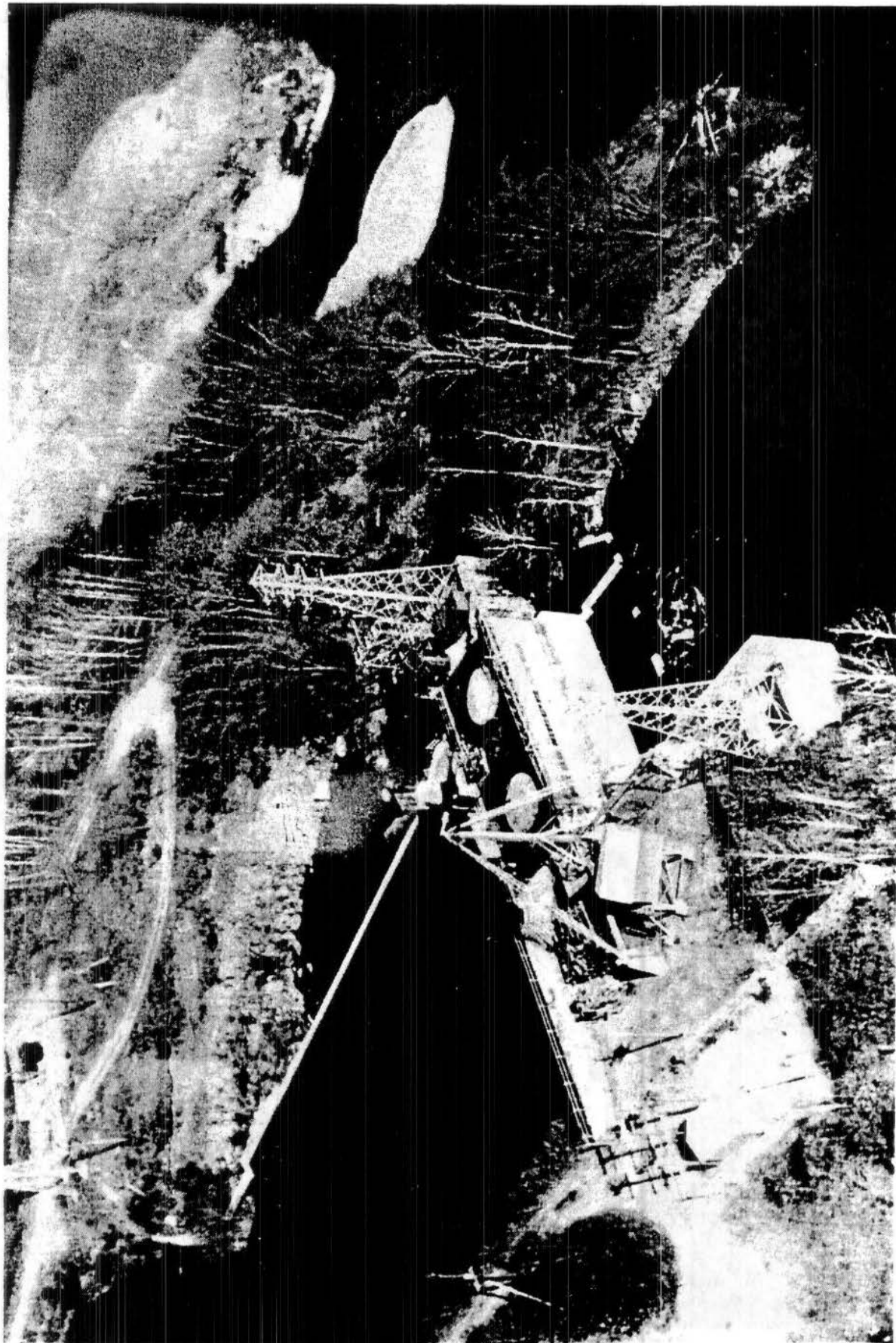


Figure III-2. Power house at Bar Mills Dam, Hollis.



Figure III-3. Bar Mills Dam and Routes 4 and 202, Buxton-Hollis.



directs flows through a penstock approximately 100 yds downriver (Figures III-4 and III-5). The average annual flow at the West Buxton Dam is 3,045 cfs (NERBC 1980). West Buxton Dam has a normal full pond elevation of 177.8 ft, and a normal tailwater elevation of 150.3 ft (CMP 1970). The dam receives the drainage from 1,572 mi<sup>2</sup> (Cowing and Caracappa 1978).

The last dam within this reach is Bonny Eagle Dam (FERC No. 2549), located approximately 1.6 miles upriver of West Buxton Dam. The water between West Buxton Dam and Bonny Eagle Dam has a surface area of approximately 125 acres. Bonny Eagle Dam (Figure III-6) is a hydroelectric dam with a 36-ft head (CMP-1972). It is a two-section dam with a powerhouse located approximately 300 yds downriver from the spillway (Figure III-7). Bonny Eagle Dam has a normal full-pond elevation of 216.0 ft, and a normal tailwater elevation of 180.0 ft. This dam receives the drainage from 1,560 mi<sup>2</sup> (Cowing and Caracappa 1978). Water is impounded behind Bonny Eagle Dam to a point just below the Limington Rips in East Limington (Pierce 1984). The surface area of the water between Bonny Eagle Dam and the confluence of the Little Ossipee River is approximately 252 acres. Further information on the dams in Reach III can be seen in Table 1-2.

Tributaries: Cooks Brook is a direct tributary to the Skelton Flowage in Dayton and Hollis. This brook has two barriers; a natural barrier of ledge and boulders approximately 100 yards upstream from its mouth (DeRouche 1967), and a seven-to-eight-foot dam at the outlet of Cooks Pond (Pierce 1985). The drainage area of Cooks Brook is 23.6 mi<sup>2</sup> (Cowing and Caracappa 1978). Drainage areas of other tributaries within Reach III were not determined for this report.

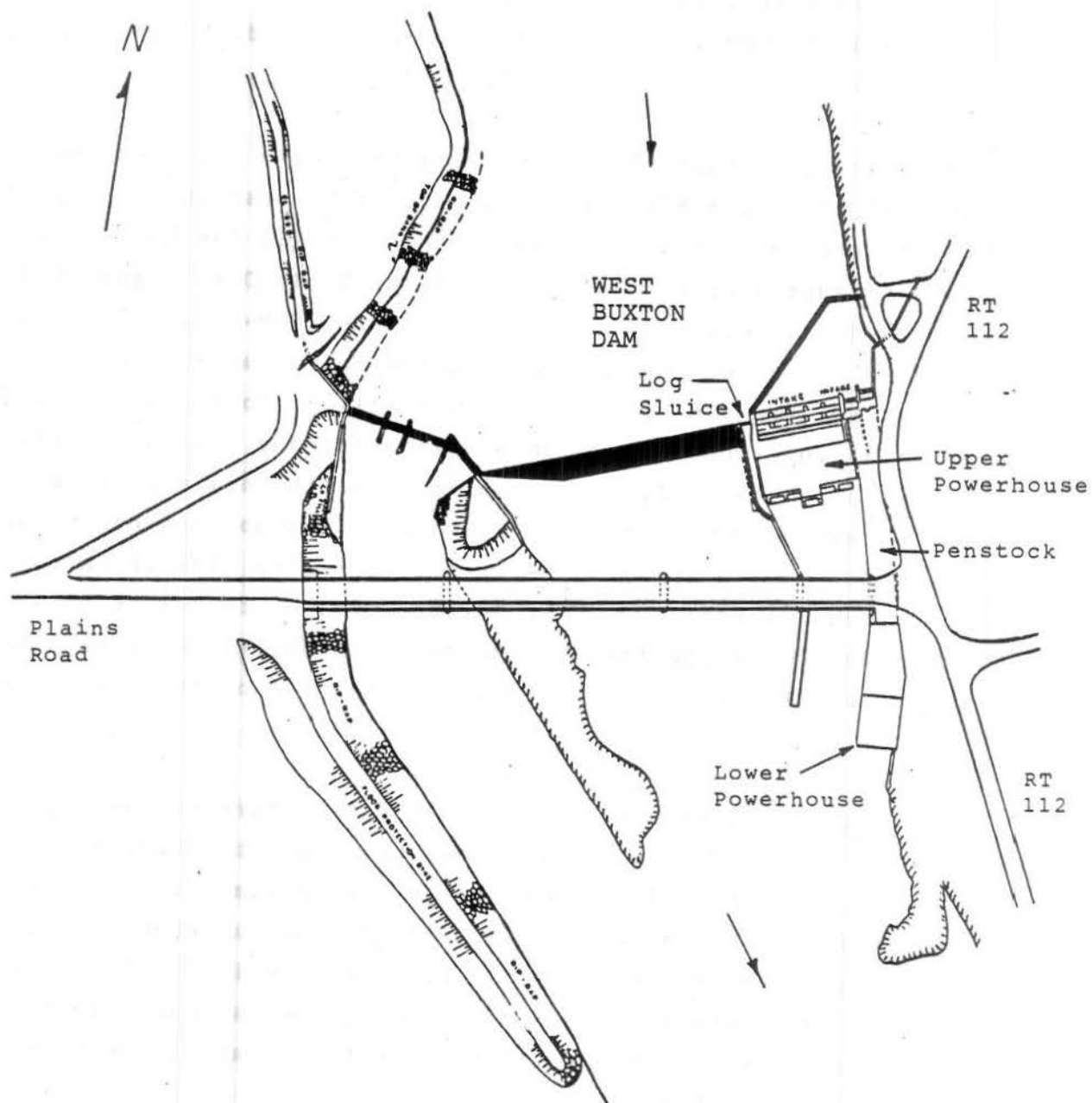


Figure III-4. Layout of West Buxton Dam on the Saco River in West Buxton, Maine.



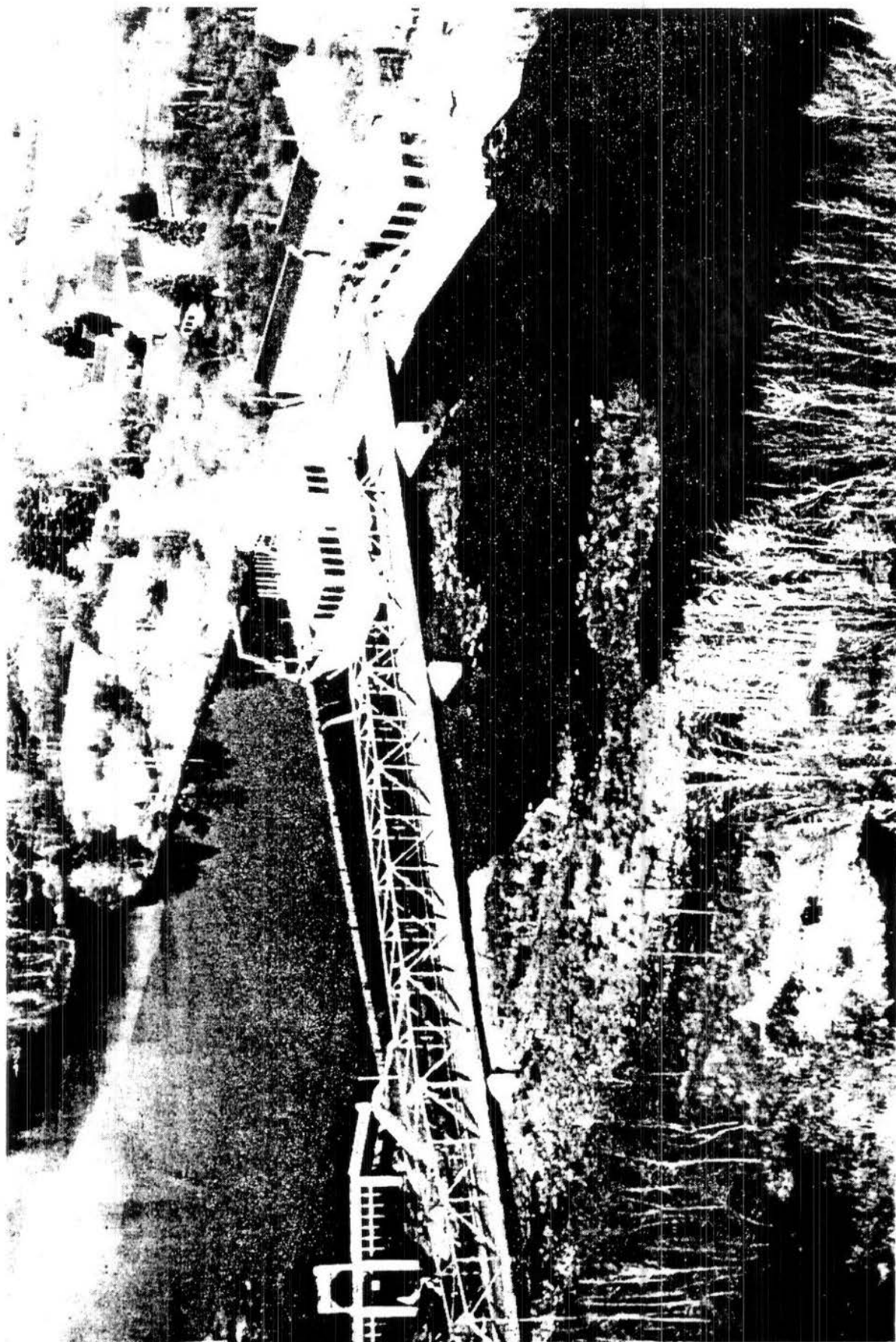


Figure III-5. West Buxton Dam, Buxton-Hollis.

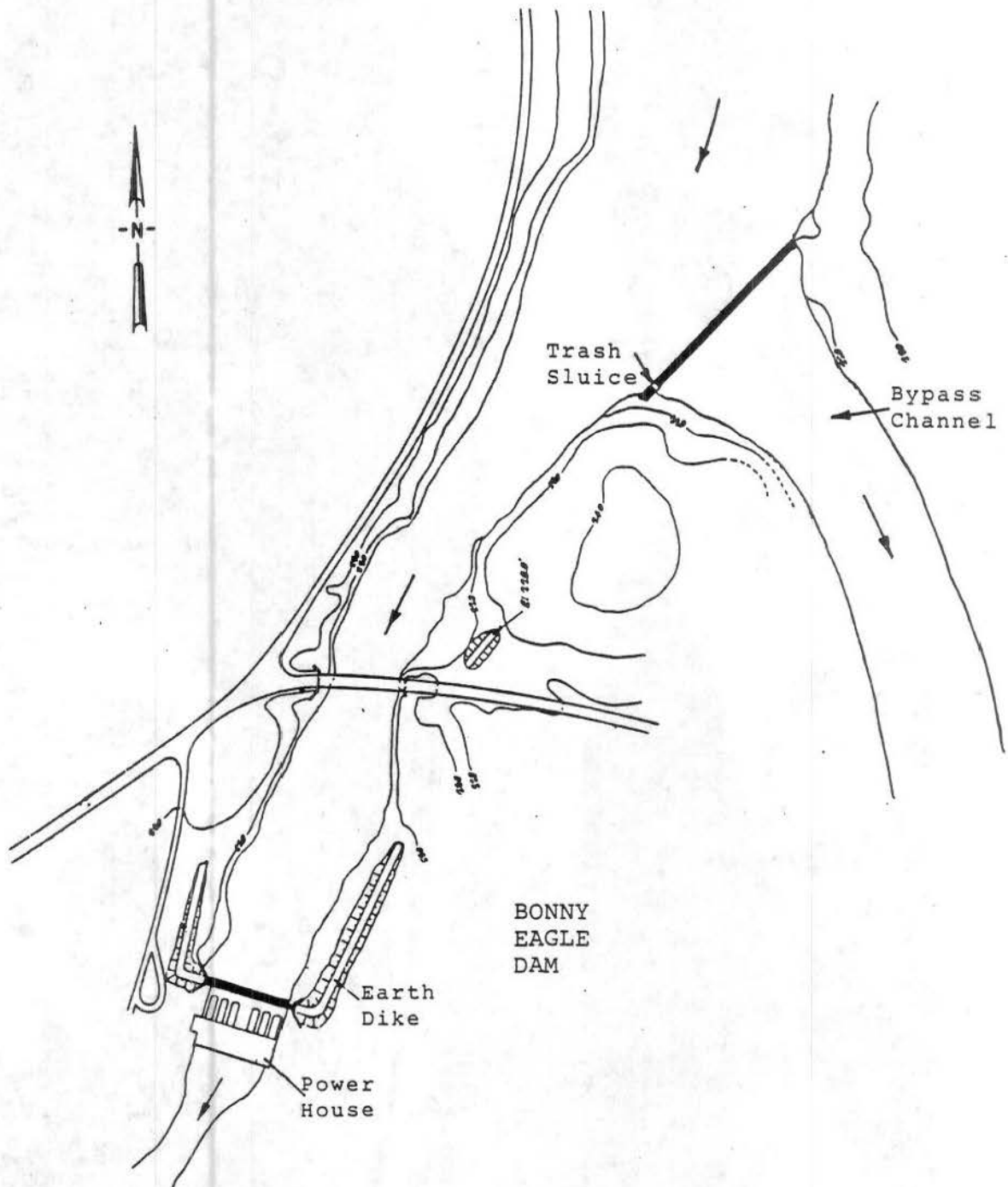


Figure III-6. Layout of Bonny Eagle Dam on the Saco River in Hollis and Standish, Maine.

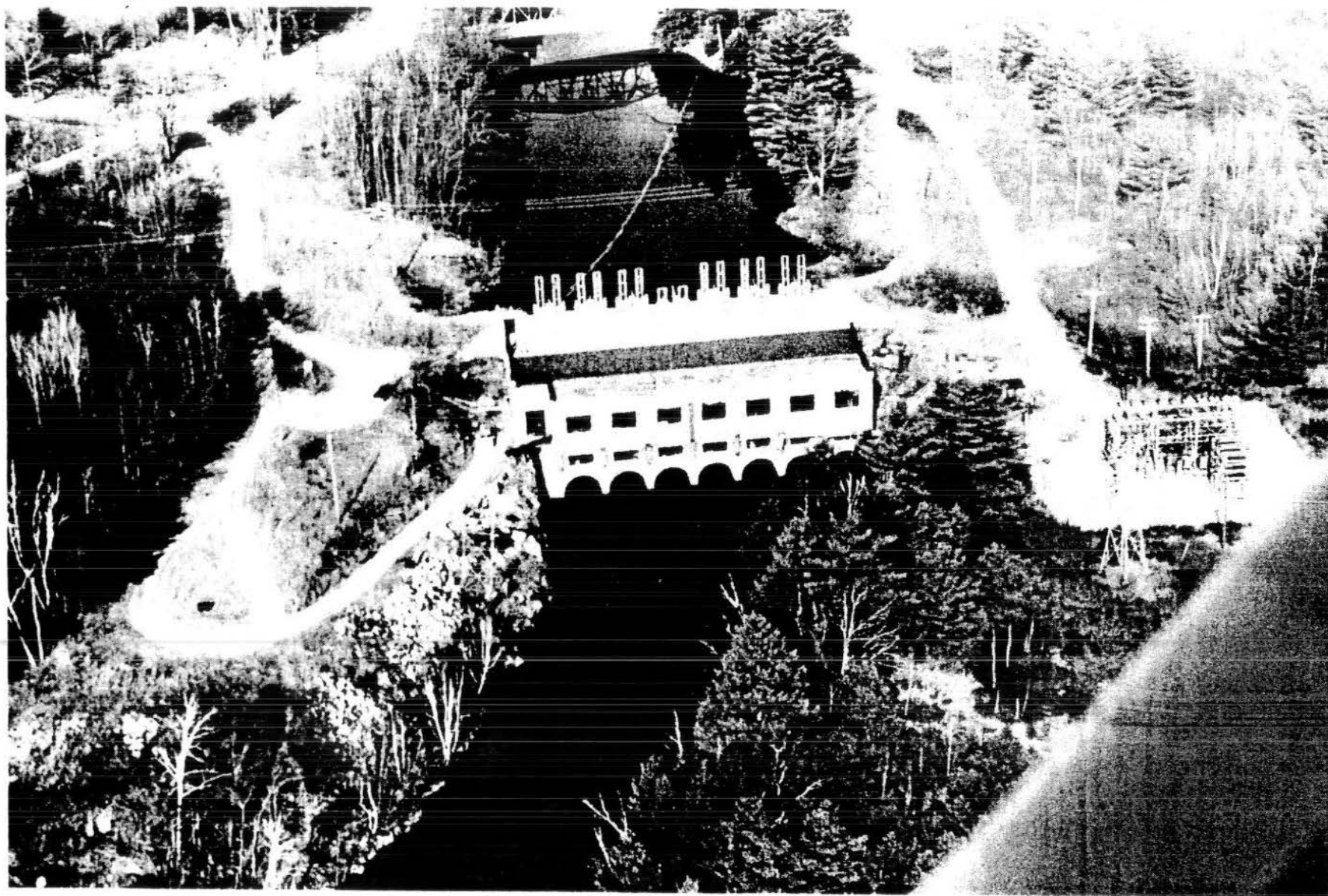


Figure III-7. Power house at Bonny Eagle Dam, Hollis-Standish.

## WATER QUALITY AND USE

Saco: The water in the Saco River between Bar Mills Dam and the Route 4A highway bridge at Salmon Falls village is classified as Class B-2 (MEDEP 1976). The remainder of the Saco River within the reach is classified as Class B-1.

Tributaries: All the tributaries within this reach, both direct and indirect, are classified as Class B-1.

## LAND USE

The area between Skelton Dam and Salmon Falls is undeveloped (SREAC 1973). Development is heavy between Salmon Falls and West Buxton, primarily due to several roads which parallel the river. The development consists of seasonal and year-round dwellings, several small developments, and the villages of Bar Mills and West Buxton. Land use by town is given in Table 1-4.

## FISHERIES

### HABITAT ASSESSMENTS

Personnel of the Maine Department of Inland Fisheries and Wildlife, Gray, Maine, surveyed the entire Saco River within Reach III in August of 1984. The total surface area including the bypass channels at Bar Mills and Bonny Eagle Dams was estimated at 50,799, 100-yd<sup>2</sup> units. The distribution of surface area is as follows: Skelton Dam to Bar Mills Dam, 20,732 units; Bar Mills Dam to West Buxton Dam, 11,237 units; West Buxton Dam to Bonny Eagle Dam, 6,632 units; and Bonny Eagle Dam to the confluence of the Little Ossipee River, 12,198 units. Depths were recorded on survey maps which are available at the MEDIF&W in Gray. All of the water in the Saco River within Reach III is impounded except a small section immediately below each of the three dams. Substrate types were not delineated beneath impounded waters. A 1/10-mile section below Bar Mills Dam contains rubble, boulder, and ledge substrates, and a 1/4-mile section below West Buxton Dam contains gravel, rubble, and boulder substrates. On the east side of the island immediately below Bonny Eagle Dam is a normally dewatered section approximately 1/3 mile long that is composed almost entirely of fractured ledge, with a boulder overlay. A small area of boulder and rubble habitat is located adjacent to the southeastern end of the island. Substrate maps of the areas below the three dams may be seen in Appendix G. No pools other than impoundments were found in the Saco River within Reach III.

### HABITAT SUITABILITY

Saco River: The Saco River within Reach III provides suitable habitat for both anadromous and inland fish species (Tables III-3 through III-6). A summary of habitat potential for the reach is given in Tables 2-5, 2-6. Fish passage facilities and aquatic base flows will provide for production and migration of Atlantic salmon,



Table III-3. Suitable habitat, spawning escapement, and production estimates for important fish species in the Saco River between Skelton Dam and Bar Mills Dam.

Fish Species	Habitat		Spawning Escapement (males plus females)	Potential Production
	Number of Units (100 yd <sup>2</sup> )	Location		
Atlantic salmon	Limited	Immediately below powerhouse at Bar Mills Dam	--	--
	(100)	Bypass channel at Bar Mills Dam	(6)	(100 smolts)
American shad	20,732	Entire segment	23,842	1.5 to 2.5 million juveniles
Alewives	20,159	Impounded sector	14,578	48,880 to 97,760 adults
Brown trout	20,732	Entire segment	--	Limited. Annual stocking of 4,300 spring yearlings
Brook trout	Limited	Immediately below powerhouse at Bar Mills Dam	--	--
	(560) (seasonal, temperature limiting)	Bypass channel at Bar Mills Dam	--	Limited. Annual stocking of 700 catchables
Warmwater species (e.g. bass, perch, pickerel)	20,732	Entire segment	--	--

Table III-4. Suitable habitat, spawning escapement, and production estimates for important fish species in the Saco River between Bar Mills Dam and West Buxton Dam.

Fish Species	Habitat		Spawning Escapement (males plus females)	Potential Production
	Number of Units (100 yd <sup>2</sup> )	Location		
Atlantic salmon	531	Immediately below West Buxton Dam	32	531 smolts
American shad	11,237	Entire segment	12,923	0.8 to 1.3 million juveniles
Alewives	10,405	Impounded sector	7,524	25,262 to 50,525 adults
Brown trout	11,237	Entire segment	--	Limited. Annual stocking of 2,300 spring yearlings
Brook trout	748 (seasonal, temperature limiting)	Immediately below West Buxton Dam	--	Limited. Annual stocking of 1,000 catchables
Warmwater species (e.g. bass, perch, pickerel)	11,237	Entire segment	--	--

Table III-5. Suitable habitat, spawning escapement, and production estimates for important fish species in the Saco River between West Buxton Dam and Bonny Eagle Dam.

Fish Species	Habitat		Spawning Escapement (males plus females)	Potential Production
	Number of Units (100 yd <sup>2</sup> )	Location		
Atlantic salmon	62	Tailrace at Bonny Eagle Dam	4	62 smolts
	(594)	(Bypass channel at Bonny Eagle Dam)	(36)	(594 smolts)
American shad	6,632	Entire segment	7,627	0.5 to 0.8 million juveniles
Alewives	6,038	Entire segment excluding bypass channel at Bonny Eagle Dam	4,366	14,688 to 29,375 adults
Brown trout	6,632	Entire segment	--	Limited. Annual stocking of 1,400 spring yearlings
Brook trout	62 (seasonal, temperature limiting)	Tailrace at Bonny Eagle Dam	--	Limited. Annual stocking of 100 catchables
	(828) (seasonal, temperature limiting)	(Bypass channel at Bonny Eagle Dam)	(--)	(Limited. Annual stocking of 1,000 catchables)
Warmwater species (e.g. bass, perch, pickerel)	6,632	Entire segment	--	--



Table III-6. Suitable habitat, spawning escapement, and production estimates for important fish species in the Saco River between Bonny Eagle Dam and the Little Ossipee River confluence.

Fish Species	Habitat		Spawning Escapement (males plus females)	Potential Production
	Number of Units (100 yd <sup>2</sup> )	Location		
Atlantic salmon	Limited	Entire segment	--	--
American shad	12,198	Entire segment	14,027	.0.9 to 1.4 million juveniles
Alewives	12,198	Entire segment	8,821	29,610 to 59,220 adults
Brown trout	12,198	Entire segment	--	Limited. No stocking
Brook trout	Limited	Entire segment	--	No stocking
Warmwater species (e.g. bass, perch, pickerel)	12,198	Entire segment	--	--

American shad, and alewives in this reach. The suitable habitat available for Atlantic salmon within the reach is limited and this species would primarily use the Saco River as a migration pathway. The only area presently planned for alewife management within Reach III is the Skelton headpond. This area is suitable for 14,578 spawning adult alewives. Additional alewife habitat is available throughout the remainder of the reach which could support 20,711 spawning adults.

The entire Saco River within Reach III contains habitat for brown trout; however, under present management plans, only the area between Skelton and Bonny Eagle Dams will be stocked. This area will receive an annual allotment of 8,000 spring yearlings. Brook trout habitat is presently available immediately below West Buxton Dam and in the tailrace at Bonny Eagle Dam. These areas will be stocked annually with a total of 1,100 catchable brook trout.

The bypass channels at Bar Mills and Bonny Eagle Dams, and the unimpounded waters immediately below all three dams are critical to fish species within the reach. Adequate minimum flow releases in the bypass channels will increase Atlantic salmon production by 694 units and produce 694 additional smolts. Brook trout habitat will be similarly increased by 1,388 units, and annual brook trout stockings would increase by 1,700 catchables. This additional habitat is noted in parentheses in Tables III-3 and III-5. The aquatic base flow recommended for release at Bonny Eagle dam is 780 cfs and at West Buxton Dam, 786 cfs or inflow, whichever is less (USFWS 1986). Based on U.S. Fish and Wildlife Service policy, the recommended aquatic base flow for Bar Mills Dam would be 796 cfs.

## RIVER RECREATIONAL USE

### SACO RIVER

General: Information regarding the recreational use of the Saco River within Reach III is limited. A small portion of a 1,000-acre tract of land owned by the Maine Department of Conservation abuts the west bank of the Saco River in Limington (Cieslinski 1985). It is located approximately one mile north of Nasons Mills Road in the vicinity of Hardscrabble Road, the Little Ossipee River, and the Saco River.

Canoeing: Nearly the entire reach is impounded water behind a series of dams. There are two canoe rental facilities in the lower portion of the reach; one at Salmon Falls and one at Bar Mills (Saco Bound undated).

Fishing: The Saco River within Reach III provides warmwater fisheries and seasonal coldwater fisheries. Coldwater species, which may include brook trout, rainbow trout, brown trout and landlocked salmon, are primarily sought in the tailrace areas below each of the dams. A major portion of the salmonid fishing in the Saco River in Reach III is in the bypass channel of Bonny Eagle Dam. The relative scarcity of coldwater species in impounded areas results in concentration for warmwater species (e.g. bass, perch, pickerel).

Other Water-Related Activities: Information on other water-related activities within the reach is unavailable at this time.

Camping: There are no known campgrounds on the Saco River in Reach III (Saco Bound undated, Delorme 1984).

Access: There are six known canoe access points to the Saco

River within Reach III (Appendix J). One of these is a dirt public boat launch located on the south side of the river just upstream of Skelton Dam, which provides poor access (Flagg 1984). Another poor boat access site is located in the impounded area upriver of Bar Mills Dam. This is only accessible to boats when impounded waters are at high levels (Pierce 1985). Access is also available immediately outside of Reach III at the Route 25 crossing in East Limington and below the Skelton Dam in Union Falls.

REACH IV. CONFLUENCE OF THE LITTLE OSSIPEE RIVER, EAST LIMINGTON TO HIRAM DAM, HIRAM, MAINE (Includes the Little Ossipee River).

### PHYSICAL CHARACTERISTICS

#### TOPOGRAPHY AND GEOLOGY

Reach IV (Figure 1-1) is the portion of the watershed within the 17.5 mile length of the Saco River between the confluence of the Little Ossipee River, East Limington (mi 32.3) to the Hiram Dam, Hiram, Maine (mi 49.8). This reach includes the Little Ossipee River and Ossipee River watersheds, both of which have portions in New Hampshire. The northwest corner of the Ossipee River watershed lies in the White Mountain land form and is characterized by hills exceeding 2,000 feet. The remainder of the reach lies within the Northern New England Upland land form. Hills within the New Hampshire portion of this land form commonly exceed 1,100 ft and peaks of over 2,000 ft are not unusual. The Maine portion is characterized by steep hills and broad flat valleys. Most hills range between 450 and 800 ft with occasional peaks exceeding 900 ft. One peak near Hiram Dam exceeds 1,100 ft.

Two major tributaries, the Ossipee River and the Little Ossipee River, and seven minor tributaries drain into the Saco River within Reach IV (Appendix K).

#### CLIMATE

Information on the climate within Reach IV is based on data from four locations: two in Tamworth, New Hampshire; one in Hiram, Maine and one in Cornish, Maine. Data from the Cornish location only covers precipitation. Monthly data on mean precipitation, temperatures, and snowfall are shown in Tables IV-1, IV-2 and IV-3 respectively. The Tamworth 2 location was closed in 1969.

TABLE IV-1. Mean precipitation-inches (Ferrin 1984 unless otherwise noted).

	<u>Tamworth</u> <sup>2</sup>	<u>Tamworth</u> <sup>3</sup>	<u>Hiram</u> <sup>1/</sup>	<u>Cornish</u> <sup>2/</sup>
Period of Record	1962-1969	1974-1982	1941-1970	Unknown - 67 years of record prior to 1954
Elevation (ft above M.S.L.)	500	785	360	370
January	3.10	4.49	3.60	3.55
February	3.86	3.27	3.67	3.65
March	3.39	4.12	3.85	4.29
April	3.85	4.19	3.48	3.67
May	3.44	3.75	3.62	3.61
June	3.55	4.16	3.75	3.75
July	2.89	4.59	3.55	4.15
August	3.20	3.84	3.42	4.28
September	2.80	4.39	3.30	3.64
October	3.40	5.01	3.55	4.04
November	5.88	3.74	5.24	4.17
December	4.68	3.72	4.18	3.63
Annual	43.63	49.50	45.21	46.43

<sup>1/</sup> NHWSPCC 1979

<sup>2/</sup> NENYIAC 1954

TABLE IV-2 Mean air temperatures-°F (Ferrin 1984 unless otherwise noted).

	<u>Tamworth 2</u>	<u>Tamworth 3</u>	<u>Hiram<sup>1/</sup></u>
Period of Record	1962-1969	1974-1981	1974-1983
Elevation (ft above M.S.L.)	500	785	410-528 <sup>2/</sup>
January	18.8	14.9	15.7
February	18.6	18.9	17.9
March	30.5	30.3	30.2
April	41.5	41.2	41.5
May	52.8	54.2	53.7
June	63.1	61.6	62.2
July	67.3	66.2	68.1
August	65.4	63.7	65.4
September	56.8	54.0	56.7
October	47.6	43.4	44.6
November	35.3	35.6	36.7
December	22.2	20.5	22.5
Annual	43.6	42.0	42.8

<sup>1/</sup> NOAA 1974-1983

<sup>2/</sup> 1974 through 1979 reports are listed at 410 feet  
1980 is listed at 445 feet  
1981 through 1983 are listed at 528 feet

TABLE IV-3. Average snowfall-inches (Ferrin 1984 unless otherwise noted).

	<u>Tamworth 2</u>	<u>Tamworth 3</u>	<u>Hiram</u> <sup>1/</sup>
Period of Record	1962-1969	1974-1982	14 years of records prior to 1954
Elevation (ft above M.S.L.)	500	785	
January	23.6	26.9	<div style="text-align: center;"> ↑ not available ↓ </div>
February	32.0	12.7	
March	12.5	14.5	
April	5.1	8.0	
May	1.5	--	
June	--	--	
July	--	--	
August	--	--	
September	--	--	
October	1.2	1.1	
November	4.9	5.6	
December	19.3	22.4	
Annual	82.9	78.3	89

<sup>1/</sup> NENYIAC 1954



## RIVER HYDROLOGY

Saco: The average gradient of the Saco River within this reach is approximately 2.1 feet per mile based on a normal tailwater elevation at Hiram Dam of 272.4 ft (CMP 1981) and a USGS contour map elevation of 236 ft at the confluence of the Little Ossipee River. The Saco River above the mouth of the Little Ossipee River receives the drainage from approximately 1,352 mi<sup>2</sup> (Cowing and Caracappa 1978).

The lowermost USGS gaging station on the Saco River is within this reach in Cornish, Maine, and is approximately  $\frac{1}{2}$  mile downstream from the Ossipee River confluence (MEDEP 1976). The drainage area of the Saco River Basin at this station is 1,293 mi<sup>2</sup> and the average discharge, based on 67 years of record, is 2,709 cfs (Morrill et al. 1983).

The Hiram Dam (FERC No. 2503) is the only dam on the Saco River within Reach IV. It is located at Great Falls in Hiram (mi 49.8) and is owned by Central Maine Power Company, Augusta, Maine. The dam has a 77 foot head and is built at the top of a large outcropping of ledge. Water is directed through a penstock to a powerhouse approximately 150 yds below the dam (Figures IV-1 and IV-2). Hiram Dam has a normal full-pond elevation of 349 ft and a normal tailwater elevation at the base of the ledge outcropping of 272.4 ft (CMP 1981). The dam receives the drainage from 829 mi<sup>2</sup> (Cowing and Caracappa 1978). Additional information on Hiram Dam can be seen in Table 1-2.

A potential site for further hydropower development is at Steep Falls, located approximately five river miles upstream of the confluence of the Little Ossipee River (NERBC 1981). If developed, the dam would have a 2.515 Mw capacity and a gross head of ten feet.

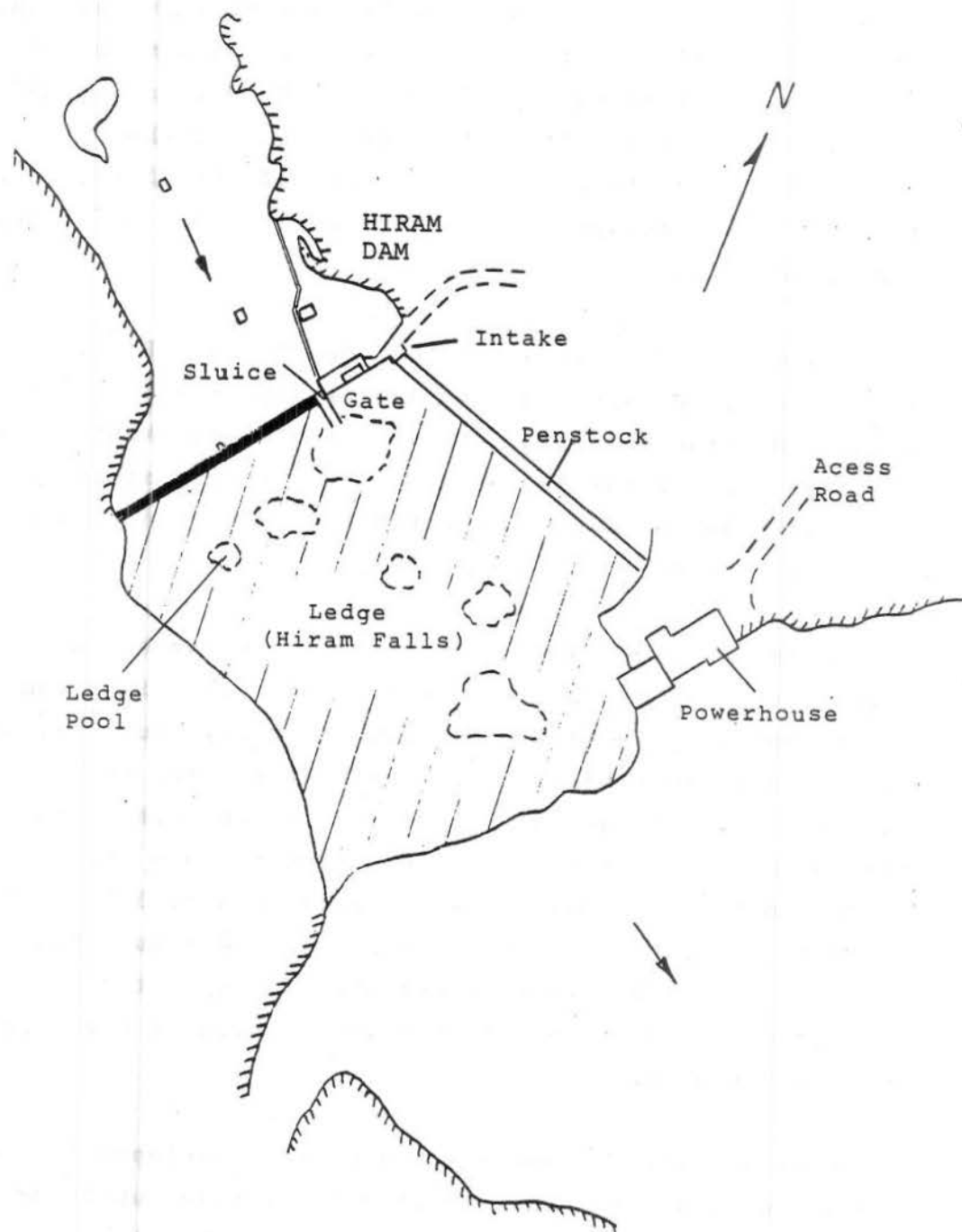


Figure IV-1. Layout of Hiram Dam on the Saco River in Hiram, Maine.



Figure IV-2. Hiram Dam, Baldwin-Hiram.

Tributaries: The Little Ossipee River originates at Balch Pond in Acton and Newfield, Maine, and flows 33 miles to its confluence with the Saco River in East Limington (Pierce 1982). A profile of the Little Ossipee River can be seen in Figure IV-3. The Little Ossipee River drains an area of 187 mi<sup>2</sup> (Cowing and Caracappa 1978). A United States Geological Survey gaging station is located on the Little Ossipee River in South Limington. The drainage area of the Little Ossipee River at this station is 161 mi<sup>2</sup> and average flows, based on 42 years of record (1940-1982), are 290 cfs (USGSWDR 1982).

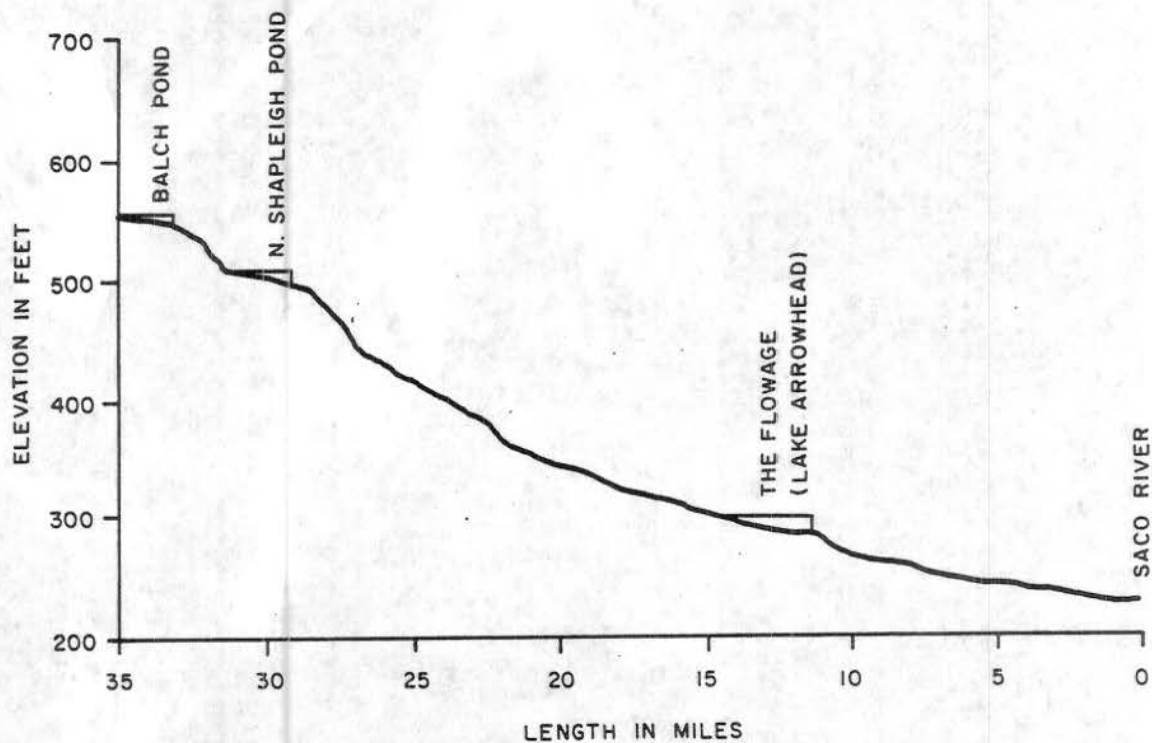


Figure IV-3. Profile of the Little Ossipee River (Pierce 1982).

There are three functional dams on the Little Ossipee River; Ledgemere Dam in Limerick and Waterboro, Shapleigh Dam in Shapleigh and Newfield, and Balch Pond Dam in Acton and Newfield. Ledgemere Dam, often called The Flowage Dam or Lake Arrowhead Dam is a hydroelectric dam that has a 20 foot head (Russell 1985). This dam is located 11 3/4 miles upriver from the Little Ossipee River's confluence with the Saco (AMC 1978). The dam receives the drainage from 157 mi<sup>2</sup> (Cowing and Caracappa 1978) and creates an 1,100-acre impoundment (Pierce 1985). It is owned by Lawrence and Virginia Smith, N. Windham, Maine (Guinan 1985). The Smiths also own a portion of Windham Electric Co., Windham, Maine. Shapleigh Dam is a storage dam at the outlet of Shapleigh Lake. Balch Pond Dam is a storage dam at the outlet of Balch Pond, the origin of the Little Ossipee River. The East Limington Dam is a non-functional dam in disrepair and poses no problems for fish passage (DeRoche 1967).

There are two known dams on tributaries to the Little Ossipee River. One is 12 feet high and is located at the outlet of Little Ossipee Lake in Waterboro. The impounded water is used for recreational purposes. The other dam is located on Buff Brook, Waterboro (Mower 1985). When this dam is in, a 50-acre shallow impoundment is formed called Sherburne Pond. When the dam is out the pond is occasionally nothing more than a stream.

The Ossipee River is approximately 18 miles in length (NHWSPCC 1979). It originates at the outlet of Ossipee Lake in Effingham Falls, New Hampshire at an elevation of 406 ft. It falls approximately 140 ft to its confluence with the Saco River at Cornish, Maine and drains approximately 455 mi<sup>2</sup>. The gradient is approximately 7.8 feet per mile. There are two dams on the Ossipee River, both of which are located at Kezar Falls. The lower dam is 19 ft in height and the upper dam is 13 ft (Dube 1984). Both are FERC unlicensed hydroelectric dams (Russell 1985) owned

by the Windham Electric Co., Windham, Maine (Dube 1983). Additional information may be seen in Table 1-2.

There is a USGS gaging station on the Ossipee River at Effingham Falls, New Hampshire located 0.3 miles downstream from the outlet of Ossipee Lake (Morrill et al. 1983). This station receives the drainage from 330 mi<sup>2</sup>. Average discharge over 41 years of record is 690 cfs. A hydroelectric dam owned by Central Maine Power Co., is present on the Ossipee River at Effingham, New Hampshire (NERBC 1981). The dam is unlicensed by FERC (Russell 1985) and has a generating capacity of 0.857 Mw.

There are three major tributaries to Ossipee Lake: Bearcamp, Pine, and Lovell Rivers (NHWSPCC 1979). Bearcamp River is approximately 25 miles in length and originates in Sandwich Notch in the mountains of western Sandwich, New Hampshire. The Bearcamp River drains approximately 152 mi<sup>2</sup> and drops 1,030 ft entering Ossipee Lake on the western shore. There is a dam approximately ten feet high on the Bearcamp River in Tamworth, New Hampshire (Nowell 1985). A dam is present on Sanborn Brook near the Wonalancet River in Tamworth, New Hampshire. This dam, which is unlicensed by FERC (Russell 1985), is owned by David Brooks and generates 27 kw of electricity (NERBC 1980). The Wonalancet River is a tributary to the Bearcamp River.

Pine River is approximately 12 miles in length and drains an area of approximately 82 mi<sup>2</sup> (NHWSPCC 1979). It originates at Pine River Pond (elevation 580 ft) and falls approximately 180 ft before it enters the southern shore of Ossipee Lake. Hoover (1937) reported a 22-foot-high dam at the outlet of Pine River Pond.

Lovell River originates in the central portion of the Ossipee Mountain range (NHWSPCC 1979). Over its ten mile length, it

falls approximately 1,900 ft and drains an area of approximately 16 mi<sup>2</sup>. It enters Ossipee Lake on the western shore. Profiles of the Bearcamp, Pine, and Lovell Rivers may be seen in Figure IV-4.

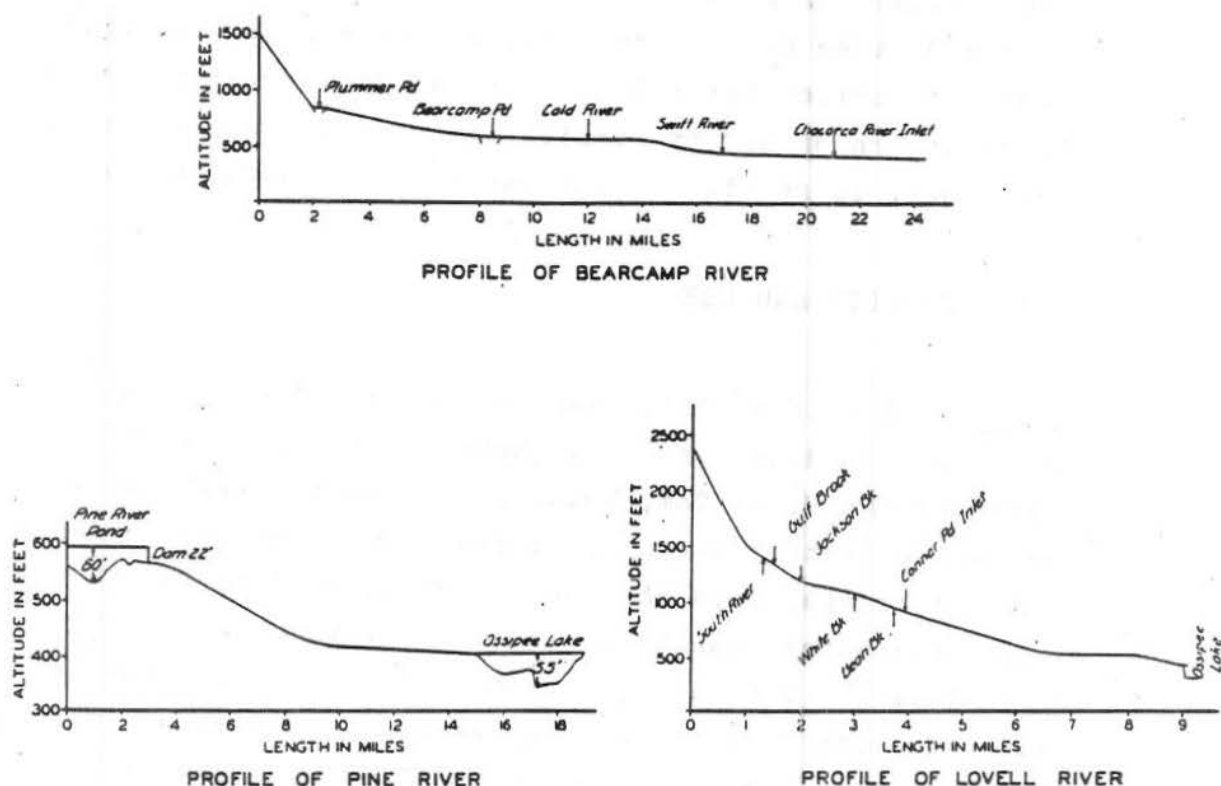


Figure IV-4. Profiles of the Bearcamp, Pine, and Lovell Rivers (Hoover 1937).

Another tributary to Ossipee Lake is the West Branch, sometimes called Silver River. This tributary flows from Silver Lake to the northern shore of Ossipee Lake. A dam is present on West Branch next to Silver Lake Road, near the outlet of Silver Lake (AMC 1978).



The outlet of Watchic Pond also contains a dam (MEDEP 1976). This dam is owned and maintained by the Watchic Lake Association and is used to manipulate the water levels of Watchic Pond (Pierce 1985).

The drainage area of Pease Brook, a direct tributary to the Saco River, is 4.86 mi<sup>2</sup> (Cowing and Caracappa 1978). Saco River drainage areas at several specific locations within the reach, and drainage areas of some of the tributaries to the Ossipee and Little Ossipee Rivers are available in a report entitled "Drainage Areas of Surface Water Bodies of the Saco River Basin in Southwestern Maine" by Derrill Cowing and Douglas Caracappa, 1978. The report is available from the USGS, Augusta, Maine.

#### WATER QUALITY AND USE

Saco: All waters of the Saco River main stem within this reach are classified as Class B-1 (MEDEP 1976). Central Maine Power Co., owner of the Hiram Dam, holds a license to discharge 350,000 gpd of cooling water, storm water run-off and miscellaneous facility sump discharges into the Saco River in Baldwin (MEDEP 1984a). Discharge water cannot exceed a temperature increase greater than 10°F from one generator, or 8°F from another generator. Specific water quality data on the Saco River at Cornish are available from the U.S. Geological Survey Water-Data Report ME-83-1 (Morrill et al. 1983).

Tributaries: Portions of the waters of the Ossipee and Little Ossipee River Watersheds in Maine have Class C designations. The locations in the Ossipee River Watershed are the Ossipee River from ½ mile upstream of the Route 25 bridge at Kezar Falls, Maine to the confluence with the Saco River at Cornish, Maine, and Little River from its junction with Route 5 to its confluence with the Ossipee River in Cornish Village, Maine (MEDEP 1976). The



Ossipee River receives 3,800 gpd of sanitary waste from a sand filter at Kezar Falls, Maine (Mower 1985). Storm water discharges at Kezar Falls may also contain some domestic sewage. Little River, a tributary to the Ossipee River, receives untreated discharges from a privately owned sewage collection system in Cornish Village, Maine (Dube 1983). Class C waters in the Little Ossipee River Watershed occur on two direct tributaries to the Little Ossipee River: Hamlin Brook (Wards Brook) from its origin at the outlet of Ward Pond to its confluence with the Little Ossipee River, and Brown Brook from the outlet of Sokokis Lake (Holland Pond) to its confluence with the Little Ossipee River at Lake Arrowhead (MEDEP 1976). Brown Brook receives treated sewage discharged by the Town of Limerick (Dube 1983).

All other tributaries, direct and indirect, within the Maine portion of this reach are designated as Class B-1 (MEDEP 1976). All tributaries within the reach in New Hampshire have Class B designations except portions of the Wonalancet River in Waterville Valley, and Moulton Brook in Freedom, which have Class A designations (NHWSPPC 1979).

Water quality data for 1975 through 1977 on specific tributaries within the New Hampshire portion of this reach are appended by the New Hampshire Water Supply and Pollution Control Commission, Concord, New Hampshire, in their 1979 report entitled "Saco River Basin: Water Quality Management Plan". This report listed a point source of significant discharge for Precinct A in Ossipee, New Hampshire. The discharge of untreated waste into a large swamp adjacent to Folsom Brook, a tributary to Pine River, has since been corrected (Neill 1984). The Summer Brook Hatchery near Pine Brook in Ossipee, that was noted in the same report, has changed ownership but is still discharging (Woodard 1985).

## LAND USE

Saco: The land adjacent to the Saco River from Hiram Dam to Steep Falls is forested (SREAC 1973). The forests at Steep Falls give way to more agricultural land downriver. Seasonal and year-round dwellings occur along the river, primarily around East Limington (AMC 1978). Land use by town is given in Table 1-4.

Major Tributaries: The Little Ossipee River is bordered by villages, wetlands, and forests (SREAC 1973). After passing through the village of North Shapleigh, the river is bordered to Newfield by the Newfield Game Management Area, a 2,247-acre parcel of land owned by the Maine Department of Inland Fisheries and Wildlife. With the exception of Lake Arrowhead which is intensely developed for year-round residences, the remainder of the Little Ossipee River below Newfield is bordered by forests.

The Ossipee River from Ossipee Lake, New Hampshire to Kezar Falls, Maine contains many camps and year-round residences (AMC 1978). After the village of Kezar Falls which is largely developed, the land is forested until Cornish, Maine where agricultural use predominates (SREAC 1973). Land use by town is given in Table 1-4.

## FISHERIES

### HABITAT ASSESSMENTS

Habitat surveys on the Saco, Ossipee, and Little Ossipee Rivers were made in August 1983. Portions of the Saco and Ossipee Rivers were surveyed by personnel of the Maine Atlantic Sea-Run Salmon Commission, Bangor, Maine; the Maine Department of Inland Fisheries and Wildlife, Gray, Maine; and the U.S. Fish and Wildlife Service, Laconia, New Hampshire. The Little Ossipee River was surveyed at numerous selected locations within the 11 3/4 miles between Ledgemere Dam and the Saco River confluence by personnel from the MEASRSC. These locations were chosen for their potential as Atlantic salmon habitat. A summary of assessed habitat within Reach IV is presented in Table IV-4. Available substrate maps may be seen in Appendix G.

### HABITAT SUITABILITY

The Saco, Little Ossipee, and Ossipee Rivers contain suitable habitat for anadromous and inland species of fish (Tables IV-5 through IV-7). A summary of habitat potential for the reach is given in Tables 2-5 and 2-6. Adequate fish passage facilities and flow releases at dams within the reach will provide access for Atlantic salmon, American shad, and alewives.

There are 29,086 known units of brown trout habitat within the reach but brown trout are not scheduled to be stocked in Reach IV under present management plans. Annual stockings of 15,500 fall fingerling brook trout are planned to utilize the seasonal habitat available in the Saco and Ossipee Rivers. Numerous coolwater influxes in the Saco River between Hiram Dam and Quaker Brook are available to fishes seeking refugia from warm waters (Appendix G).

Table IV-4. Summary of habitat assessments within Reach IV.

Survey Segment	Length Surveyed (miles)	Units of Surface Area (100 yd <sup>2</sup> )	Pools		Range of Maximum Depths (feet)	Substrate Types	Average Gradient (feet/mile)
			Qty	Units of Surface Area (100 yd <sup>2</sup> )			
<u>Saco River:</u>							
Limington Rips, mi 32.5 to 33.1	0.6	1209	2	51	7-8	Boulder, ledge, and sand	16.6
Steep Falls, mi 36.1 to 37.6	1.5	2858	11	478	5-12	Boulder, sand, gravel, and ledge	4.6
E. Baldwin to Hiram Dam, mi 39.4 to 49.8	10.4	10,279	43	3915	5->15	Rubble, gravel, sand, and gravel- sand mixes (Appendix G)	2.1
Remainder of Saco River in Reach IV	none	4,410 (estimated)					
Saco River Total	12.5	18,756	56	4444	--	--	--
<u>Tributaries:</u>							
Little Ossipee River, various sites (see text)	1.2	1025	1	11	6-12	Gravel, rubble, boulder, ledge, and sand	Various (see text)
Ossipee River, confluence with Saco River to lower Kezar Falls Dam and three small segments (Appendix G)	13.0	9305	50 <sup>1/</sup>	707	5->15	Gravel, rubble, boulder, and mixes of gravel and sand, gravel and rubble, and rubble and boulder (Appendix G)	7.2
Tributary Total	14.2	10,330	51	718	--	--	--
Reach Total	26.7	29,086	107	5162	--	--	--

<sup>1/</sup> Includes ten pools of undetermined dimensions.

Table IV-5. Suitable habitat, spawning escapement, and production estimates for important fish species in the Saco River within Reach IV.

Fish Species	Habitat		Spawning Escapement (males plus females)	Potential Production
	Number of Units (100 yd <sup>2</sup> )	Location		
Atlantic salmon	6,257	Saco River (Table IV-4)	372	6,257 smolts
American shad	18,756	Saco River (Table IV-4)	21,570	1.4 to 2.2 million juveniles
Alewives	Limited	Saco River (Table IV-4)	--	--
Brown trout	18,756	Saco River (Table IV-4)	--	Limited. No stocking
Brook trout	6,257 (seasonal, temperature limiting)	Saco River (Table IV-4)	--	Limited. Annual stocking of 8,000 fall fingerlings
Warmwater species (e.g. bass, perch, pickerel)	18,756	Saco River (Table IV-4)	--	--

Table IV-6. Suitable habitat, spawning escapement, and production estimates for important fish species in the Little Ossipee River.

Fish Species	Habitat		Spawning Escapement (males plus females)	Potential Production
	Number of Units (100 yd <sup>2</sup> )	Location		
Atlantic salmon	581	Surveyed segments between Ledgemere Dam and Saco River confluence	36	1,162 smolts
American shad	Limited	Surveyed segments between Ledgemere Dam and Saco River confluence	--	--
Alewives	48,642	The Flowage (Arrowhead Lake, 1,005 acres)	35,175	118,090 to 236,180 adults
Brown trout	1,025	Surveyed segments between Ledgemere Dam and Saco River confluence	--	No stocking
Brook trout	581 (seasonal, temperature limiting)	Surveyed segments between Ledgemere Dam and Saco River confluence	--	No stocking
Warmwater species (e.g. bass, perch, pickerel)	1,025	Surveyed segments between Ledgemere Dam and Saco River confluence	--	--

Table IV-7. Suitable habitat, spawning escapement, and production estimates for important fish species in the Ossipee River.

Fish Species	Habitat		Spawning Escapement (males plus females)	Potential Production
	Number of Units (100 yd <sup>2</sup> )	Location		
Atlantic salmon	5,816	Ossipee River (Table IV-4)	346	11,632 smolts
American shad	Limited	Ossipee River (Table IV-4)	--	--
Alewives	179,080	Ossipee Lake including Berry Bay and Broad Bay (3,700 acres)	129,500	434,750 to 869,500 adults
Brown trout	9,305	Ossipee River (Table IV-4)	--	Limited. No stocking
Brook trout	5,816 (seasonal, temperature limiting)	Ossipee River (Table IV-4)	--	Limited. Annual stocking of 7,500 fall fingerlings
Warmwater species (e.g. bass, perch, pickerel)	9,305	Ossipee River (Table IV-4)	--	--

The section of the Saco River below Hiram Dam is an important area of suitable habitat, particularly for Atlantic salmon and brook trout. With fish passage facilities at Hiram Dam, this section would also be used as a pathway for anadromous species during migration. It is therefore critical that adequate flows be released at Hiram Dam. A minimum continuous flow release of 416 cfs (ABF), or inflow to the project area, whichever is less, has been recommended at Hiram Dam (USFWS 1986).

Adequate flow releases are also needed at the two Kezar Falls dams to maintain suitable habitat below and to provide a pathway for anadromous species. Appropriate minimum flows have been negotiated with the owner of the dams.

If new management plans were developed to utilize the alewife habitat in The Flowage, fish passage facilities and adequate flow releases would be necessary at Ledgemere Dam. A minimum flow of 78 cfs has been established for this site.



## RIVER RECREATIONAL USE

### SACO RIVER

General: The Saco River within Reach IV is heavily used by recreationists, and accounted for 19,700 user days in 1984 (Hardy 1985). Its use is considerably less than that of the Fryeburg area primarily due to problems with landowners, and a lack of sandbars, campgrounds, and access points (SMRPC 1983). The Maine Department of Transportation owns a state highway rest area and picnic site at the Route 25 bridge in East Limington. This is a popular multi-use recreational area (Hardy 1985). The Maine Department of Conservation owns a 1,000-acre tract of land in Limington that has a small amount of frontage on the Saco River (Cieslinski 1985). The frontage is located near the area where Hardscrabble Road is the closest to the Saco River (mi 30.6).

In a report entitled "Maine Rivers Study", the Saco River within Reach IV has been given an "A" rating (MEDOC and USDOINPS 1982). This rating means that the river's natural and recreational resources have greater than statewide significance. The report also noted that the Critical Areas Program designated Steep Falls as having statewide importance. This designation is only informational and does not exclude the area from development (Tyler 1984).

Canoeing: The Saco River within this reach is scenic and contains mostly flatwater although riffles and rapids are also available (AMC 1978). According to Hardy (1985), the segment of the Saco River within Reach IV places second in canoe touring use of all the rivers in Maine. This section of the river received approximately 14,000 user days by canoeists and small boaters in 1984. The most popular rapids in the Saco River in Maine are located between Steep Falls and East Limington. These rapids are

popular whitewater runs but their use is diminished under summer flows. There are no canoe rental facilities within the reach (Saco Bound undated).

Fishing: The Saco River within Reach IV supports fisheries for brown trout, brook trout, smallmouth bass, largemouth bass, and landlocked salmon. The smallmouth bass fishing is considered good and some fishermen in canoes are also successful on pickerel (Pierce 1985). Fishing pressure on this section of the Saco River is much less than that received by the Ossipee and Little Ossipee Rivers (Hardy 1985). It does, however, receive moderate pressure in the spring, particularly at Steep Falls and East Limington where there is good road access. Hardy reported 5,000 user days by anglers on the Saco River within Reach IV in 1984).

Other Water-Related Activities: Swimming is available at the Great Falls Dam Beach (MEBPR 1984), Steep Falls, and East Limington (SREAC 1973). According to Hardy (1985), the beach area at Steep Falls is heavily used by swimmers, campers, and picnickers. He reported swimming use to be 700 user days in 1984. He also reported that the area immediately adjacent to the Route 25 bridge in East Limington is a very popular highway picnic area.

Camping: Camping facilities along the Saco River within Reach IV are inadequate (Hardy 1985). There are few sandbars such as those found above Hiram Dam so campers camp on the river banks. This practice has resulted in problems with landowners (SMRPC 1983). The Maine Bureau of Parks and Recreation is aware of the problems and has recommended that CMP be caused to investigate the feasibility of establishing a primitive campground below Hiram Dam if canoeing activities increase (MEBPR 1984). Hardy (1985), in a recent report for this bureau, recommended that at least one (preferably two) campsites be established between Cornish Station and East Limington. The Maine Bureau of Parks

and Recreation presently has no plans to establish any campsites below Hiram Dam (Cieslinski 1985).

The only formal campsite on the Saco River in Reach IV is in Cornish (Roy 1985). This is a 50-site commercial campground with 200-300 yards of frontage on the Saco River (Talbot 1985). It is primarily oriented toward off-road use rather than off-river use. The beach area near Steep Falls is also used as a primitive campsite by canoeists (Hardy 1985).

Access: Access to the Saco River within Reach IV is considered poor. According to Saco Bound (undated), there are six canoe access points to the Saco River within the reach (Appendix J). The access point immediately below Hiram Dam is difficult to use and parking is limited (MEBPR 1984). The next access point occurs approximately 3.6 miles downriver at the Route 5 bridge. There is no additional access for 8.6 miles until Steep Falls where two access points are located. The remaining two access points are at the Route 25 bridge, East Limington, 5.3 miles downriver from Steep Falls.

#### LITTLE OSSIPEE RIVER

General: The State of Maine owns two large tracts of land which border the Little Ossipee River. The Maine Department of Conservation owns a 1,000-acre parcel in Limington which borders the Little Ossipee from approximately  $\frac{1}{2}$  mile south of Nasons Mills Road to approximately  $\frac{3}{4}$  mile north of the Black Brook confluence (Cieslinski 1985). This land includes Hardscrabble Falls. The second parcel of land is the Newfield Game Management Area, owned by the Maine Department of Inland Fisheries and Wildlife (SREAC 1973). This is a 2,247-acre tract of land that is primarily managed for waterfowl and upland game species but which also contains good trout habitat. It borders the Little Ossipee River from approximately  $\frac{1}{2}$  mile east of Route 11, North

Shapleigh, to approximately 1/10 mile west of Ross Corner Road, Newfield (Pierce 1982).

Canoeing: According to the AMC River Guide (1978) the Little Ossipee River is fairly popular with canoeists. The section above the Route 5 bridge in Limerick and Waterboro is recommended for running under medium to high water levels, whereas the remainder can usually be run through summer.

Fishing: The Little Ossipee River contains both warmwater and coldwater species of game fish (Boland 1985). It is presently being stocked with brook trout and brown trout in Newfield, by the Maine Department of Inland Fisheries and Wildlife (MEDIF&W 1984). The previous practice of stocking brown trout below Lake Arrowhead has been discontinued (Pierce 1985). Trout fishing is popular, particularly in the spring.

Other Water-Related Activities: There is no information available regarding other water-related activities on the Little Ossipee River.

Camping: There are no known campgrounds on the Little Ossipee River (DeLorme 1984).

Access: There are four direct (Pierce 1985) and two indirect canoe access points to the Little Ossipee River (AMC 1978). Three of the direct access points are in Limington; Hardscrabble Falls, Edgcombs Bridge (Rt 117), and below Arrowhead Lake. The remaining direct access point is in the Newfield Management Area approximately 0.6 river miles downriver of the confluence of Granny Kent Pond outlet in Newfield. This point may be reached via an unimproved road off Mann Road in Shapleigh (Pierce 1982). Indirect access is from two tributaries; Davis Brook in Shapleigh and Chellis Brook in Newfield.

## OSSIPEE RIVER

General: Information regarding recreational use of the Ossipee River is limited. This river receives some use by canoeists and fishermen.

Canoeing: The Ossipee River offers limited attraction for canoeists (AMC 1978). The section from Ossipee Lake, New Hampshire, to Kezar Falls, Maine is not appealing to canoeists because it is almost entirely flatwater and is surrounded by camps, houses, and a major highway. The section from Kezar Falls to the Saco River confluence, on the other hand, is very scenic and is a popular whitewater stretch in the spring. Low flows, however, preclude its use in summer.

Fishing: The Ossipee River is not presently stocked by either the Maine (Boland 1985) or the New Hampshire fishery agencies (Bresosky 1984). Ossipee Lake, which is drained by the Ossipee River, is stocked with landlocked salmon. The Maine Department of Fisheries and Wildlife stocked the Ossipee River with brown trout until 1982 but this practice was terminated because of the Atlantic salmon restoration program (Pierce 1985). The Ossipee River supports an excellent smallmouth bass fishery but fishing is also popular for largemouth bass, brook trout, brown trout, and landlocked salmon. Some of the tributaries to the Ossipee River support wild populations of brown trout and brook trout.

Other Water-Related Activities: No information was found regarding other water-related activities on the Ossipee River.

Camping: The only known campground on the Ossipee River is a year-round facility located at Kezar Falls (DeLorme 1984).

Access: Canoe access to the Ossipee River can be gained at the dam at the outlet of Ossipee Lake, and below the lower dam in

Kezar Falls (AMC 1978). The access at the dams in Kezar Falls is poor and improvement is being sought through the FERC process (Pierce 1985).

REACH V. HIRAM DAM, HIRAM TO SWANS FALLS DAM, FRYEBURG, MAINE.

### PHYSICAL CHARACTERISTICS

#### TOPOGRAPHY AND GEOLOGY

Reach V (Figure 1-1) contains 35.4 miles of the Saco River and is located between the Hiram Dam, Hiram, Maine (mi 49.8) and the Swans Falls Dam, Fryeburg, Maine (mi 85.2). Most of this reach lies within the Northern New England Upland land form. The broad flat valleys typical of this land form are prominent within Reach V and typify the land adjacent to the Saco River throughout the reach. Most hills are at elevations between 500 and 850 feet although several exceed 1,000 feet. The extreme northwestern corner of Reach V is in the White Mountain land form, and hills there typically exceed 1,500 feet.

There are eight named minor tributaries to the Saco River within this reach (Appendix K).

#### CLIMATE

Climate within Reach V is typified by data collected at Bridgton, Maine and Hiram, Maine. Monthly mean precipitation and temperatures for each of these locations may be seen in Tables V-1 and V-2 respectively. The average annual snowfall for Bridgton, Maine as reported by the NHWSPCC (1979), is 76 inches. This figure may be inaccurate due to an unknown short period of record. The average annual snowfall for Hiram, based on 14 years of record prior to 1954, is 89 inches (NENYIAC 1954).

#### RIVER HYDROLOGY

Saco: Above the Hiram Dam there is only one other dam on the Saco River within this reach; Swans Falls Dam in Fryeburg,

TABLE V-1. Mean precipitation - inches (Ferrin 1984 unless otherwise noted).

	<u>Bridgton</u>	<u>Hiram</u> <sup>1/</sup>
Period of Record	1955-1982	1941-1970
Elevation (ft above M.S.L.)	600	360
January	3.67	3.60
February	3.26	3.67
March	3.34	3.85
April	3.73	3.48
May	3.42	3.62
June	3.66	3.75
July	3.70	3.55
August	3.37	3.42
September	3.31	3.30
October	4.18	3.55
November	4.55	5.24
December	3.96	4.18
Annual	44.16	45.21

<sup>1/</sup> NHWSPCC 1979



TABLE V-2. Mean temperature - °F (Ferrin 1984 unless otherwise noted).

	<u>Bridgton</u>	<u>Hiram</u> <sup>1/</sup>
Period of Record	1953-1982	1974-1983
Elevation (ft above M.S.L.)	600	410-528 <sup>2/</sup>
January	18.7	15.7
February	21.5	17.9
March	31.4	30.2
April	42.4	41.5
May	54.4	53.7
June	63.6	62.2
July	68.6	68.1
August	66.3	65.4
September	56.2	56.7
October	48.5	44.6
November	37.6	36.7
December	24.4	22.5
Annual	44.8	42.8

1/ NOAA 1974-1983

2/ 1974 through 1979 reports are listed at 410 feet  
1980 is listed at 445 feet  
1981 through 1983 are listed at 528 feet

Maine (Figure V-1). This hydroelectric facility is unlicensed by FERC and is located 4.3 river miles from the Maine border. It has a 13-ft head (Savage 1973), and is owned by Swans Falls Corp., P.O. Box 211, Fryeburg, Maine 04037 (Keddy 1986). Swans Falls Dam receives the drainage from 446 mi<sup>2</sup> (Cowing and Caracappa 1978). Normal pond elevation behind Swans Falls Dam is 394 ft (NERBC 1980).

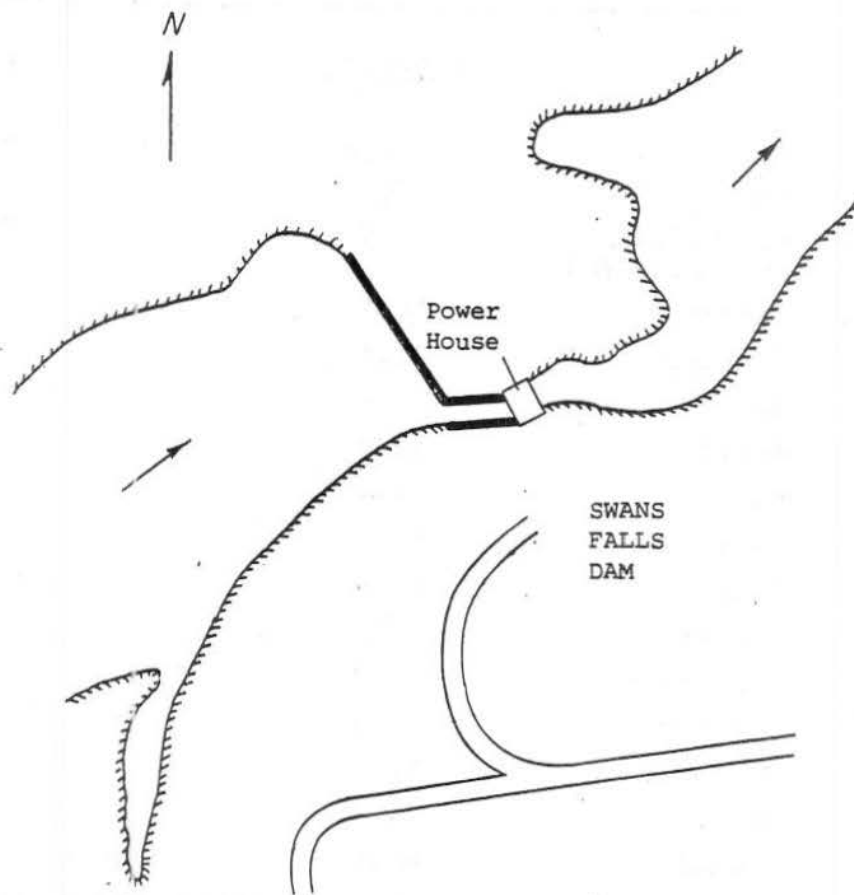


Figure V-1. Layout of Swans Falls Dam on the Saco River in Fryeburg, Maine.

The Saco River drops an average of 0.9 ft per mile within this reach, changing from an approximate tailwater elevation at Swans

Falls Dam (mi 85.2) of 381 ft (NERBC 1980, Dube 1983) to a normal head pond elevation behind Hiram Dam of 349.0 ft (CMP 1981). The water impounded by Hiram Dam extends 9.2 river miles to the confluence of Moose Pond Brook (Pierce 1984).

Tributaries: The Saco River historically flowed north at Swans Falls into what is now known as the Old Course Saco River. To control flooding, a canal was dug in 1817 which changed the Saco River's flow to an easterly direction (AMC 1978). Since this canal was built, much of the Old Course Saco has silted in. Because of this, and for the purposes of this report, the Old Course Saco will be treated as a tributary to the Saco River which joins the main stem at only one point. This point is at river mile 78.1, and is located approximately 1 3/4 river miles below the outlet of Kezar Pond.

An important tributary to the Old Course Saco River is the Cold River. This tributary drains approximately 57.0 mi<sup>2</sup> (Cowing and Caracappa 1978).

Drainage areas for Lovewell Pond outlet brook, Pleasant Pond outlet brook, Kezar River, Kezar outlet, Charles River, Bog Pond outlet brook and various locations along the Saco River within Reach V are available in a report entitled "Drainage Areas of Surface Water Bodies of the Saco River Basin in Southwestern Maine" by Derrill Cowing and Douglas Caracappa, 1978, United States Geological Survey, Augusta, Maine.

According to DeRoche (1967) there are three dams on Hancock Brook, a direct tributary to the Saco River; two saw-mill dams located near the mouth and a dam on the outlet of Barker Pond. The latter dam is of plank construction and has a ten-foot head. There is a small dam on the outlet of Kezar Lake (not to be confused with Kezar Pond) where it joins the Old Course Saco (Sheehan 1980).

## WATER QUALITY AND USE

SACO: The Saco River main stem from its junction with Route 5 in Fryeburg, Maine to a point 3/4 mile below Route 5 has a water quality classification of Class B-2 (MEDEP 1976). All remaining water in the Saco River main stem within this reach is classified as Class B-1.

Public Service Company of New Hampshire holds a permit to discharge 1.73 mgd of uncontaminated cooling waters into the Saco River at Swans Falls. The temperature increase of the discharge is less than 1° C (Mower 1985).

Tributaries: All tributaries that directly feed the Saco River within Reach V are classified as Class B-1 (MEDEP 1976). The only segment of Class C water within the reach occurs in Kimball Brook in North Fryeburg, Maine. This segment lies between Charles Pond and 1/2 mile upriver of the junction of Route 113 and Kimball Brook. The outlet of Charles Pond empties into the Old Course Saco River which in turns feeds the main stem of the Saco River in eastern Fryeburg.

## LAND USE

Saco: The land adjacent to the Saco River in Reach V is composed primarily of forests and agricultural land (SREAC 1973). The land upstream from Hiram Dam is forested until Hiram Village where the land is intensely developed. Forests predominate above Hiram Village to the Old Course Saco River. Beyond that, the forests eventually give way to some of the most productive agricultural land in Maine, located in Fryeburg. Fryeburg is the agricultural center of the basin with dairy, poultry, fruit farms, and vegetable farms dominating the agricultural industries (NERBC 1980). Nearly 40% of the cropland in the Saco River Watershed is found in Fryeburg (USDA 1983). Land use by town is given in Table 1-4.

## FISHERIES

### HABITAT ASSESSMENTS

Survey work on the Saco River within Reach V was performed in August of 1983 by personnel of the Maine Department of Inland Fisheries and Wildlife, Gray, Maine. The entire reach was surveyed for surface area and general substrate types. The surface area was estimated at 42,408, 100-yd<sup>2</sup> units. With two minor exceptions, the substrate between Hiram Dam (mi 49.8) and the Bog Pond outlet in Fryeburg (mi 80.6) is sand. The two exceptions are a small gravel pad upstream from the Route 117 bridge in Hiram, and a 150-ft stretch of boulder habitat just below Walker's Falls. Detailed surveys of substrates and pools were only made from Bog Pond outlet (mi 80.6) to Swans Falls (mi 85.2). The habitat in this area is primarily gravel with sand although there are scatterings of boulders and rubble. There is one pool between Bog Pond outlet and Swans Falls which has a surface area of 4 units. No further information is available for the pools within Reach V.

Shepards River and Hancock Brook, minor tributaries to the Saco River, were surveyed by the Maine Atlantic Sea Run Salmon Commission. The substrate of Hancock Brook between Barkers Pond and the brook's confluence with the Saco River in Hiram (mi 52.4) is primarily boulder and gravel (Pierce 1984). Further information regarding these two tributaries is available from the MEASRSC, Box 1298, Bangor, Maine 04401.

### HABITAT SUITABILITY

The surveyed portions of Reach V provide suitable habitat for anadromous and inland species of fish (Table V-3). With adequate fish passage facilities the Saco River within Reach V would be used as a pathway and for production by Atlantic salmon.

Table V-3. Suitable habitat, spawning escapement, and production estimates for important fish species within Reach V.

Fish Species	Habitat		Spawning Escapement (males plus females)	Potential Production
	Number of Units (100 yd <sup>2</sup> )	Location		
Atlantic salmon	481	Saco River from Bog Pond to Swans Falls Dam	30	481
	565	Shepards River	34	1,130
	116	Hancock Brook	8	232
Total	1,162	Reach V	72	1,843 smolts
Brown trout	42,408	Entire Saco River in Reach V	--	Limited. No stocking
Brook trout	200 (seasonal, temperature limiting)	Saco River immediately below Swans Falls Dam	--	Limited. Annual stocking of 300 fall fingerlings
	565 (year-round)	Shepards River	--	Unknown. Natural population, no stocking
	116 (seasonal, temperature limiting)	Hancock Brook		No stocking
Total	881	Reach V	--	--
Warmwater species, (e.g. bass, perch, pickerel)	42,408	Entire Saco River in Reach V	--	--

Brown trout are not scheduled to be stocked into assessed areas of Reach V under present management plans. The Saco River between Bog Pond outlet and Swans Falls Dam will be stocked annually with 300 fall fingerling brook trout. Additional brook trout habitat is available in Shepards River and Hancock Brook but stocking is not planned for these tributaries.

It is important that continuous adequate flows be released at Swans Falls Dam to protect the habitat immediately downstream. Stocking of brook trout in the Saco River between Bog Pond Outlet and Swans Falls Dam is contingent on adequate flows in this section. Fish passage facilities and adequate flows at Swans Falls Dam are required to maintain this area as a migration pathway for Atlantic salmon. Based on U.S. Fish and Wildlife Service policy, the recommended aquatic base flow at Swans Falls Dam would be 223 cfs, or inflow to the project, whichever is less.

#### UNIQUE REACH FEATURES

Lake whitefish apparently emigrate from Kezar Lake in the fall or winter into the Old Course Saco River and may return to Kezar Lake in the spring.

## RIVER RECREATIONAL USE

### SACO RIVER

General: The heaviest inland recreational use of the Saco River occurs within Reach V (SMRPC 1983). The river's popularity in this section can be attributed to two factors: the characteristics of the river itself, and the numerous available recreational facilities. The river is characterized by flatwater and is therefore usable by canoeists of all skill levels (AMC 1978). The water is clean, and the river passes through scenic farms and forests. Numerous sandbars exposed during the summer months provide miles of beaches which are popular with canoeists, swimmers, picnickers, and campers. Recreational facilities including access and take-out sites, canoe rental agencies, and campgrounds are readily available (Saco Bound undated).

The reach also contains the Brownfield Bog Wildlife Area, a 2,785-acre area owned by the State of Maine and managed primarily for waterfowl (SREAC 1973).

Canoeing: The entire length of the Saco River within Reach V constitutes a major portion of what is probably the most heavily canoed section of river in all of New England (SMRPC 1983). Canoe rentals, and access and take-out points are readily available within or just outside of the reach (MEBPR 1984).

Fishing: Recreational anglers fish for rainbow trout and brown trout that have moved downriver from New Hampshire. There is also a seasonal fishery for brook trout from stockings at Swans Falls by the Maine Department of Inland Fisheries and Wildlife. Some fishermen in canoes are successful catching chain pickerel and smallmouth bass. Lake whitefish are harvested in the Old Course Saco River in mid-to-late April.



Other Water-Related Activities: Swimming is popular throughout the reach at the numerous sandbars but there are two locations specifically maintained for swimmers; Brownfield Bridge (Rt 160) at River Run I, and the Hiram Town Beach (MEBPR 1984).

Camping: Of the five campgrounds on the Saco River within the reach, four are upriver of the Brownfield Bridge (Rt 160) (Saco Bound undated), and one is in Hiram just below the Rt 113 bridge on the west side of the river. A report by the Southern Maine Regional Planning Commission (1983) expressed the need for an additional campground between Brownfield and Hiram. This need is presently being investigated by the Maine Bureau of Parks and Recreation (MEBPR 1984).

Access: There are ten canoe access points to the Saco River within Reach V (Appendix J). Two of these points, Lovewell Pond and Barnes Brook, provide indirect access.

REACH VI. SWANS FALLS DAM, FRYEBURG, MAINE TO THE CONFLUENCE  
OF THE ELLIS RIVER, BARTLETT, NEW HAMPSHIRE.

PHYSICAL CHARACTERISTICS

TOPOGRAPHY AND GEOLOGY

Reach VI (Figure 1-1) contains 25.1 miles of the Saco River, and includes the Saco River Watershed from Swans Falls Dam, Fryeburg, Maine to the junction of the Ellis River in Bartlett, New Hampshire. It does not include the Ellis River Watershed. The reach is composed of both the Northern New England Upland and White Mountain land forms. The area adjacent to the Saco River from approximately the junction of the Swift River, Conway, New Hampshire to the Swans Falls Dam in Fryeburg, Maine, lies in the Northern New England Upland land form. This area is surrounded by hills having elevations between 600 and 900 feet, although several hills in the southeastern portion of the reach exceed 1,000 feet. The balance of the reach lies in the White Mountain land form, and mountains commonly exceed elevations of 2,000 feet. Several mountains in the Swift River Watershed exceed 3,000 feet.

One major tributary, the Swift River, and seven minor tributaries drain into the Saco River within Reach VI (Appendix K).

CLIMATE

The climate within Reach VI is typified by data collected at Conway and North Conway, New Hampshire. Average monthly precipitation, temperatures, and snowfall are shown in Tables VI-1, VI-2, and VI-3, respectively.

TABLE VI - 1. Mean precipitation - inches (Ferrin 1984).

	<u>North Conway</u>	<u>Conway</u>
Period of Record	1974-1982	1959-1973
Elevation (ft above M.S.L.)	530	475
January	4.47	2.99
February	3.21	3.86
March	3.95	3.66
April	3.98	3.70
May	3.55	3.37
June	4.00	3.99
July	3.62	3.94
August	4.45	3.58
September	4.09	3.23
October	4.84	3.86
November	3.68	5.84
December	3.66	4.87
Annual	47.49	45.98

TABLE VI - 2. Mean temperature - °F (Ferrin 1984).

	<u>North Conway</u>	<u>Conway</u>
Period of Record	1974-1981	1961-1973
Elevation (ft above M.S.L.)	530	475
January	16.9	17.2
February	20.9	18.8
March	31.2	30.8
April	42.6	41.1
May	55.8	53.2
June	64.0	63.4
July	68.9	67.6
August	66.4	65.3
September	56.5	57.5
October	45.2	47.2
November	36.8	34.9
December	22.4	22.1
Annual	44.1	43.1

TABLE VI - 3. Average snowfall - inches (Ferrin 1984).

	<u>North Conway</u>	<u>Conway</u>
Period of Record	1973-1982	1961-1973
Elevation (ft above M.S.L.)	530	475
January	26.3	20.8
February	13.9	26.8
March	16.8	17.9
April	7.1	9.4
May	--	1.6
June	--	--
July	--	--
August	--	--
September	--	--
October	2.3	4.9
November	5.0	11.5
December	21.5	29.4
Annual	77.6	112.7

## RIVER HYDROLOGY

Saco: The elevation of the Saco River at its junction with the Ellis River is 510 ft (NHWSPPC 1979) and the normal pond level behind Swans Falls Dam is 394 ft (NERBC 1980). This represents a drop of 136 ft over 25.1 miles or an average gradient of 4.6 ft per mile.

There is a USGS gaging station in Conway, New Hampshire on the Saco River at Odell Falls, approximately 1.8 miles below the Swift River (Morrill et al. 1983). The drainage area at this station is 385 mi<sup>2</sup>, and the average discharge, based on 60 years of record, is 933 cfs.

There are no dams within Reach VI on the Saco River beyond the Swans Falls Dam. At the Maine-New Hampshire border the Saco River receives the drainage from 424 mi<sup>2</sup> (Cowing and Caracappa 1978).

Tributaries: The Swift River is a major tributary to the Saco River, and joins the Saco River in Conway, New Hampshire (mi 96.9). Reports by the NHWSPCC (1979), Hoover (1937), and Newell (1958) differ in their descriptions of the length and gradients of the Swift River. Based on our review of USGS topographic maps, this report will follow Newell's description.

The Swift River originates on the north slope of Mount Kancamagus in Livermore, New Hampshire at an elevation of 3,200 ft. Over its 24½ mile length, it falls 2,760 ft to its confluence with the Saco River at elevation 440 ft. The average gradient for the Swift River is 113.8 ft per mile. The drainage area is approximately 90 mi<sup>2</sup>. There are no dams on the Swift River.

Two direct tributaries to the Saco River in Conway have dams (Nowell 1985). Pequawket Brook contains a 12 to 14 ft high dam adjacent to Route 16. A dam is also present on Conway Lake which is owned by the town of Conway.

Data on flows in selected streams and rivers within the New Hampshire portion of this reach may be seen in the 1937 publication "Biological Survey of the Androscoggin, Saco and Coastal Watersheds" by Earl E. Hoover of the New Hampshire Fish and Game Department, Concord, New Hampshire.

Further information on Elm Brook and Lucy Brook is available in a report by Seamans (1959) entitled "Trout Stream Management Investigations of the Saco River Watershed, Survey Report No. 9" published by the New Hampshire Fish and Game Department, Concord, New Hampshire.

## WATER QUALITY AND USE

Saco: The Maine portion of the Saco River within this reach is classified as Class B-1 (MEDEP 1976). The Saco River within the New Hampshire portion of this reach has a Class B classification (NHWSPCC 1979). There are two point sources of significant discharge into the Saco River within Reach VI; the White Mountain Laundry and Cleaners, North Conway, and the Conway Fire Precinct, Conway (Roberts 1985, Woodard 1985). Neither facility degrades the water quality below a classification of "B" (NHWSPCC 1979).

Tributaries: All rivers and streams within the Maine portion of this reach have classifications of Class B-1 (MEDEP 1976). In the New Hampshire portion of the reach, all surface waters have at least a Class B classification (NHWSPCC 1979). Those tributaries having at least a portion of their waters in Class A classifications are shown in Table VI-4.

TABLE VI-4. Tributaries in New Hampshire having at least a portion of their waters classified as Class A (NHWSPCC 1979).

Tributary	Location
East Branch Saco River	Bartlett and Jackson
Kearsarge Brook	Conway, Chatham, and Bartlett
Hurricane Mountain Brook	Conway
White Lot Brook <sup>1/</sup>	Conway
Dry Brook	Albany
Artist Falls Brook	Conway

<sup>1/</sup> This brook empties into the Saco River just above Swans Falls, Maine. The Class A classification is for the upper reaches of White Lot Brook.

Unpublished water quality data for many streams within the White Mountain National Forest were compiled by Jerry Marancik of the U.S. Fish and Wildlife Service in the late 1970's. His data are recorded either in special reports or as raw data and are available at the USFWS office, Federal Building, Room 124, Laconia, New Hampshire 03246.

Water quality data for 1975 through 1977 on specific tributaries within the New Hampshire portion of this reach are appended by the New Hampshire Water Supply and Pollution Control Commission, Concord, New Hampshire, in their 1979 report entitled "Saco River Basin; Water Quality Management Plan".

In the NHWSPCC report noted above, two companies were listed as point sources of significant discharges; J.V. Components, Inc., Conway, and the Kearsarge Metallurgical Company, Conway. These companies are no longer in operation. The J.V. Components company discharged contact cooling water into Pequawket Pond (Woodard 1985). The Kearsarge Metallurgical Company discharged process water into Pequawket Pond outlet (NHWSPCC 1979). According to Woodard (1985), hazardous waste drums stored at the Kearsarge Metallurgical Company have since been removed. There is still ground water contamination at Kearsarge Metallurgical in the form of chlorinated hydrocarbons. A consulting firm is presently studying the extent of contamination and will suggest plans for future action. Their study is expected to be completed in 1986.

Data on pH in selected streams and rivers within the New Hampshire portion of this reach may be seen in the 1937 publication "Biological Survey of the Androscoggin, Saco and Coastal Watersheds" by Earl E. Hoover of the New Hampshire Fish and Game Department, Concord, New Hampshire.

## LAND USE

Saco: Specific information on the use of the land abutting the Saco River in Reach VI was not determined. Recreational development is heavy in Conway, particularly in vacation and second homes (NERBC 1980). Conway also contains the second largest block of cropland in the Saco River Watershed (USDA 1983). Land use by town is given in Table 1-4.



## FISHERIES

### HABITAT ASSESSMENTS

Slightly over half of the Saco River within Reach VI has been recently surveyed. The area between the Rt. 113 bridge in Fryeburg, Maine (mi 85.5) and the Rt. 16 bridge in Conway, New Hampshire (mi 96.8) was surveyed in October of 1983 by personnel of the U.S. Fish and Wildlife Service, Laconia, New Hampshire. Survey work from the Rt. 16 bridge in Conway to a point approximately 7,200 feet upstream from the North Conway Scenic Railway Bridge (mi 102.3) was completed in August of 1983 by personnel from the U.S. Fish and Wildlife Service, Laconia, New Hampshire with assistance from the members of the Youth Conservation Corps (YCC). The habitat estimates from river mile 102.3 to approximately 1,000 feet beyond the junction of the East Branch Saco River (mi 109.2) are based on NHF&GD data (Hoover 1937). Habitat assessments for Reach VI are presented in Table VI-5.

Additional information regarding fish habitat in the Saco River Watershed within Reach VI is available in "A Stream Survey of the Waters of the White Mountain National Forest" by J. Adger Smyth and H.S. Davis (1935) and in "Biological Survey of the Androscoggin, Saco and Coastal Watersheds" by Earl E. Hoover (1937).

The most recent assessment of habitat in the Swift River was made by Newell (1958). The following data are a composite of Newell's description.

"The section between point A on the map (see Figure VI-1), and the mouth has a gradient of 560 feet in seven miles, or 80 feet/mile. The stream bed consists of boulders, rubble, and bedrock with some sand and

Table VI-5. Assessments of habitat in the Saco River within Reach VI.

Survey Segment, River Mile	Length Surveyed (mi)	Units of Surface Area (100 yd <sup>2</sup> )	Pools			Substrate Types	Average Gradient (ft/mi)
			Qty	Units of Surface Area (100 yd <sup>2</sup> )	Range of Max Depths (feet)		
Swans Falls Dam Fryeburg, Maine to Rt 113, Fryeburg, 85.2 to 88.5	none	4492 (estimated)	--	--	--	Mostly sand	1.2
Rt 113, Fryeburg, Maine to Maine-New Hampshire border, 88.5 to 89.5	1.0	1038	1	6	8	Mostly sand, some rubble	1.2
Maine-New Hampshire border to Rt 16 bridge Conway, NH, 89.5 to 96.8	7.3	9015	8	294	5-12.5	Mostly sand and gravel. Small amount of boulder	5.6
Rt 16 bridge to 7,200 ft upstream of Conway Scenic Railway Bridge, 96.8 to 102.3	5.5	4650	33	901	U <sup>1/</sup>	Mostly sand, or gravel and sand. Small amount of boulder and rubble (Appendix G)	1.8
7,200 ft upstream of Conway Scenic Railway Bridge to River Rd. bridge, N. Conway, 102.3 to 105.6	3.3	2383	U	U	U	Rubble and sand	4.2
River Rd. bridge to 1000 ft upstream of E. Br. Saco, 105.6 to 109.2	3.6	2556	U	U	U	Rubble and sand	11.4
Grand Total	20.7	24,134	42	1201	--	--	--

<sup>1/</sup> Undetermined



gravel. Pools, although numerous, are small in size and are graded as C. This area was not studied as intensively as was the section between Point A and the headwaters.

The section between points A and B on the map are quite similar to that described in the preceding paragraph, except that pools are more numerous and could probably be graded as B. The gradient in this section is 300 feet in four and one-half miles, or 66.7 feet/mile. The average width and depth of this section is 70 feet and 18 inches respectively.

Between points B and C the gradient is 360 feet in four and one-fourth miles, or 84.7 feet/mile. The bottom is predominately sand and gravel and pools are large and numerous (grade A). The average width of this section is approximately 50 feet, while the average depth is approximately one foot (exclusive of pools).

Above point C the gradient is 1,940 feet in eight and one-half miles, or 228.2 feet/mile. The stream bed is predominately boulders, rubble, and gravel, with some bedrock. Pools, although numerous, are smaller than in the previous section and are graded B. At the lower end of this section the average width is 35 feet and the average depth 8 inches. This tapers toward the headwaters where the average width is 6 feet and the average depth 6 inches."

Pool grade descriptions as indicated by the letters A, B, and C in Newell's data are defined by Seamans (1959) as follows:

"A. Length or width greater than width of the stream:  
over two feet deep: abundant drift, logs and/or

boulders for shelter: well shaded: approximately 75 percent of the area consisting of pools.

- B. Length or width equal to width of stream: depth, shelter, and shade somewhat less than A: approximately 50 percent pools-50 percent ripples.
- C. Narrower or shorter than width of the stream: shallow and exposed: infrequent, less than 25 percent of the area."

Detailed descriptions of the Swift River and many of its tributaries are available at the New Hampshire Fish and Game Department, Concord, New Hampshire in a report entitled "The 1952 Trout Stream Survey of the Swift River, Passaconaway, New Hampshire" by Richard Seamans, Jr. and Lester Garvin (1952).

#### HABITAT SUITABILITY

The suitable habitat in the Saco River in Maine within Reach VI has been quantified for anadromous and inland fish species (Table VI-6). The habitat in the Saco River in New Hampshire within Reach VI has been quantified for Atlantic salmon only (Table VI-7).

With adequate fish passage facilities and flow releases, Atlantic salmon could use the Saco River for migration and production. The Atlantic salmon habitat within Reach VI requires a spawning escapement of 620 adults and can produce an estimated 20,685 smolts.

The Saco River Watershed within Reach VI contains extensive habitat for trout. Brown trout and brook trout habitat have been quantified in the Maine portion of the Saco River within the reach but neither species will be stocked under present management plans. The trout habitat in the Saco River in the New Hampshire portion of the reach has not been quantified but the river

Table VI-6. Suitable habitat, spawning escapement, and production estimates for important fish species in the Saco River in Maine within Reach VI.

Fish Species	Habitat		Spawning Escapement (males plus females)	Potential Production
	Number of Units (100 yd <sup>2</sup> )	Location		
Atlantic salmon	93	Rt. 113, Fryeburg to ME - NH border	6	93 smolts
Brown trout	5,530	Swans Falls Dam to ME - NH border	--	Limited. No stocking
Brook trout	93	Rt. 113, Fryeburg to ME - NH border	--	Limited. No stocking
Warmwater species	5,530	Swans Falls Dam to ME - NH border	--	--

Table VI-7. Suitable habitat, spawning escapement, and production estimates for Atlantic salmon in the Saco River in New Hampshire within Reach VI.

	Number of Units (100 yd <sup>2</sup> )	Location	Spawning Escapement (males plus females)	Potential Smolt Production
Surveyed	5,168	Maine-New Hampshire border to Rt 16 bridge, Conway, NH	308	10,336
	2,658	Rt 16 bridge to approximately 7,200 ft upstream of Conway Scenic Railway Bridge	158	5,316
Estimated <sup>1</sup>	1,192	7,200 ft upstream of Conway Scenic Railway Bridge to West Side Bridge, N. Conway	72	2,384
	1,278	West Side Bridge, N. Conway to 1,000 ft upstream of E. Branch Saco River confluence	76	2,556
Total	10,296	--	614	20,592

<sup>1</sup> Estimates were based on the area of the river, calculated by using dimensions noted by Hoover (1937). The habitat was estimated at 50% of the river area.

contains extensive habitat for trout. The New Hampshire Fish and Game Department presently manages the Saco River for a brown trout and a brook trout fishery (Bresosky 1986). The Department annually stocks brook trout and brown trout throughout the Saco River in Reach VI above the Artist Brook confluence (Kidder 1986). A local chapter of Trout Unlimited stocks the Saco River with brook and rainbow trout (SMRPC 1983). The Swift River contains extensive trout habitat and is stocked annually with brook and rainbow trout. Many other tributaries in New Hampshire within the reach contain suitable trout habitat and are managed for brook trout. Much of the habitat is seasonal but some tributaries, such as the East Branch Saco River provide year-round habitat. The New Hampshire Fish and Game Department is now in the process of classifying streams into categories for a statewide trout management plan. Classifications for streams within the Saco River Basin have not been determined.

#### UNIQUE REACH FEATURES

Burbot are found in the East Branch Saco River (Nowell 1985).



## RIVER RECREATIONAL USE

### SACO RIVER

General: There is heavy recreational use of the Saco River within Reach VI (SMRPC 1983). Much of the river is near the White Mountain National Forest and is also in a highly developed recreational area.

Canoeing: The area upstream of Conway, New Hampshire is popular for white-water canoeing in the spring (NERBC 1980). The portion of the Saco River between Conway and Swans Falls, Maine, is part of what is probably the most heavily canoed stretch of water in New England (SMRPC 1983). Canoe rentals are available throughout much of the river below North Conway (Saco Bound undated). Canoe access sites are limited north of Conway; however, the most popular section of the river is east of Conway and has numerous access sites.

Fishing: Fishing in the Saco River in Reach VI is primarily for trout (SMRPC 1983). The New Hampshire Fish and Game Department stocks brook and brown trout throughout the Saco River in Reach VI above the Artist Brook confluence (Kidder 1986). Additionally, a local chapter of Trout Unlimited stocks the Saco River with brook and rainbow trout. One section of the river is open to fly fishing only, beginning just below the Iron Bridge in North Conway and ending approximately two miles downstream near the golf course. This section is heavily utilized.

Other Water-Related Activities: Swimming is popular in the Saco River at the Iron Bridge in North Conway, the Fryeburg Beach at Weston's Bridge (Rt 113) in Fryeburg, Maine (MEBPR 1984), and on the numerous sandbars throughout the reach below North Conway (NERBC 1980, Pratt 1985).

Whitewater kayaking and rafting are popular activities on the Saco River in the spring (Pratt 1985). Low flows preclude such activities in the summer. Floating down the river in tubes is also a popular activity on the Saco River.

Camping: There are five campgrounds on the Saco River located throughout the reach below North Conway. Adequate camping facilities can be found after May 15; however, there are presently no campgrounds open before May 15 to accommodate early spring whitewater canoeists and kayakers. As a result, campers resort to using private land which has caused problems with landowners (SMRPC 1983).

Access: According to Saco Bound (undated), there are seven access points for canoeists on the Saco River in Reach VI (Appendix J). Six of these occur between Conway and Swans Falls. The only access point above Conway is located at the Iron Bridge in North Conway.

## SWIFT RIVER

General: The Swift River is the only major tributary to the Saco River within Reach VI. Nearly its entire length is located within the White Mountain National Forest. The Kancamagus Highway parallels the river throughout most of its length and provides easy access for recreationists of all types. The river receives intense recreational use (Pratt 1985).

Canoeing: Use of the Swift River by canoeists is limited (Pratt 1985). The river's challenging rapids and quickwater runs confine most of its use to skilled canoeists. Moreover, the river is normally runnable only from mid-April to the end of May (AMC 1978). The six-mile stretch in Albany from Lower Falls to Darby Field is one of the most difficult continuous runs in New England.

One-half mile below a point known as the Staircase in Albany is the site of an annual canoe race in Class IV (difficult) waters. There are no known canoe rental facilities on the Swift River.

Fishing: Fishing in the Swift River is primarily a put-and-take fishery for brook and rainbow trout stocked by the New Hampshire Fish and Game Department (Pratt 1985). Published information on fishing in the Swift River is available in "Trout Stream Management Investigations of the Swift River Watershed in Albany, New Hampshire" by Arthur E. Newell (1958).

Other Water-Related Activities: According to Pratt (1985) the Swift River is heavily used for many other water-related activities. The only formal swimming area is at Lower Falls, but swimming is popular in the many pools throughout the length of the river. The Swift River receives concentrated whitewater rafting and kayaking use during the last two weeks in April and the first week in May. There are five commercial rafting outfitters in the area that cater to rafters. The Swift River is nationally recognized as an outstanding Class IV water and was recently the setting for the U.S. Whitewater Kayaking Team Trials. Tubing is also popular on the Swift River. Over eight miles of the river from Rocky Gorge to Darby Field is suitable for covered boats only (AMC 1978).

Camping: There are four campgrounds adjacent to the Swift River (DeLorme 1983). All of these are located in the western end of the river in the town of Albany. No campgrounds are found in the 6½ miles of the Swift River upstream from its confluence with the Saco River in Conway. There are campgrounds nearby on the Saco River just upstream of the junction of the Swift River (Saco Bound undated).

Access: The AMC River Guide for Central and Southern New England (1978) notes four direct and one indirect points of access for

canoeists on the Swift River. Direct access points are located throughout the Swift River in Albany and the indirect access point is on the Saco River just below the confluence with the Swift River.

REACH VII. CONFLUENCE OF THE ELLIS RIVER, BARTLETT, NEW HAMPSHIRE TO SACO LAKE, CARROLL, NEW HAMPSHIRE (Includes the Ellis River).

### PHYSICAL CHARACTERISTICS

#### TOPOGRAPHY AND GEOLOGY

Reach VII (Figure 1-1) contains 21.8 miles of the Saco River between the confluence of the Ellis River, Bartlett, New Hampshire (mi 110.3) and the outlet of Saco Lake at Crawford Notch in Carroll, New Hampshire (mi 131.7). It includes the Ellis River Watershed. The reach lies in the White Mountain land form and is composed of rugged mountain terrain with most peaks exceeding 2,000-foot elevations. Several peaks are in excess of 5,000 feet, with Mount Washington, the highest peak in New England having an elevation of 6,288 feet (NERBC 1980).

One major tributary, the Ellis River, and 22 minor tributaries flow into the Saco River within Reach VII (Appendix K).

#### CLIMATE

This reach experiences the most severe weather conditions in the Saco River Basin (NERBC 1980). Average annual precipitation and snowfall are the greatest and temperatures are the lowest of any other reach within the Saco River Watershed. Average monthly precipitation, temperature and snowfall at Mount Washington and Pinkham Notch may be seen in Tables VII-1, VII-2, and VII-3, respectively.

#### RIVER HYDROLOGY

Saco: The Saco River originates at the outlet of Saco Lake located in the White Mountains at an elevation of 1,890 ft

TABLE VII-1. Average precipitation - inches (Ferrin 1984).

	<u>Mt. Washington</u>	<u>Pinkham Notch</u>
Period of Record	1950-1982	1950-1982
Elevation (ft above M.S.L.)	6262	2029
January	6.95	4.30
February	8.00	4.55
March	7.71	4.97
April	6.78	4.35
May	6.17	4.30
June	6.83	4.80
July	6.75	4.55
August	7.50	4.51
September	7.05	4.65
October	6.51	5.11
November	8.23	6.17
December	8.25	5.42
Annual	86.50	57.68

TABLE VII-2. Mean temperature - °F (Ferrin 1984).

	<u>Mt. Washington</u>	<u>Pinkham Notch</u>
Period of Record	1950-1981	1950-1981
Elevation (ft above M.S.L.)	6262	2029
January	5.2	15.5
February	5.1	17.0
March	11.8	25.6
April	22.4	37.4
May	34.5	50.0
June	44.5	59.0
July	48.7	63.1
August	47.1	60.9
September	40.5	53.3
October	30.5	43.7
November	20.5	32.5
December	9.3	19.7
Annual	26.7	39.8

TABLE VII - 3. Average snowfall - inches (Ferrin 1984).

	<u>Mt. Washington</u>	<u>Pinkham Notch</u>
Period of Record	1951-1982	1951-1982
Elevation (ft above M.S.L.)	6262	2029
January	44.1	33.0
February	49.0	33.3
March	49.7	33.3
April	33.6	16.4
May	11.3	4.2
June	2.1	--
July	0.7	--
August	1.4	--
September	2.4	--
October	13.1	3.2
November	33.3	15.4
December	53.0	36.1
Annual	285.5	156.7

It falls 1,380 ft, over 70% of its total elevation, in the 21.8 miles between Saco Lake and the confluence with the Ellis River (NHWSPCC 1979). This represents an average gradient of approximately 63.3 ft per mile.

There is a five-foot high dam on the Saco River main stem located in the headwaters at the Willey House in Harts Location, New Hampshire (Dube 1983). A small dam is also present at the outlet of Saco Lake (Nowell 1985).

Drainage areas for the Saco River within this reach were not determined.

Tributaries: The Ellis River is the largest of the 24 direct tributaries to the Saco River within this reach. It is

approximately 14 miles in length (Hoover 1937), and because of high amounts of precipitation, has an average run-off of approximately 41 inches per year (NHWSPPC 1979). It originates near Pinkham Notch in the White Mountains, and falls from an elevation of 2,500 ft to 510 ft at its confluence with the Saco River just below Glen in Bartlett, New Hampshire (NHWSPPC 1975). This is an average gradient of approximately 142 ft per mile.

There is a combination hydroelectric dam and impassable falls located on the Ellis River at Goodrich Falls, Bartlett (Nowell 1985). The dam is owned by the Goodrich Falls Energy Corp. (Nowell 1985) and is not licensed by the FERC (Russell 1985).

Several minor tributaries also have obstructions (Nowell 1985). A small diversion dam is present on the East Branch Saco River in Bartlett but it is not a barrier to fish passage. Several tributaries to the Saco River have impassable falls: Nancy Brook, Bemis Brook, Artist Falls Brook, Halfway Brook, Dry River, and the Sawyer River. The locations of the impassable falls in the brooks were undetermined for this report. The falls in Dry River are located approximately six miles upriver from Rt 302, and the falls in Sawyer River are located approximately three miles upstream from Route 302.

Data regarding flows in selected streams and rivers within this reach may be seen in the 1937 publication "Biological Survey of the Androscoggin, Saco and Coastal Watersheds" by Earl E. Hoover of the New Hampshire Fish and Game Department, Concord, New Hampshire.

Further information on direct tributaries to the Saco River within Reach VII is available in a report by Seamans (1959) entitled "Trout Stream Management Investigations of the Saco



River Watershed, Survey Report No. 9" published by the New Hampshire Fish and Game Department, Concord, New Hampshire.

#### WATER QUALITY AND USE

Saco: The Saco River waters within Reach VII are classified as Class B (NHWSPPC 1979). There are no point sources of significant discharges into the Saco River within the reach

Tributaries: With the exception of most of the East Branch Saco River, which has a Class A classification, all direct tributaries to the Saco River have Class B classifications (NHWSPPC 1979). Indirect tributaries within the reach have Class B classifications except for Meserve Brook, a tributary to the Ellis River, which carries a Class A classification

Data on pH in selected streams and rivers within this reach may be seen in the 1937 publication "Biological Survey of the Androscoggin, Saco and Coastal Watersheds" by Earl E. Hoover of the New Hampshire Fish and Game Department, Concord, New Hampshire.

Water quality data from 1975 through 1977 for specific rivers and streams within this reach are appended by the New Hampshire Water Supply and Pollution Control Commission, Concord, New Hampshire, in their 1979 report entitled "Saco River Basin; Water Quality Management Plan".

Unpublished water quality data for many streams within the White Mountain National Forest were compiled by Jerry Marancik of the U.S. Fish and Wildlife Service in the late 1970's. His data are recorded either in special reports or as raw data and are available at the USFWS office, Federal Building, Room 124, Laconia, New Hampshire 03246.

## LAND USE

Saco: A small headwater portion of the Saco River lies within the Crawford Notch State Forest (SMRPC 1983). Information on the use of the land abutting the Saco River throughout the remainder of the reach was not determined; however, the area is surrounded by the White Mountain National Forest. Land use by town is given in Table 1-4.

## FISHERIES

### HABITAT ASSESSMENTS

None of the habitat within Reach VII has been quantified or recently surveyed. Assessments of habitat in the Saco River and tributaries within Reach VII were recorded in "A Stream Survey of the Waters of the White Mountain National Forest" by J. Adger Smyth and H.S. Davis (1935), and in "Biological Survey of the Androscoggin, Saco and Coastal Watersheds" by Earl E. Hoover (1937).

Smyth and Davis wrote about the Saco River between Saco Lake and the confluence of Rocky Branch:

"The Saco River is an average mountain stream down to its junction with Dry River where it assumes more nearly the proportions of a river. The stream above this junction is characterized by small pools, plentiful food, shallow gravel or rubble riffles, and small boulders with a few scattering outcrops of bedrock. Below the mouth of the Dry River, the bottom is more thickly strewn with boulders. The pools are larger and deeper and gravel and sand extremely rare."

According to Hoover, the substrate contained in the remainder of the Saco River in Reach VII is primarily rubble. Pools are shallow and exposed, narrower or shorter than the width of the stream, and infrequent.

### HABITAT SUITABILITY

The habitat in the Saco River and many tributaries has not been quantified but is suitable for Atlantic salmon and trout. Present management plans are directed almost exclusively to brook trout

(Bresosky 1986). There are no current management plans for Atlantic salmon and minimal plans for brown trout and rainbow trout management. Many of the waters within Reach VII provide year-round habitat for brook trout. Tributaries such as Rocky Branch and Dry River have naturally reproducing populations of brook trout and are not stocked. According to Marancik (1977) there is a natural population of rainbow trout in the Ellis River. This river is stocked exclusively with brook trout (Bresosky 1986). Annual brown trout stockings within the entire reach are limited to a short portion of the Saco River above the Ellis River confluence (Kidder 1986). The entire Saco River throughout Reach VII is stocked annually with brook trout.

## RIVER RECREATIONAL USE

### SACO RIVER

General: Nearly the entire reach is within the White Mountain National Forest, a popular year-round recreational area (NERBC 1980). A small portion of the Saco River lies within the Crawford Notch State Forest, a multirecreational facility located in the headwaters (SMRPC 1983). The Saco River is paralleled by Route 302 throughout the reach providing access for recreationists of all types.

Canoeing: The upper Saco River provides some of the most challenging whitewater canoeing in New England (AMC 1978). The continuous rapids and White Mountain scenery attract many canoeists in the spring; however, low flows prohibit its use in summer (Pratt 1985). Canoes may be rented in Bartlett (Saco Bound undated).

Fishing: Fishing in the Saco River within Reach VII is almost entirely for trout (SMRPC 1983). The New Hampshire Fish and Game Department currently stocks brook trout throughout the entire Saco River within the reach. Brown trout stocking in the Saco River is minimal and is confined to the area immediately upriver of the Ellis River confluence.

Other Water-Related Activities: Swimming is popular in many of the pools within the reach (Pratt 1985). One site near the Sawyer River confluence, and another site at a narrow gorge approximately five miles upstream of the Sawyer River, are two favorite locations. Kayaking and rafting are popular recreational activities in the spring but low flows prohibit these activities in summer. Tubing is also a popular pastime.

Camping: There are four campgrounds in close proximity to the Saco River within the reach (DeLorme 1983). These campgrounds are fairly evenly distributed throughout the reach.

Access: There are only two known specific access points for canoeists and kayakers: the bridge in Bartlett, and a narrow gorge between Davis Path and Nancy Pond Trail (Pratt 1985). The Saco River upstream of Davis Path is not used by canoeists or kayakers due to the rugged substrate and steep gradient.



