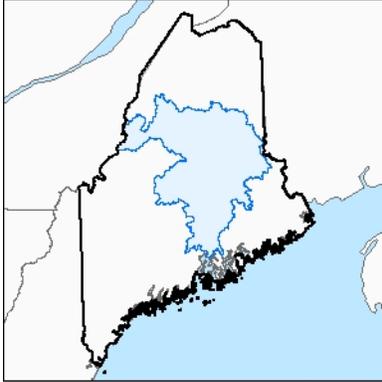


3.0 Penobscot River Basin



3.1 Watershed Description

The Penobscot River Basin occupies 8,570 square miles in northeastern Maine. The Penobscot River flows for 105 miles from the confluence of its East and West Branches in Medway, south to its mouth in Penobscot Bay. The River Basin is largely undeveloped, approximately 95% is forested. Major communities in this basin include Millinocket, Howland, Lincoln, Old Town, Orono, Veazie, Bangor, and Brewer.

Table 16 presents the major tributaries to the Penobscot River and their respective drainage areas.

Table 16. Penobscot River, Tributaries from Upstream to Downstream and Drainage Areas

Tributary	Drainage Area (square miles)
West Branch Penobscot River	2,140
East Branch Penobscot River	1,150
Mattawamkeag River	1,520
Piscataquis River	1,470
Penobscot River	2,400
Total	8,670

The Penobscot River is influenced by tides as far as Bangor, 30 miles above the confluence with Penobscot Bay. Figure 9 illustrates the location of the Penobscot River basin within Maine as well as the subbasins of major tributaries.



Figure 9. Penobscot River Basin and Major Tributaries

3.2 Dams and Reservoirs

In general, dams in Maine are not constructed as flood control structures. However, the dams with large impoundment capacity can be useful for controlling flood discharges if their reservoirs are below capacity. Many dams in the lower reaches of Maine's rivers are run-of-river dams, and have little or no capacity to capture and hold runoff during floods (MGS, 2005).

The collaborative dam database indicates that the Penobscot River Basin contains approximately 119 dams. At the present, sixteen of the dams on the Penobscot River are used for generating hydroelectric power,

twelve for flood control and stormwater management, twelve for water supply, twenty-six for recreational purposes and thirty-nine for “other” uses. The storage capacity of impoundments in the Penobscot River Basin is approximately 1,192,000 acre-feet. Appendix E contains the list of dams located within the Penobscot River Basin and included in the collaborative dam database.

3.3 Precipitation

The average annual precipitation in the Penobscot River Basin is approximately forty-one inches uniformly distributed throughout the year. Snowfall contributes the water equivalent of six to eight inches per year.

3.4 Population

The Penobscot River Basin contains all or portions of three cities (including Bangor, Brewer, and Old Town), 108 towns, and 184 unincorporated areas, and falls within seven counties. Table 17 presents the historical population data within the Penobscot River Basin. The population within the drainage basin has increased since the 1970s, but the proportion of the population residing within cities has remained relatively constant.

Census date	Population	Population in cities
1970	149,000	51,000
1980	165,000	49,000
1990	174,000	51,000
2000	172,000	49,000

Table 17. Penobscot River Basin, Population

3.5 Historic Flooding Events (1970 – 2007)

Flooding within the Penobscot River Basin is most often caused by a combination of precipitation and snowmelt. Ice jams can exacerbate high flow conditions and cause acute localized flooding. Conditions favorable for flooding typically occur during the spring months. Table 5 presents the list of major and minor flood events identified within the Penobscot basin between 1970 and the present using the sources of data described in Section 1 of this report. The flood events indicated with an “x” are described in greater detail in the following sections of the report.

Table 18. Penobscot River Basin, Identified Flood Events.

	Date	Flood Location	Source of Flood Record	Damages
x	April/May 1973	Penobscot River	ACOE, USGS	
	1974		FIS Howland	
	1975		FIS Howland	
	April 1976	Mattawamkeag River, Passadumkeag River	USGS	
x	January 1978	Penobscot River, Piscataquis Rivers	CRREL	Moderate damages
	April 1983	Penobscot River	FIS Howland, FIS Enfield	
	April 1979	Piscataquis River	FIS Howland, USGS	
x	March/April 1987	Penobscot River, Sebec River, Piscataquis River, Kenduskeag Stream	CRREL, IHMT, USGS, ACOE	Severe damages
	1988		FIS Howland	
x	April 1993		IHMT	
x	January 1996	Penobscot River, Piscataquis Rivers	CRREL	Severe damages
	January 1997	Penobscot River	CRREL	Road flooded
	March 1999	Piscataquis River	CRREL	One home flooded
x	April 2005	E. Br. Penobscot River	CRREL	House evacuations
x	October 2005		Unknown	
	January 2006	East Branch Mattawamkeag River	CRREL	Store, parking lot
	April 2007			
	May 2006			

CRREL – Ice jam database, USGS – Streamgage record, ACOE – 1990 study, FIS – Flood Insurance Study, IHMT – Interagency Hazard Mitigation Report

The USGS record of peak discharge and stage at streamgages within the Penobscot drainage basin indicate major high flow events, which may have resulted in flooding. Appendix B contains a streamgage inventory of all active and historical gages in the Penobscot River Basin. Table 19 presents the highest recorded daily discharge at selected streamgages. The streamgage record indicates that major flood events resulting from high flows occurred in April/May 1923, April/May 1973, and April 1987. The flood of record within the Penobscot River Basin occurred in May 1923 as the result of three days of rainfall totaling 5.3 inches on a high water content snowpack. The flood of April 1987 is considered the flood of record in the Penobscot River Basin.

Table 19. Penobscot River Basin, Flood of Record at Streamgages

Site	Site Name	Date	Discharge (cfs)	Gage Height
01029500	East Branch Penobscot River at Grindstone, Maine	4/30/1923	37,000	16.9
01030500	Mattawamkeag River near Mattawamkeag, Maine	5/1/1923	46,600	
01031500	Piscataquis River near Dover-Foxcroft, Maine	4/1/1987	37,300	22.62
01034000	Piscataquis River at Medford, Maine	4/1/1987	85,000	18.65
01034500	Penobscot River at West Enfield, Maine	5/1/1923	153,000	25.15
01036390	Penobscot River at Eddington, Maine	4/3/1987	159,000	23.53

3.5.1 April/May 1973

The Penobscot River Basin received approximately three inches of rainfall accompanied by warm temperatures and melting snowpack. The communities of Bradley, Costigan, and Old Town experienced significant losses of property. Table 20 presents the observed stage, discharge, and recurrence interval (where available) for the April/May 1973 flood. The USGS estimated the return period of the flows on the East Branch Penobscot River and the upper reaches of the Penobscot River to be fifty to one hundred years.

Table 20. Penobscot River Basin, USGS Streamgage Peaks, April/May 1973

Station	Name	Stage	Discharge (cfs)	Estimated Recurrence Interval (years)
01029500	East Branch Penobscot River at Grindstone, Maine	14.71	30,600	50-100
01030000	Penobscot River near Mattawamkeag, Maine	16.89	66,000	50-100
01030300	Trout Brook near Danforth, Maine	4.51	229	2-5
01030500	Mattawamkeag River near Mattawamkeag, Maine	13.26	23,800	5-10
01031500	Piscataquis River near Dover-Foxcroft, Maine	11.33	10,500	2-5
01031600	Morrison Brook near Sebec Corners, Maine		125	2-5
01033000	Sebec River at Sebec, Maine	8.99	5,140	2-5
01033500	Pleasant River near Milo, Maine	9.87	14,100	5-10
01034000	Piscataquis River at Medford, Maine	11.36	33,200	5-10
01034500	Penobscot River at West Enfield, Maine	21.66	128,000	25-50
01035000	Passadumkeag River at Lowell, Maine	5.99	2,760	5-10
01036500	Kenduskeag Stream near Kenduskeag, Maine	8.48	2,850	<2

3.5.2 January 1978

The CRREL ice jam database indicates that flooding occurred on the Penobscot and Piscataquis Rivers as a result of ice jams. The USGS estimated the return period of the flows on the Penobscot River and tributaries to be two to five years.

Table 21. Penobscot River Basin, USGS Streamgage Peaks, January 1978

Station	Name	Stage	Discharge (cfs)	Estimated Recurrence Interval (years)
01031500	Piscataquis River near Dover-Foxcroft, Maine	11.51	10,800	2-5
01033000	Sebec River at Sebec, Maine	7.35	3,640	<2
01033500	Pleasant River near Milo, Maine	8.66	7,300	<2
01034000	Piscataquis River at Medford, Maine	9.58	23,200	2-5
01036500	Kenduskeag Stream near Kenduskeag, Maine	11.1	4,410	2-5

3.5.3 March/April 1987

The Penobscot River Basin received approximately three inches of rainfall between March 31 and April 1, 1987. The rainfall was accompanied by warm temperatures and melting snowpack. Three days later, the river basin received an additional two inches of rain. This event caused the flood of record within the Piscataquis River subbasin. Table 22 presents the observed stage, discharge, and recurrence interval (where available) for the March/April 1987 flood. The USGS estimated the return period of the flows on the Penobscot River to be one hundred to five hundred years and the Piscataquis to be greater than five hundred years.

Table 22. Penobscot River Basin, USGS Streamgage Peaks, March/April 1987

Station	Name	Stage	Discharge (cfs)	Estimated Recurrence Interval (years)
01030000	Penobscot River near Mattawamkeag, Maine	12.9	55,400	25-50
01030500	Mattawamkeag River near Mattawamkeag, Maine	13.1	23,300	5-10
01031500	Piscataquis River near Dover-Foxcroft, Maine	22.62	37,300	>500
01033000	Sebec River at Sebec, Maine	12.89	11,000	100
01034000	Piscataquis River at Medford, Maine	18.65	85,000	100-500
01034500	Penobscot River at West Enfield, Maine	23.58	147,000	50-100
01036390	Penobscot River at Eddington, Maine	23.53	159,000	
01036500	Kenduskeag Stream near Kenduskeag, Maine	15.84	7,400	50-100

3.5.4 April 1993

An interagency hazard mitigation team report describing flooding during the spring of 1993 indicates that flood warnings were issued on the Penobscot River in response to a moderate rainfall event falling on a snowpack with high water content. Information on this flood event is not comprehensive. Table 23 presents the observed stage, discharge, and recurrence interval (where available) for the April 1993 event. The USGS estimated the return period of the flows on the Penobscot River and tributaries to be five to twenty-five years.

Table 23. Penobscot River Basin, USGS Streamgauge Peaks, March/April 1993

Station	Name	Stage	Discharge (cfs)	Estimated Recurrence Interval (years)
01030500	Mattawamkeag River near Mattawamkeag, Maine	16.16	26,100	10-25
01031500	Piscataquis River near Dover-Foxcroft, Maine	12	12,100	2-5
01033000	Sebec River at Sebec, Maine	9.33	5,820	5-10
01034000	Piscataquis River at Medford, Maine	12.33	37,300	5-10
01034500	Penobscot River at West Enfield, Maine	18.93	101,000	10-25
01036390	Penobscot River at Eddington, Maine	18.62	106,000	n/a

3.5.5 January 1996

The CRREL ice jam database indicates that ice jams caused severe flooding and damages along the Penobscot and Piscataquis Rivers in January 1996. Table 24 presents the observed stage, discharge, and recurrence interval (where available) for the January 1996 event. The USGS estimated the return period of the flows on the Piscataquis to be two to five years.

Table 24. Penobscot River Basin, USGS Streamgauge Peaks, January 1996

Station	Name	Stage	Discharge (cfs)	Estimated Recurrence Interval (years)
01031500	Piscataquis River near Dover-Foxcroft, Maine	11.48	11,200	2-5
01034000	Piscataquis River at Medford, Maine	9.89	24,000	2-5
01036390	Penobscot River at Eddington, Maine	16.7	92,300	n/a

3.5.6 April 2005

The CRREL ice jam database indicates that ice jams caused severe flooding and damages along the East Branch Penobscot River in April 2005. Table 25 presents the observed stage, discharge, and recurrence interval (where available) for the January 1996 event. The USGS estimated the return period of the flows on the Penobscot River and tributaries to be five to twenty-five years.

Table 25. Penobscot River Basin, USGS Streamgage Peaks, April 2005

Station	Name	Stage	Discharge (cfs)	Estimated Recurrence Interval (years)
01027200	North Branch Penobscot River nr Pittston Farm, ME	9.32	8,410	
01029200	Seboeis River near Shin Pond, Maine	11.62	4,280	
01029500	East Branch Penobscot River at Grindstone, Maine	13.56	25,600	10-25
01030500	Mattawamkeag River near Mattawamkeag, Maine	14.31	19,100	2-5
01031300	Piscataquis River at Blanchard, Maine	10.79	7,150	
01031500	Piscataquis River near Dover-Foxcroft, Maine	12.19	12,600	5-10
01034000	Piscataquis River at Medford, Maine	12.11	35,800	5-10
01034500	Penobscot River at West Enfield, Maine	19.76	107,000	10-25

3.5.7 October 2005

[information on this event was not available at the time of publication]

Table 26. Penobscot River Basin, USGS Streamgage Peaks, October 2005

Station	Name	Stage	Discharge (cfs)	Estimated Recurrence Interval (years)
01027200	North Branch Penobscot River nr Pittston Farm, ME	8.61	6,270	
01029200	Seboeis River near Shin Pond, Maine	10.55	3,360	
01029500	East Branch Penobscot River at Grindstone, Maine	12.38	20,700	5-10
01031300	Piscataquis River at Blanchard, Maine	9.93	5,330	
01031450	Kingsbury Stream at Abbot Village, Maine	13.32	6,670	
01031500	Piscataquis River near Dover-Foxcroft, Maine	12.89	13,900	5-10
01034000	Piscataquis River at Medford, Maine	11.46	32,000	5-10
01034500	Penobscot River at West Enfield, Maine	16.63	79,600	2-5