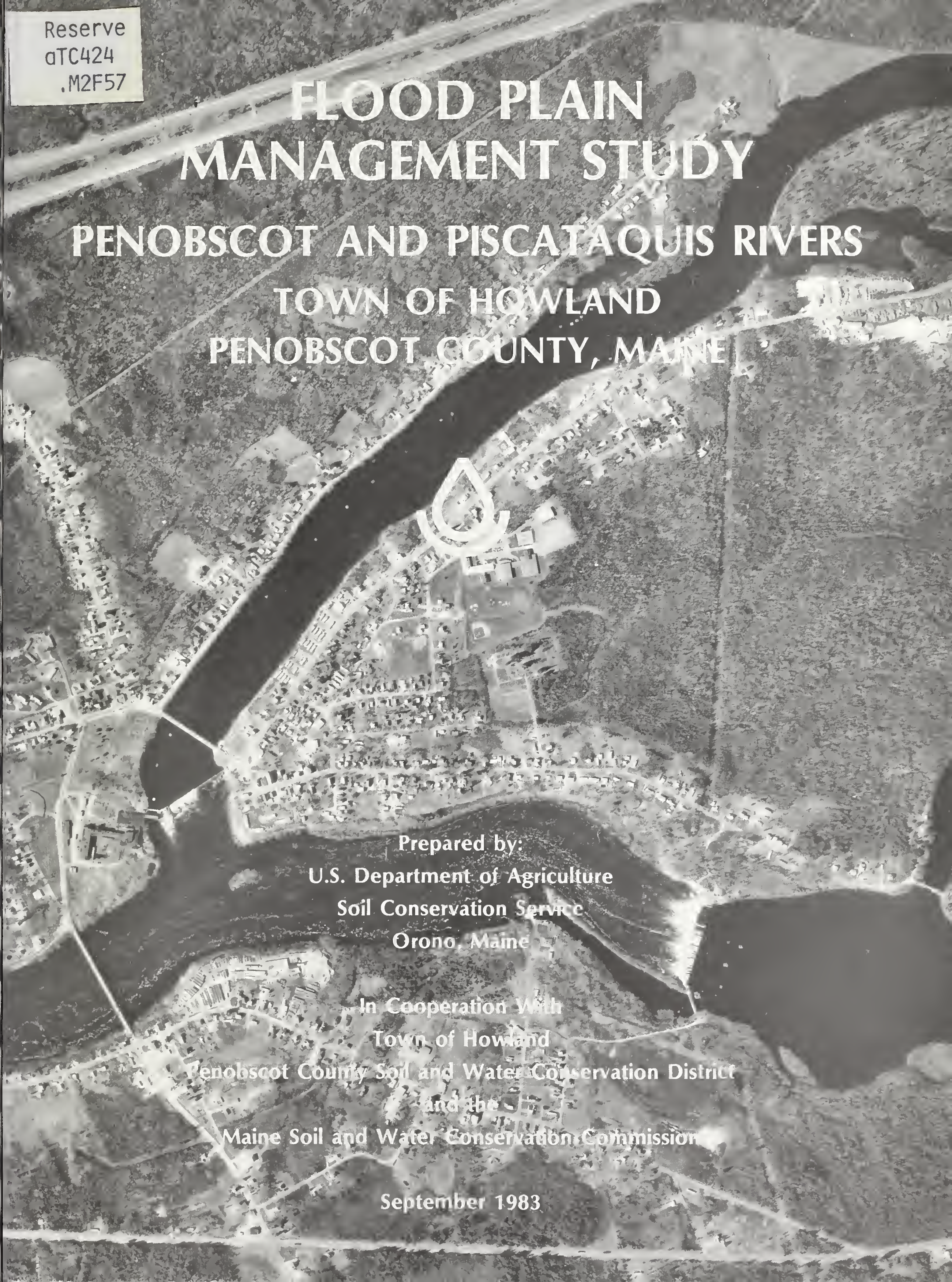
FLOOD PLAIN MANAGEMENT STUDY

PENOBSCOT AND PISCATAQUIS RIVERS

TOWN OF HOWLAND
PENOBSCOT COUNTY, MAINE



Prepared by:
U.S. Department of Agriculture
Soil Conservation Service
Orono, Maine

In Cooperation With
Town of Howland
Penobscot County Soil and Water Conservation District
and the
Maine Soil and Water Conservation Commission

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FLOOD PLAIN MANAGEMENT STUDY

PENOBSCOT AND PISCATAQUIS RIVERS

HOWLAND, MAINE

Introduction

This report presents flood plain information along the Penobscot and Piscataquis Rivers within the town of Howland. Data generated as a result of this study consists of a flood hazard evaluation, including flood plain maps and profiles, recommendations for flood protection, and an inventory of natural resource values served by the flood plains.

The town of Howland will use the technical information provided in this study to identify flood plain areas, and as a guide for developing a flood plain management program for the areas studied. This report will provide the town with information needed to comply with Maine's "Mandatory Zoning and Subdivision Control Law", which applies to shoreland areas. Such regulations are needed to minimize loss of life and property damage from future floods, prevent environmental degradation of the area's resources and ensure orderly community growth. The data generated from this study can also be used for developing conservation plans, the design of hydraulic structures, roads, bridges, and other types of community planning by federal, state, and local agencies, planning groups, engineers, and conservation district cooperators.

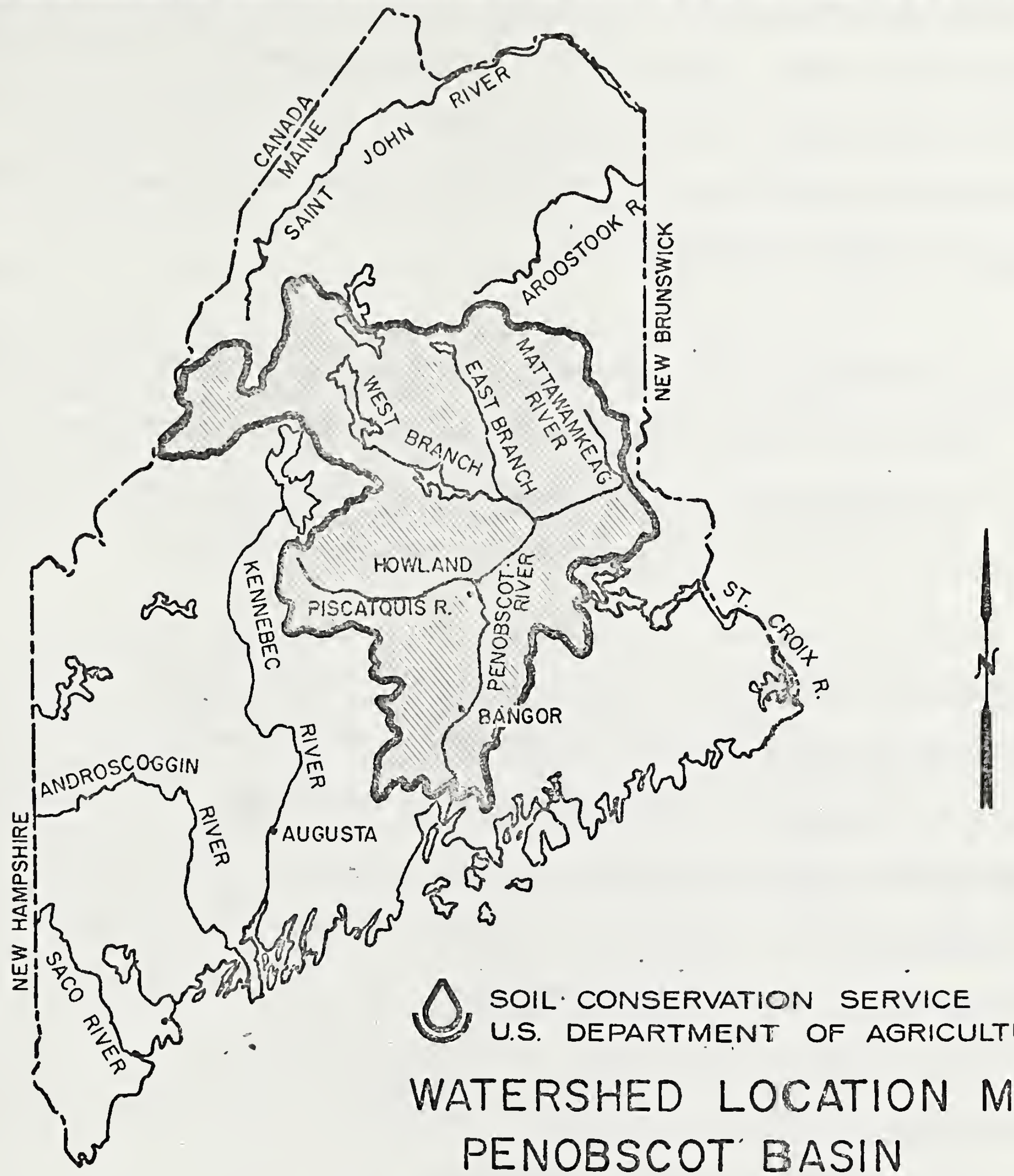
This study was performed in response to a request by the town of Howland to the Maine Soil and Water Conservation Commission (MSWCC). A cooperative Plan of Work was approved by the town and the MSWCC in March 1981, and authorized by the Soil Conservation Service (SCS) in April 1981. That plan provides the basis for funding and also outlines the areas to be included and scope of the study.

The SCS, United States Department of Agriculture, carries out Flood Plain Management Studies under the provisions of Federal Level Recommendation (3) of A Unified National Program for Flood Plain Management, Water Resources Council, September 1979, in accordance with Section 6 of Public Law 83-566, the Watershed Protection and Flood Prevention Act (1954). Priorities of studies in Maine are established by the MSWCC through a Joint Coordination Agreement between the Commission and SCS to carry out these studies.

The Watershed[1]

The Penobscot River Basin, with an area of approximately 8,590 square miles, is the largest river basin lying wholly within Maine and the second largest in New England, being exceeded only by the Connecticut River Basin. Its area covers approximately one quarter of the state, extending to a maximum length of about 125 miles and a maximum width of about 115 miles, (see Watershed Location Map). A principal physiographic feature of the central part of the basin is 5,267-foot Mt. Katadin, the state's highest

(1) Reference number - Bibliography.



SOIL CONSERVATION SERVICE
U.S. DEPARTMENT OF AGRICULTURE

WATERSHED LOCATION MAP
PENOBSCOT BASIN

- AREA .... 8590 square miles
- POPULATION 165,000
- PRIMARY LAND & WATER USES ...... Commercial Forestry Agriculture
- PRINCIPAL STREAMS ... Penobscot, Mattawamkeag, Sebec, Piscataquis, Passadumkeag
- SPECIAL FEATURES ... Baxter State Park (200,000 acres), largest park in Me. Mt. Katahdin (5267') highest point in Maine.

peak. It is located in 200,000-acre Baxter State Park, the state's largest public recreation area. There are several large impoundments in the basin. In addition, headwaters of the Allagash River in the St. John Basin are diverted into the East Branch of the Penobscot River via the man-made lakes of Allagash, Chamberlain and Telos.

Principle tributaries of the Penobscot River are: West Branch Penobscot River - 2,131 square miles, East Branch Penobscot River - 1,120 square miles, Mattawamkeag River - 1,507 square miles, Piscataquis River - 1,453 square miles, and the Passadumkeag River - 399 square miles.

The majority of the basin is located in the New England Upland physiographic region, with moderate to gentle slopes interspersed with occasional mountains or monadnocks of resistant rocks. Structurally, it is composed of metamorphic bedrock, principally: shale, slate and schist folded to form complex geologic structures and intruded by resistant granitic and igneous material. The principal lowland in the basin is located along the valley of the Penobscot main stem. It is characterized by low relief with hills generally rising 300 to 400 feet. Divides at the perimeter of the valley reach elevations of 600 to 800 feet.

The northernmost reaches of the White Mountain physiographic region form a band of high rugged relief across the upper basin. This region is characterized by irregular uplands with granitic mountains ranging from 2,000 to over 5,000 feet. Evidence of volcanism is also found in this region. Bedrock delineations throughout the basin trend in a northeast - southwest direction.

The surficial geology of the basin is primarily the result of glacial erosion and deposition, and marine sedimentation. The basin is blanketed by glacial till and stratified drift. In the highlands the till is often exposed, whereas in the valleys it is generally buried under marine deposits. Areas underlain by marine clay deposits are characterized by poor drainage which has resulted in the formation of a number of bogs and swamps throughout the basin. Eskers composed of sorted sands and gravels are located along the main stem and most of the tributary valleys and comprise the major surficial aquifers in the basin. The majority of the lakes in the basin are the result of glacial scouring of bedrock formations.

On an annual basis, precipitation in the Penobscot River Basin averages approximately 41 inches, ranging from a minimum of 38 inches in the Mattawamkeag sub-basin to a maximum of 45 inches in the Piscataquis sub-basin. The distribution of precipitation is fairly uniform throughout the year. Annual snowfall throughout the basin varies from approximately 60 inches in the southern, coastal region to in excess of 100 inches in the headwaters of the East and West Branches of the Penobscot River. The water content of the snow cover is released during the spring freshet, and often amounts to an average of six to eight inches of water over the entire basin, and 10 or more inches over the upper areas of the basin.

The average annual runoff throughout the basin is about 1.7 cubic feet per second (cfs) per square mile, equivalent to approximately 22 inches per year, or 55 percent of the mean annual precipitation. The Piscataquis sub-basin averages 1.8 cfs per square mile, or 25 inches per year. Over 40 percent of the runoff occurs in the months of March, April and May with the remainder being uniformly distributed throughout the rest of the year.

There are numerous lakes and associated dams in the basin, with a total lake area of approximately 250,000 acres (Atlantic Salmon Commission, 1963). The two largest lakes, Chesuncook Lake (26,200 acres) and the Pemadumcook Lake Chain (18,300 acres), are both located on the West Branch. Total usable storage in the basin amounts to nearly 1.6 million acre-feet, and is primarily located in the watersheds of the East and West Branches, and the Piscataquis River. Over 80 percent (1.3 million acre-feet) of this storage is located in the West Branch Watershed and is regulated via a system of 15 dams, all owned and operated by Great Northern Paper Company (GNP). This storage is used in the production of electricity at GNP's pulp mills in Millinocket and East Millinocket. Another 10 percent of basin storage is located in the East Branch Watershed and is controlled by Bangor Hydro-Electric Company for the benfit of its facilities along the main stem.

The hydrology of the basin has also been altered in the headwaters of the Penobscot East Branch, where flows from several lakes can be diverted from the Saint John River Basin by a lock and dam which was constructed in 1841 to increase water levels for log driving purposes. Although log driving no longer takes place, the dam is still in operation, and water from Telos, Chamberlain, and Allagash Lakes can be discharged into either the Penobscot or Saint John River Basins. The Penobscot has received all of the flow for the last 30 to 40 years (Bangor Hydro Personal Communication, 5/81). East Branch flow is also regulated at Grand Lake Matagamon via an agreement between the Maine Department of Inland Fisheries and Wildlife and Bangor Hydro-Electric Company, in which the latter has agreed to maintain an instantaneous minimum flow of 150 cfs.

The net effect of storage and flow regulation in the upper branches of the basin is to moderate the discharge throughout the lower basin. For example, during April it is evident that the presence of adequate storage in the upper basin reduces natural flow, thus reducing potential flood waters. During the month of August, however, when natural river flow has been low, the effect of upstream storage releases has been to increase flows.

Large supplies of ground water in the Penobscot River Basin are obtained from eskers, well stratified formations of sand and gravel deposits located in hydraulic continuity with bodies of surface water. The quality of ground water is generally satisfactory, although ground waters are harder and more mineralized than the basin's surface waters.

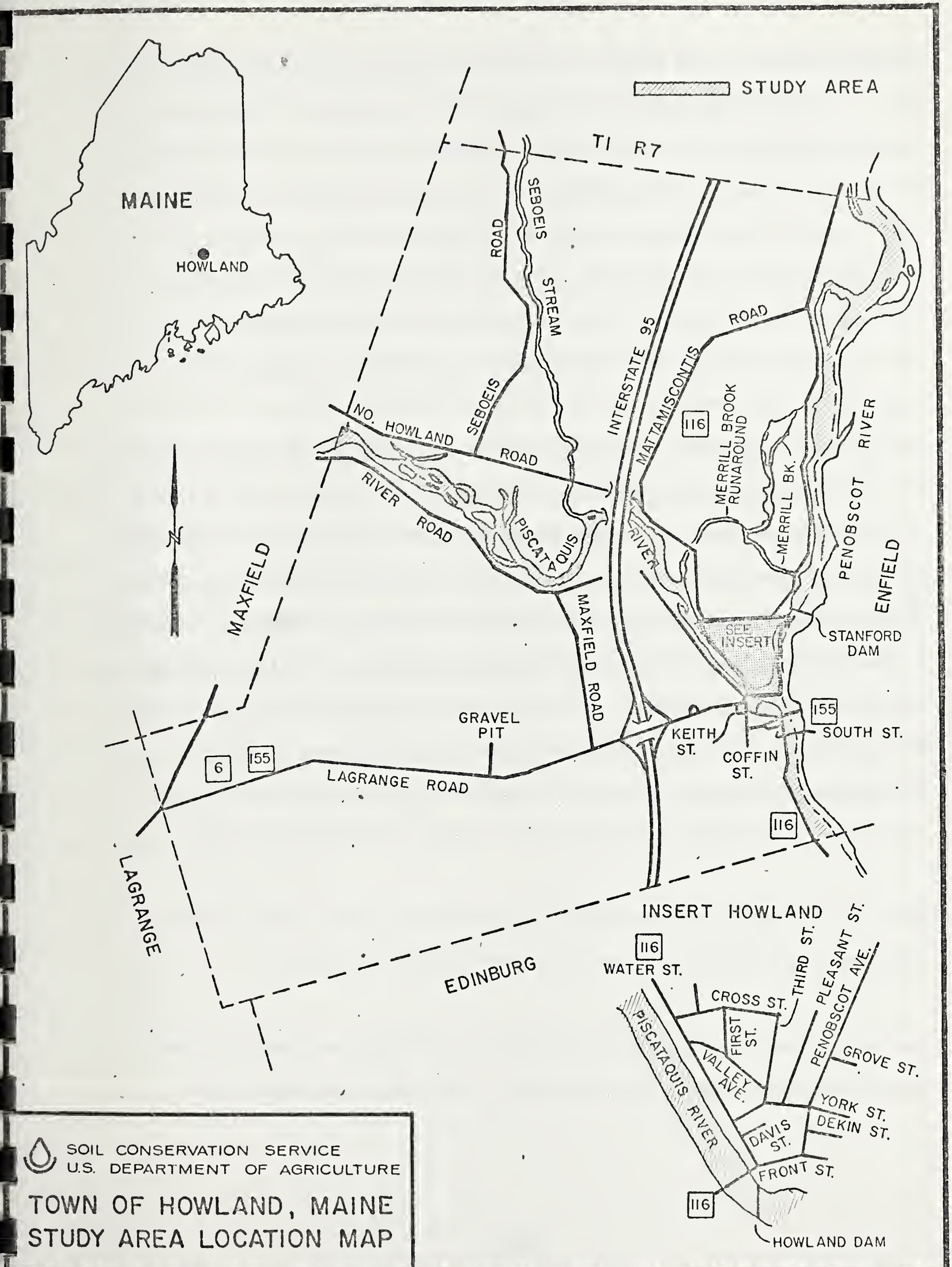
Nearly 95 percent of the Penobscot River Basin is forested, with over half of such lands being owned by private timber industries. Urban land uses have historically been concentrated in the few industrial centers along rivers in the lower and central basin. There is some recent expansion of urban development, including seasonal residences and facilities, outside the older industrial centers, but still primarily in the southern portion of the basin. In the north, there are few changes in land ownership patterns or prospects for new permanent development, although access to the woods for recreation purposes is improving with increased construction of permanent roads by timber interests.

As with other non-forest land uses, agricultural land in the basin is limited, and concentrated in the southern portion. The far northeastern part of the basin does extend into the potato growing belt of Aroostook County, and there is also some dairy and potato farming in sections of Piscataquis County east of Dover-Foxcroft. However, over three-quarters of the basin's farmland is located to the south in Penobscot County, with the most intensively farmed areas being in the Kenduskeag Watershed northwest of Bangor. Dairy and poultry operations are evident, and crops include potatoes and corn silage, and, to a lesser extent, blueberries and vegetables.

The hydrologic unit codes for the basin are 01020001000 - 5000. The study area is located in sub basins 01020004160, 01020004170, 01020005050, and 01020005110.(2)

The Study Area

The town of Howland, in which the study area is located, is situated approximately 30 miles north of Bangor on Interstate 95 (the major highway link to northern Maine). The study area (see Study Area Location Map),



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TOWN OF HOWLAND, MAINE
STUDY AREA LOCATION MAP

includes 7 miles of the Penobscot River and 6 miles of the Piscataquis River. The Penobscot River flows in a southerly direction forming the eastern boundary of Howland and has a drainage area of 5,199 square miles as it enters Howland at the Mattamiscontis town line increasing to 6,674 square miles at the Edinburg town line. The Penobscot is joined by the Piscataquis River just upstream of the State Route 155 bridge in Howland. The Piscataquis River has a drainage area of 1,268 square miles when it enters Howland at the Maxfield town line and increases to 1,453 square miles as it flows easterly to its confluence with the Penobscot in Howland. Development in the study area is heaviest from Interstate 95 east along the Piscataquis River to its confluence with the Penobscot River. This area is urban in nature and includes many homes, businesses, schools, and municipal properties. West of Interstate 95 along the Piscataquis development tends to be more rural and includes scattered farms, homes, recreational properties, a campground, and several gravel quarrying operations. Along the Penobscot River development is greatest from the Stanford Dam to the State Route 155 bridge, which includes the previously mentioned urban area of Howland. Development along the remainder of the Penobscot River consists of scattered homes, recreational properties and timber harvesting operations.

There is one bridge spanning the Penobscot River and three over the Piscataquis River within the study area (Bridge Data - Appendix).

Two large dams owned by Bangor Hydro-Electric Company and used for power generation are located in the study area. The larger of these is the

Stanford Dam located on the Penobscot River 0.8 miles above the Piscataquis River confluence. The Howland Dam is located on the Piscataquis River within the built up portion of Howland 400 feet above the confluence of the Penobscot River. Both dams appear to be in good condition and, as they are run-of-the-river type dams, provide no significant flood water storage. The Stanford Dam is currently undergoing improvements and plans call for expanding its capacity from 3.5 to 13 megawatts. The Howland Dam presently produces 1.9 megawatts. Both dams are equipped with operable fishways.

The soils in the flood plains and terraces of the study area are predominately gravelly and sandy soils of the Stetson-Machias-Allagash-Hadley association. Those found in the uplands of Howland tend to be stony and ledgy, deep to shallow, granitic and slaty soils of the Plaisted-Thorndike-Howland association. Penobscot County, in which the study area is located, has been completely soil mapped and a soil survey report published.(3) Based on the soil survey much of the land in and adjacent to the flood plains studied is considered to be prime farmland or farmland of statewide importance.(4) Additional soils information may be obtained from the SCS field office in Bangor.

Natural Values

In the early part of the century, agriculture was an important activity in Howland. At that time, a substantial amount of land along the Piscataquis River was either under cultivation or in pasture and hayland. A few of these farms remain along the river with the existing fields primarily in pasture or hayland. Approximately 10 percent of all existing land within Howland is classified as being prime farmland soil (4). About 40 percent of this land lies within the 100-year flood plains studied. For the most part, the flood plain area is wooded and the river banks appear to be stable with little erosion occurring.

The flood plain area of the lower Piscataquis River in Howland provides valuable habitats for a variety of wildlife species. The alluvial soils on the shore and islands generally produce mature hardwood stands typified by red and silver maples and red oak. Other areas not inundated as frequently will include spruce, fir, and white pine in mixed wood or pure softwood stands.

The mature forests provide an abundance of cavity nesting trees for a variety of woodpeckers, owls, wood ducks, goldeneyes, hooded mergansers, small mammals, and raccoons. Black ducks are also frequent nesters on the flood plain. Important furbearers using the main rivers, meander channels, and tributary streams include beaver, mink, otter and muskrats. Deer and moose are common along the flood plain and some winter use of softwood stands has been noted.

Conspicuous nongame birds in the area include bald eagles, osprey, great blue herons, great horned owls, and spotted sandpipers. There are at least two active bald eagle nests within the general area and eagles are frequently seen feeding along both rivers in Howland.

Fur trapping and hunting are popular sports outside the built up part of town on both the Piscataquis and Penobscot Rivers in Howland.

Protecting flood plains from development and maintaining natural vegetation and tall trees along the shores will protect the wildlife, economic, and recreation values of the area.

The Penobscot and Piscataquis Rivers are considered to be mainly warm water fish habitat due to the impoundments created by the Howland and Stanford dams. The predominant gamefish species is the smallmouth bass, which along with chain pickerel, inhabit this area year round. Many tributaries and certain areas of the rivers support brook trout which move into the impoundments during periods of cold water - October to April. Large numbers of landlocked salmon are stocked in lakes which are tributary to the Piscataquis and Penobscot Rivers. Data have shown that many salmon migrate downstream and provide a seasonal fishery in the river, including the Howland impoundment. Sea run Atlantic salmon also migrate through this area in both rivers.

The fishery is underutilized at present, although, according to the district game warden, the number of anglers is increasing every year. Only two or three years ago the warden usually did not see anglers when checking the rivers as compared to last season when he averaged eight to 10 anglers each time he visited the rivers. The area is legally open to fishing from April 1 to September 15. Both landlocked and Atlantic sea run salmon, bass, and pickerel are caught early in the open water season but as the water warms up, only bass and pickerel are caught.

Recreational use of the Penobscot and Piscataquis Rivers in Howland is currently quite low. There are a private campground and several recreational properties located on the Piscataquis River. Canoeing and boating are currently limited to some extent on both rivers by lack of suitable access points. Both rivers, however, have the capacity of offering excellent canoeing, with the exception of the areas immediately above and below the Howland and Stanford dams. Both rivers in Howland have been listed in the Maine Rivers Study (5) as having resource values of statewide significance. Unique river values identified by that study on the Piscataquis River from Howland to the West Branch were: critical-rare species, scenic, anadromous fishery, inland fishery, and white water boating. Unique values on the Penobscot River from the Veazie dam to Medway, which brackets the study area, include: geologic-hydrologic, critical-rare species, anadromous fishery, and canoe touring. Both rivers were found, by the former U.S. Heritage Conservation and Recreation Service, to be potentially eligible for inclusion in the national Wild and Scenic Rivers System. (This program is now administered by the National Park Service.) The Penobscot was identified as being a potential wild and scenic river and the Piscataquis as a potential recreational river.

There are no nationally registered historic places or natural landmarks located within the Penobscot or Piscataquis River flood plains in Howland. A landmark of local importance, Coconut Spring, is located in the Piscataquis River flood plain. Coconut Spring was used as a source of drinking water by early river drivers and now, for the same purpose, by many residents of Howland.

The most recent classification of the Penobscot River and the Piscataquis River below the Howland Dam according to Maine Department of Environmental Protection (ME DEP) standards is Class C, i.e., waters of this classification are of such quality as to be satisfactory for recreational boating and fishing, for fish and wildlife habitat and for other uses except potable water supplies and water contact recreation, unless such waters are adequately treated. The Piscataquis River, from the Howland Dam to Merrill Brook Runaround is classified as being B-2. Waters of this class are acceptable for recreational purposes including water contact recreation, for industrial and potable water supplies after adequate treatment and for fish and wildlife habitat. Above Merrill Brook Runaround, the Piscataquis River is classified as being B-1. Waters of this class are considered the higher quality of the Class B group and are suitable for all uses described under B-2.

The lower Piscataquis River and the Penobscot River at Howland have been listed as water quality problem areas by ME DEP due to discharge of untreated wastes and stormwaters by a combined sewer system. A treatment system has been designed for Howland; however, a lack of funding has delayed its construction.

Major items that should be considered to enhance the natural and recreational values of the Penobscot and Piscataquis Rivers include the adoption of measures that would regulate development within the 100-year flood plain as well as the preparation of an overall use plan for the river that would address such items as public access, recreational facilities and the preservation of significant wildlife habitat areas. Other general recommendations include:

1. Maintain wetland and flood plain vegetation buffers to reduce sedimentation and delivery of chemical pollutants to the water body.

2. Support agricultural practices that minimize nutrient flows into water bodies.

3. Control the use of pesticides, herbicides and fertilizer.

4. Minimize soil erosion on land within, or adjacent to, flood plains and on forest road systems and timber harvesting operations.

5. Minimize tree cutting and other vegetation removal.

6. Dispose of spoils and waste materials so as not to contaminate ground and surface water or significantly change land contours.

Additional technical information on the above items may be obtained from the SCS field office in Bangor.

Flood Problems

Flooding occurs most frequently in early spring when heavy rains on snow-covered or frozen ground produce greater than normal runoff. It is at this time of year that ice breaks loose from streambanks resulting in potential obstructions to bridge openings and other channel constrictions which can artificially raise flood levels. Ice jams have been a particular problem on the Piscataquis River in Howland. These occur to some extent on a nearly annual basis. Flash floods occur on occasion from thunderstorms, but these events generally produce less runoff than that associated with spring flooding.

The most recent flood in the watershed occurred in April 1983 when approximately 4 inches of rain fell throughout the watershed within 24 hours. The most serious flooding in the study area occurred along Water Street just upstream of the State Route 155 bridge. (See photo page 18). Here, floodwaters of the Piscataquis River surrounded a number of homes, trailers, and the town's water supply pumping station. Prompt sandbagging along Water Street prevented the floodwaters from reaching a much larger portion of town. Elsewhere along the Piscataquis River, flooding of cellars was experienced at a number of homes, a campground suffered extensive inundation, farmlands were flooded, and the North Howland Road, near the Medford town line, was closed due to flooding. The Penobscot River crested shortly after the Piscataquis River causing water to back up into the center of town. Approximately 18 inches of water entered the lower level of the Howland town office causing damage to the library and police station

HOWLAND , MAINE – FLOOD OF APRIL 1983

Looking across the Piscataquis River towards Water Street. The frequency of this flood is estimated to be slightly in excess of 10 years. Sand bags placed along Water Street prevented water from crossing the street and affecting additional properties. (SCS Photo) housed there. Flood waters also crossed low areas of State Route 116 south of town and caused its closure north of town. A peak discharge of 108,000 cfs was measured by the U.S. Geological Survey (USGS) on the Penobscot River at Howland. Based on this discharge and measured high water on the Piscataquis River the estimated frequency, on both rivers in the study area, is estimated to be slightly in excess of 10 years.

Other major floods have occurred in the watershed in May 1923 (flood of record - frequency estimated to be slightly greater than 100-year on the Penobscot River), March 1936, March 1953, December 1969, April 1973, December 1973, and April 1979.

The following tables summarize the approximate extent of flooding caused by 10-, 100-, and 500-year events to: flood plains, properties, and important farmlands.

Approximate Flood Plain Areas[1/]

(Acres)

	10-Year	100-Year	500-Year
Penobscot River[2/]			
Woodland	565	820	960
Agricultural Land	2	2	2
Wetlands	35	35	35
Urban[3/]	16	37	54
Subtotal	618	894	1,051
Piscataquis River[4/]			
Woodland	532	781	1,032
Agricultural Land	162	184	205
Wetlands	4	4	4
Urban[3/]	52	102	150
Other	15	34	46
Subtotal	765	1,105	1,437
GRAND TOTAL	1,383	1,999	2,488

1/ Classified by apparent primary land use. Does not include normal river area.

2/ Includes areas of backwater flooding from the Penobscot River, as shown on Flood Plain Maps.

3/ Includes commercial, municipal, residential and recreational properties, roads and bridges.

4/ Includes areas of backwater flooding from the Piscataquis River, as shown on Flood Plain Maps.

Approximate Number of Properties in Flood Plain

	10-Year	100-Year	500-Year
Penobscot River			
Houses	-	5	6
Trailers	-	-	1
Seasonal	-	1	1
Subtotal	0	6	8
Piscataquis River			
Commercial	5	11	13
Municipal	3	5	5
Houses	25	63	80
Trailers	14	33	36
Seasonal	3	3	3
Other	1	6	10
Subtotal	51	121	147
GRAND TOTAL	51	127	155

Approximate Areas of Important Farmlands1/ in the Flood Plain (Acres)

	10-Year	100-Year	500-Year
Penobscot River			
Prime Farmland	199	274	305
Piscataquis River			
Prime Farmland	405	530	662
Farmland of Statewide Importance	6	14	24
Total Important Farmland	610	818	991

1/ See Glossary for definition.

Flood Plain Management

This report is intended to provide a technical basis for arriving at solutions to minimize both present and projected flood damages. The management options presented herein are aimed at providing information on various means of flood protection, and/or alleviation of monetary loss caused by flooding. These options fall into two major categories (non-structural and structural) and are briefly described in this section. With further study, the town or individuals may find one, or a combination of several of these alternatives to be a viable means of reducing flood losses in a given area. Considerations in this evaluation include: if the area being studied is in a high or low hazard zone (see glossary for definitions), engineering feasibility, economics, effect on flooding elsewhere, and social acceptability.

Nonstructural Measures

1. Flood Warning

Flood warning can be of major importance in reducing flood loss. Through use of an audible signal activated by stage sensors on the Penobscot and Piscataquis Rivers adequate warning could be provided to most residents of Howland in the event of an impending flood. Adequate warning would allow residents to move their belongings to higher ground, take emergency precautions (prepare sandbags, disconnect furnaces, remove gas cylinders, shut off electricity, and so on), and/or evacuate themselves. Since both the Penobscot and Piscataquis Rivers have large drainage areas and their waters rise relatively slow, a flood warning system could be practical in Howland. Such a system might have allowed prevention of flooding such as that which occurred to the town office in the April 1983 flood.

2. Flood Proofing

Flood damages to some buildings and their contents can be minimized by a method known as flood proofing. This method involves sealing the lower portions of a structure to prevent the entry of flood waters. Some means of sealing include waterproof coatings on foundations, permanently closing and sealing lower openings, and water tight closures that can be quickly and easily installed over openings in the event of flooding.

The use of flood proofing is limited to structurally sound buildings, generally constructed of masonry to a height exceeding the highest designated flood stage.

There are a number of properties in Howland, primarily located on the fringe of the 100-year flood plain and where depth and velocity of flood waters is not hazardous, that might be economically flood proofed. Any such structure considered for flood proofing would require an independent evaluation and solution.

Further information on flood proofing is contained in SCS Technical Release 57, Flood Proofing available at nominal cost from:

National Technical Information Service
U.S. Department of Commerce
5285 Port Royal Road
Springfield, Virginia 22151

3. Elevation of Structure

In some cases, it is possible to elevate a structurally sound building above flood stage and flood proof the new foundation. In some cases in Howland this method could provide adequate protection to both the structure and its occupants.

However, as structural problems are often encountered in elevating a building it would be necessary to obtain an engineer's evaluation of any structure for which this method is contemplated.

4. Individual Berms and Floodwalls

Often it is possible to prevent flood water from entering a property by surrounding the property with an earthen berm or masonry wall which exceeds the design flood stage.

This method might have limited use in Howland where depths of flooding and velocities are not great. Drawbacks of this method are the high cost of a watertight masonry wall and possible ground water seepage which might defeat the measure. It might also be necessary to use a pump in conjunction with the wall or berm. Structures for which this method is contemplated would have to be evaluated on an individual basis.

5. Purchase and Relocation

In areas where the danger of flooding is so great as to render all other means of flood protection ineffective or impractical, government may be able to purchase the properties and relocate the buildings and/or their occupants. Once the properties have been evacuated the land may be used for parks or some other purpose not significantly affected by flood waters.

Due to the nature of the areas flooded and the lack of suitable land for relocation, it is doubtful if this approach would have much support or practical application in Howland.

6. Land Use Regulation and Flood Insurance

In 1971, the state of Maine enacted the "Mandatory Zoning and Sub-division Control Law" (Chapter 424, Sec. 4811 thru 4814 of the Maine Statutes) which requires all municipal units of government to adopt zoning and subdivision control ordinances for shoreland areas. Shoreland areas are defined as land within 250 feet of the normal high water mark of any pond, river or salt water body and include at least a major portion of the flood plain. Under Howland's present zoning laws, building permits are required for all new construction.

Since 1975, Howland has participated in the "emergency" phase of the National Flood Insurance Program. This permits existing dwellers within the approximate 100-year flood plain to purchase up to $45,000 worth of flood insurance coverage at subsidized rates on their homes and contents ($100,000 for multi-family and small businesses). The community must require building permits for all proposed construction and review the permit to assure that sites are reasonably free from flooding. For the flood prone areas it is also required that structures be properly anchored and that construction materials and methods be used that will minimize flood damage.

Flood plain regulations and flood insurance cannot prevent flood damages, but they can help alleviate future problems and monetary loss. As of June 30, 1983, there were six flood insurance policies, with a total amount of coverage of $132,800.00 in force in Howland.

Structural Measures

Structural measures include: dams, channel work, removal of channel restrictions, and dikes. Due to the large drainage areas and size of the channels involved only dikes were judged to have any practical application in Howland.

There appears to be a high potential for complete elimination of 100-year flood damage in the urban area of Howland through construction of a dike. This dike would have a length of approximately 2,500 feet and extend along the northeast bank of the Piscataquis River from the Howland Dam to high ground in the rear of the Strout Realty Building. Based on a top width of 10 feet, a maximum height of 8 feet, and 2 to 1 side slopes, it is estimated that such a dike would require approximately 13,000 cubic yards of fill.

It would also be necessary to relocate several mobile homes, secure land rights along the river, construct flap gates on storm drains and culverts leading to the Penobscot River (to prevent the entry of backwater), and either raise River Street or do minor diking along it to prevent increased flooding there.

Preliminary studies show that such a project would raise the 100-year level of the Piscataquis River by approximately 0.4 feet at the State Route 155 bridge. In order to determine the feasibility it would be necessary to conduct in depth engineering and economics studies to determine design and cost data for the dike, effect of the dike on the State Route 155 bridge and Howland Dam, effect of increased stages elsewhere on the Piscataquis River, cost of relocation of the water pumping station, cost-benefit ratio, environmental impact, and so on. Because of the large drainage areas involved, a project of this type would fall under the jurisdiction of the U.S. Army Corps of Engineers. If the town desires to further study and pursue such a project they should submit a request for a small project study directly to the Division Engineer, New England Division, Corps of Engineers, 424 Trapelo Road, Waltham, Massachusetts 02154.

Floodways

Any encroachments in the flood plain which increase the elevation of the land and/or present obstructions to flood flows will reduce the flood carrying capacity, resulting in increased flood heights and flow velocities. Flood hazards, both upstream and downstream, of the encroachment itself will generally be increased in these situations. One aspect of flood plain management involves balancing the economic gain from flood plain development against the resulting increase in flood hazard. Under this concept, the 100-year flood plain is divided into a floodway and a floodway fringe.

The floodway is the main channel or watercourse plus any adjacent flood plain areas that must be kept free of encroachment so that the 100-year flood can be conveyed without substantial increase in flood heights. Minimum standards of the Federal Insurance Administration (FIA) limit such increases in flood heights to 1.0 foot, provided that hazardous velocities do not result.

The floodway fringe includes that portion of the flood plain that can be completely obstructed without increasing the water surface elevation of the 100-year flood by more than 1.0 foot at any point. Theoretical floodways were computed by SCS for the Penobscot and Piscataquis Rivers within Howland. They were computed on the basis of equal conveyance reduction from each side of the flood plain.

Floodway data are not included in this report but may be obtained upon request from the U.S. Soil Conservation Service, USDA Office Building, University of Maine, Orono, Maine 04473, telephone (207)-866-2132.

Use of Technical Data

This report contains flood profiles, photo base flood plain maps, selected valley cross sections and other information which indicate the extent of potential flooding along the Penobscot and Piscataquis Rivers in the town of Howland. Four floods were analyzed, the 10-year (10 percent chance) flood, 50-year (2 percent chance) flood, 100-year (1 percent chance) flood and the 500-year (0.2 percent chance) flood.

Information in the report pertaining to the Penobscot River may also be used in the town of Enfield. However, the extent of flooding in Enfield has not been shown on the Flood Plain Maps.

The results of this study are summarized in the Flood Profiles which depict the elevations of the above four floods throughout the study area. The analyses do not account for the unpredictable obstructing effects of ice or other debris which could reduce the capacity of the channel and/or bridges during flooding conditions. Thus, the elevations presented in this report should be considered minimum for flood plain management purposes.

The Flood Plain Maps include a delineation of the 10-year, 100-year and 500-year flood boundaries and the 100-year flood elevations. Where these lines merge there is no appreciable difference in the flood boundaries. Due to variations in relief and scale, the areas outlined on the maps are approximate. To check a specific property the user should locate the property in question on the appropriate Flood Plain Map and read the elevation for the desired frequency flood at the corresponding location on the Flood Profiles. Cross section locations, as shown on the maps and profiles, can be used as references for this purpose. By comparing the elevation from the profiles to the surveyed elevation of the property in question, the flooding frequency of that property can be estimated. Elevation bench marks, whose approximate locations are shown on the Flood Plain Map Index and Flood Plain Maps, are described in the Appendix and can be used as starting points to transfer elevations (NGVD) to the desired properties.

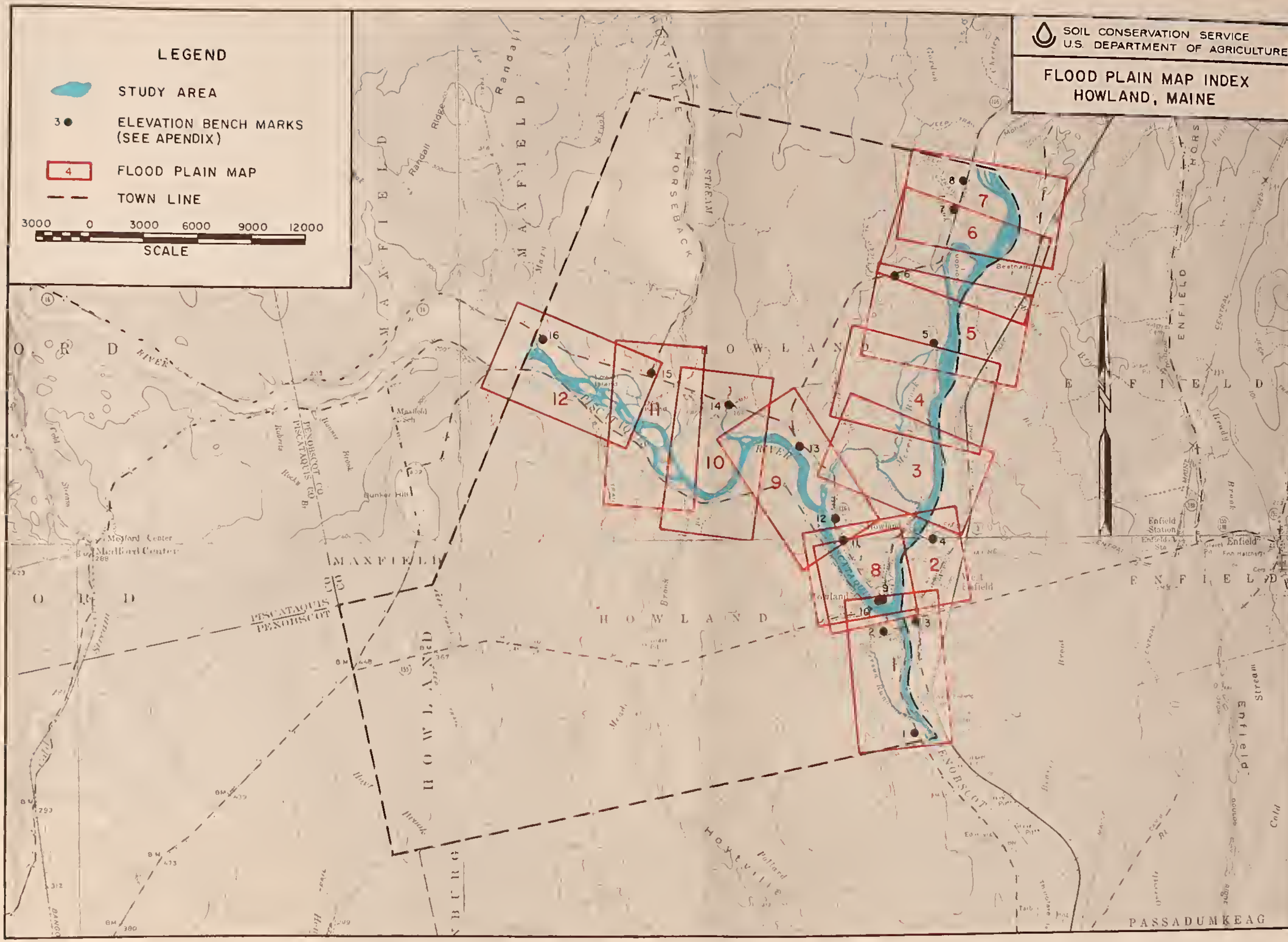
Also included are selected valley cross sections which show the relationship of various floods to existing topography under unobstructed flow conditions.

The following tables are contained in the Appendix:

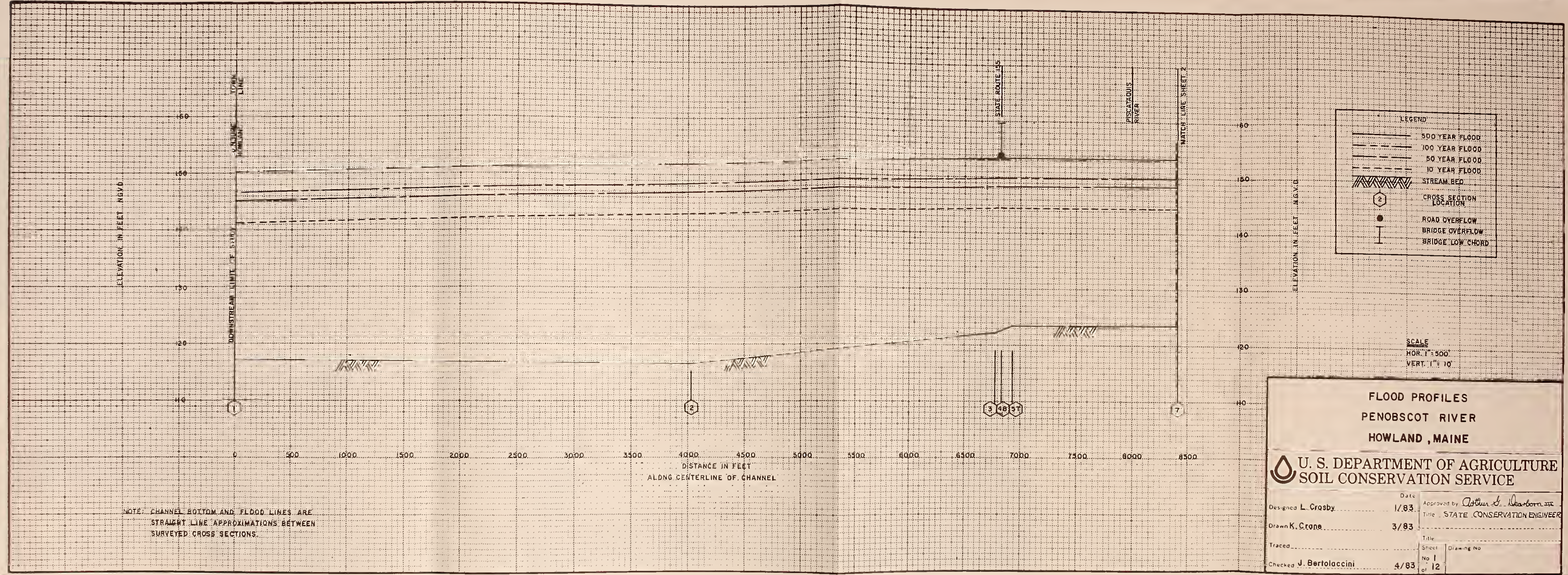
Selected Flood Discharges - provides rates of flow in cubic feet per second for the 10-year, 50-year, 100-year and 500-year floods within the study area. This data can be used as a guide for the hydraulic design of new bridges and/or stream channel modifications.

Bridge Data - presents a summary of flood and other elevations for bridges within the study area. This information can also be obtained from the Flood Profiles.

Field surveys were obtained during the summer of 1981. Only those features in the flood plain at the time the surveys were completed were considered in the computations. Changes of bridge openings and/or flood plain encroachment will affect flood levels and necessitate updating the information given in this report. Additionally, major changes in land use due to unforeseen future development within the watershed could cause a significant increase in flood discharges and require revisions in the data.

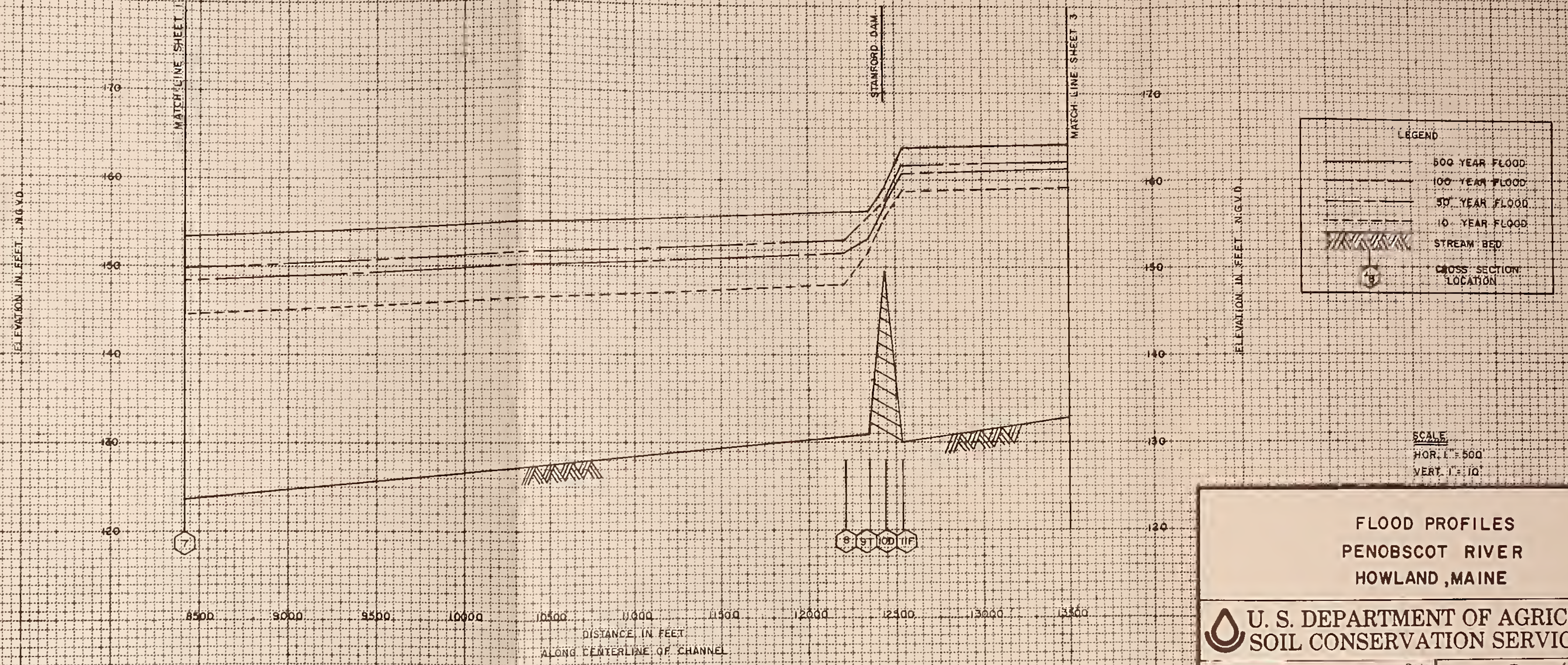

SOIL CONSERVATION SERVICE
U.S. DEPARTMENT OF AGRICULTURE
FLOOD PLAIN MAP INDEX
HOWLAND, MAINE
LEGEND
STUDY AREA
ELEVATION BENCH MARKS (SEE APENDIX)
FLOOD PLAIN MAP
TOWN LINE
3000 0 3000 6000 9000 12000
SCALE
HOWLAND
MAXFIELD
ENFIELD
PASSADUMKEAG
PENOBSCOT
PISCATAQUIS RIVER
HORSEBACK STREAM
Bunker Hill
Enfield Station
West Enfield
Howland
Medford Center
PISCATAQUIS
PENOBSCOT
1
2
3
4
5
6
7
8
9
10
11
12


LEGEND
500 YEAR FLOOD PLAIN
100 YEAR FLOOD PLAIN
10 YEAR FLOOD PLAIN
VALLEY CROSS SECTION
157 100 YEAR FLOOD ELEV.
STATE ROUTE
COFFIN STREET
TERRIO
SHEET 8
U.S. ROUTE 2
OLD COUNTY ROAD
U.S. ROUTE 2
APPROXIMATE
SOIL CONSERVATION SERVICE
U.S. DEPARTMENT OF AGRICULTURE
FLOOD PLAIN MAP
FLOOD PLAIN MANAGEMENT STUDY
TOWN OF HOWLAND, MAINE
SHEET 1 OF 12



TOWN LINE
DOWNSTREAM LIMIT OF STUDY
STATE ROUTE 155
PISCATAQUIS RIVER
MATCH LINE SHEET 2
ELEVATION IN FEET NGVD
160
150
140
130
120
110
1
2
3
4B
5T
7
0
500
1000
1500
2000
2500
3000
3500
4000
4500
5000
5500
6000
6500
7000
7500
8000
8500
DISTANCE IN FEET
ALONG CENTERLINE OF CHANNEL
LEGEND
500 YEAR FLOOD
100 YEAR FLOOD
50 YEAR FLOOD
10 YEAR FLOOD
STREAM BED
CROSS SECTION LOCATION
ROAD OVERFLOW
BRIDGE OVERFLOW
BRIDGE LOW CHORD
SCALE
HOR. 1" = 500'
VERT. 1" = 10'
NOTE: CHANNEL BOTTOM AND FLOOD LINES ARE STRAIGHT LINE APPROXIMATIONS BETWEEN SURVEYED CROSS SECTIONS.
FLOOD PROFILES
PENOBSCOT RIVER
HOWLAND, MAINE
U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
Date
Designed L. Crosby 1/83
Drawn K. Crone 3/83
Traced
Checked J. Bertolaccini 4/83
Approved by Arthur G. Dearborn III
Title STATE CONSERVATION ENGINEER
Title
Sheet No 1 of 12
Drawing No


LEGEND
500 YEAR FLOOD PLAIN
100 YEAR FLOOD PLAIN
10 YEAR FLOOD PLAIN
VALLEY CROSS SECTION
100 YEAR FLOOD ELEV.
STATE ROUTE 116
VALLEY AVENUE
WATER STREET
THIRD STREET
PLEASANT STREET
PENOBSCOT AVENUE
GROVE ST
YORK ST
MAIN STREET
FRONT STREET
BM 9
BM 4
STANFORD DAM
NORTH STREET
MILL STREET
PIERCE STREET
OLD COUNTY ROAD
WEST ENFIELD
SOIL CONSERVATION SERVICE
U.S. DEPARTMENT OF AGRICULTURE
FLOOD PLAIN MAP
FLOOD PLAIN MANAGEMENT STUDY
TOWN OF HOWLAND, MAINE
SHEET 2 OF 12



NOTE: CHANNEL BOTTOM AND FLOOD LINES ARE STRAIGHT LINE APPROXIMATIONS BETWEEN SURVEYED CROSS SECTIONS.

FLOOD PROFILES
PENOBSCOT RIVER
HOWLAND, MAINE

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

	Date	
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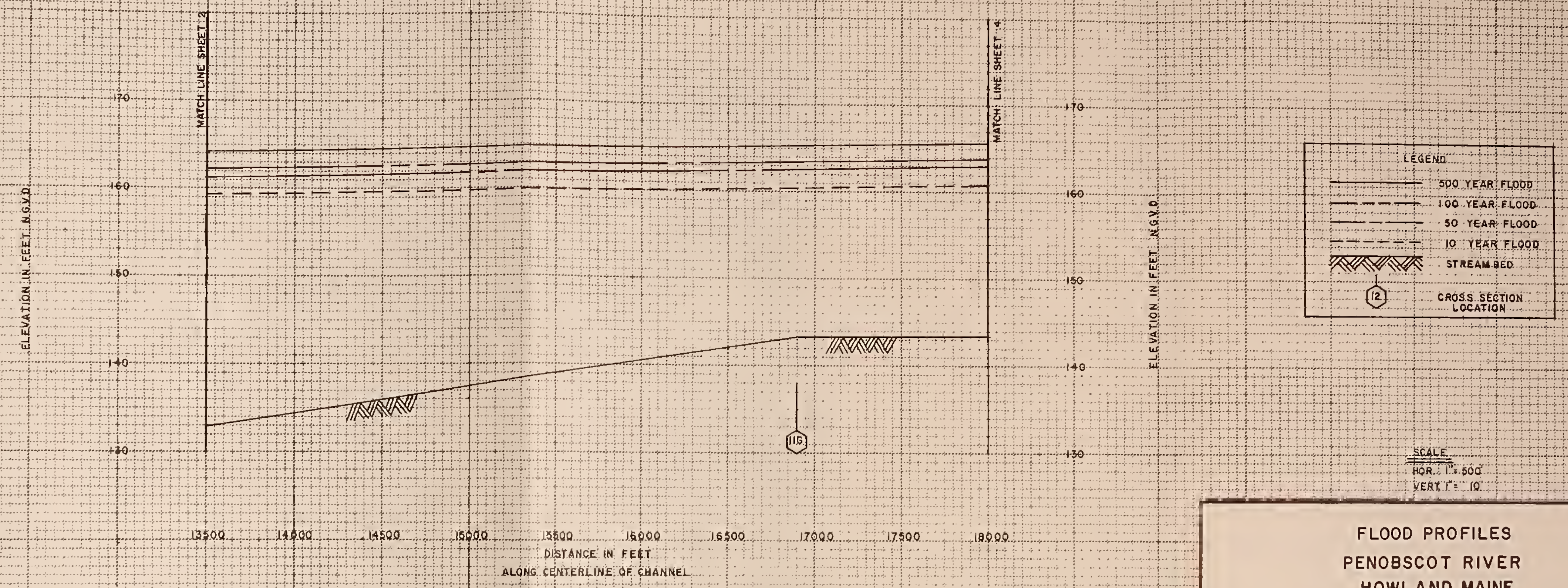
LEGEND
500 YEAR FLOOD PLAIN
100 YEAR FLOOD PLAIN
10 YEAR FLOOD PLAIN
116 VALLEY CROSS SECTION
157 100 YEAR FLOOD ELEV.
SOIL CONSERVATION SERVICE
U.S. DEPARTMENT OF AGRICULTURE
FLOOD PLAIN MAP
FLOOD PLAIN MANAGEMENT STUDY
TOWN OF HOWLAND, MAINE
SHEET 3 OF 12



NOTE: CHANNEL BOTTOM AND FLOOD LINES ARE STRAIGHT LINE APPROXIMATIONS BETWEEN SURVEYED CROSS SECTIONS.

FLOOD PROFILES
PENOBSCOT RIVER
HOWLAND, MAINE

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

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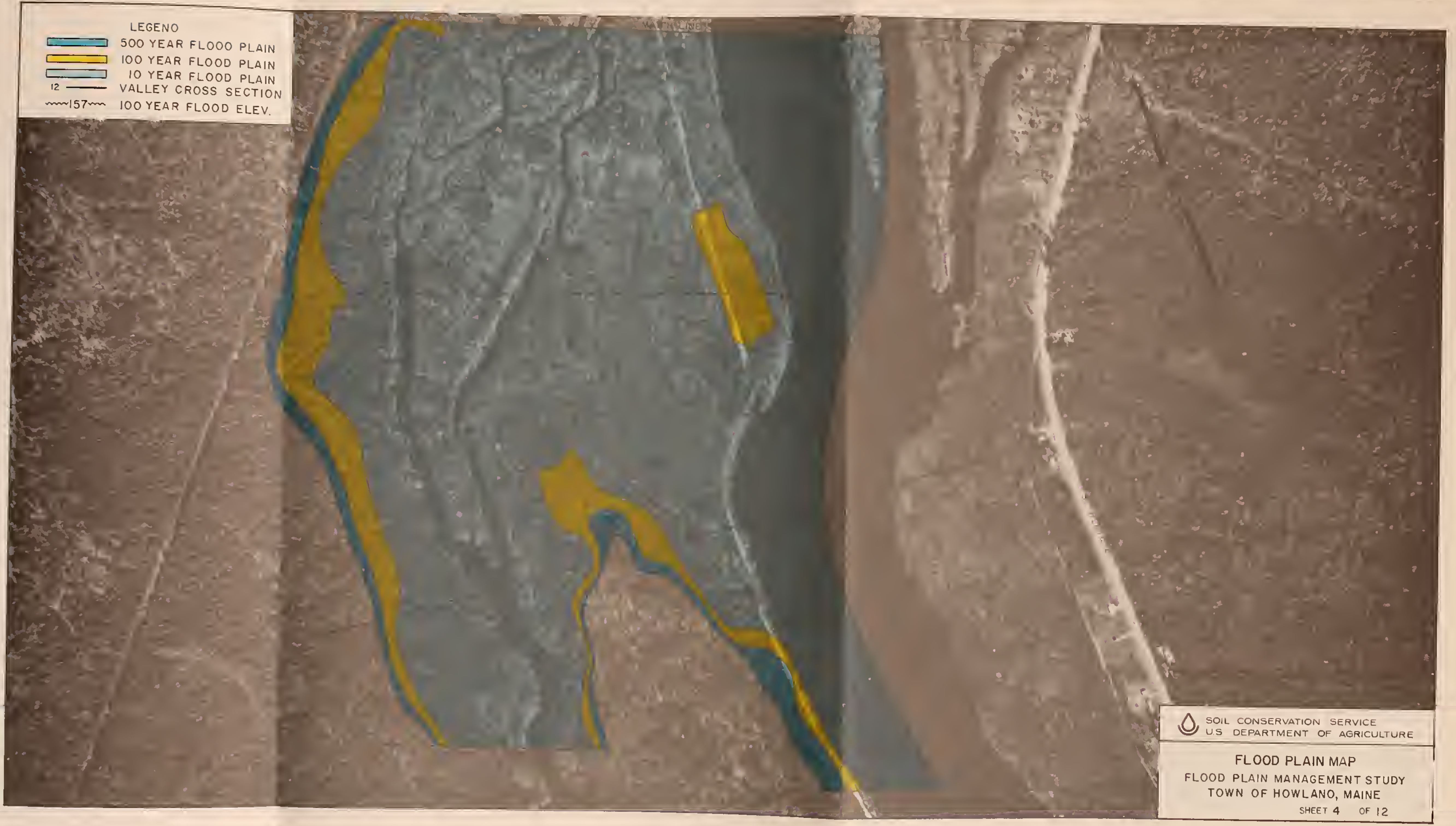
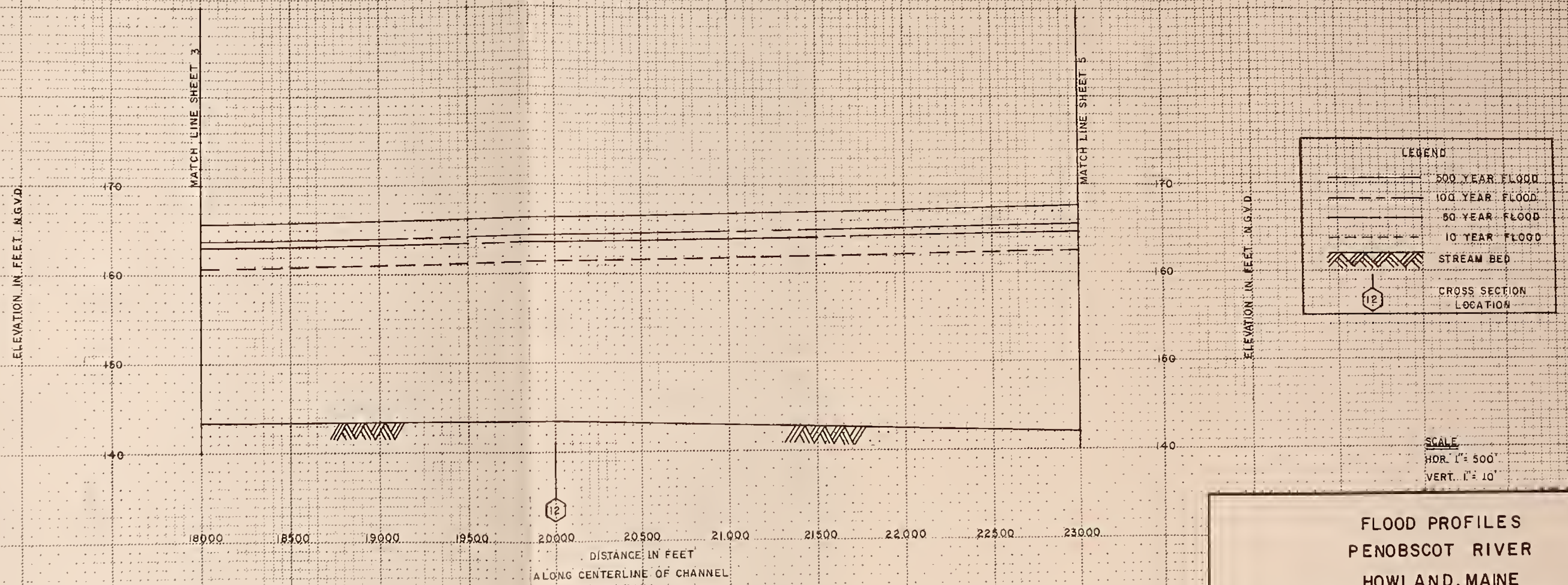

LEGENO
500 YEAR FLOOO PLAIN
100 YEAR FLOOD PLAIN
10 YEAR FLOOD PLAIN
12 VALLEY CROSS SECTION
157 100 YEAR FLOOD ELEV.
SOIL CONSERVATION SERVICE
US DEPARTMENT OF AGRICULTURE
FLOOD PLAIN MAP
FLOOD PLAIN MANAGEMENT STUDY
TOWN OF HOWLANO, MAINE
SHEET 4 OF 12



NOTE: CHANNEL BOTTOM AND FLOOD LINES ARE STRAIGHT LINE APPROXIMATIONS BETWEEN SURVEYED CROSS SECTIONS.

FLOOD PROFILES
PENOBSCOT RIVER
HOWLAND, MAINE

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

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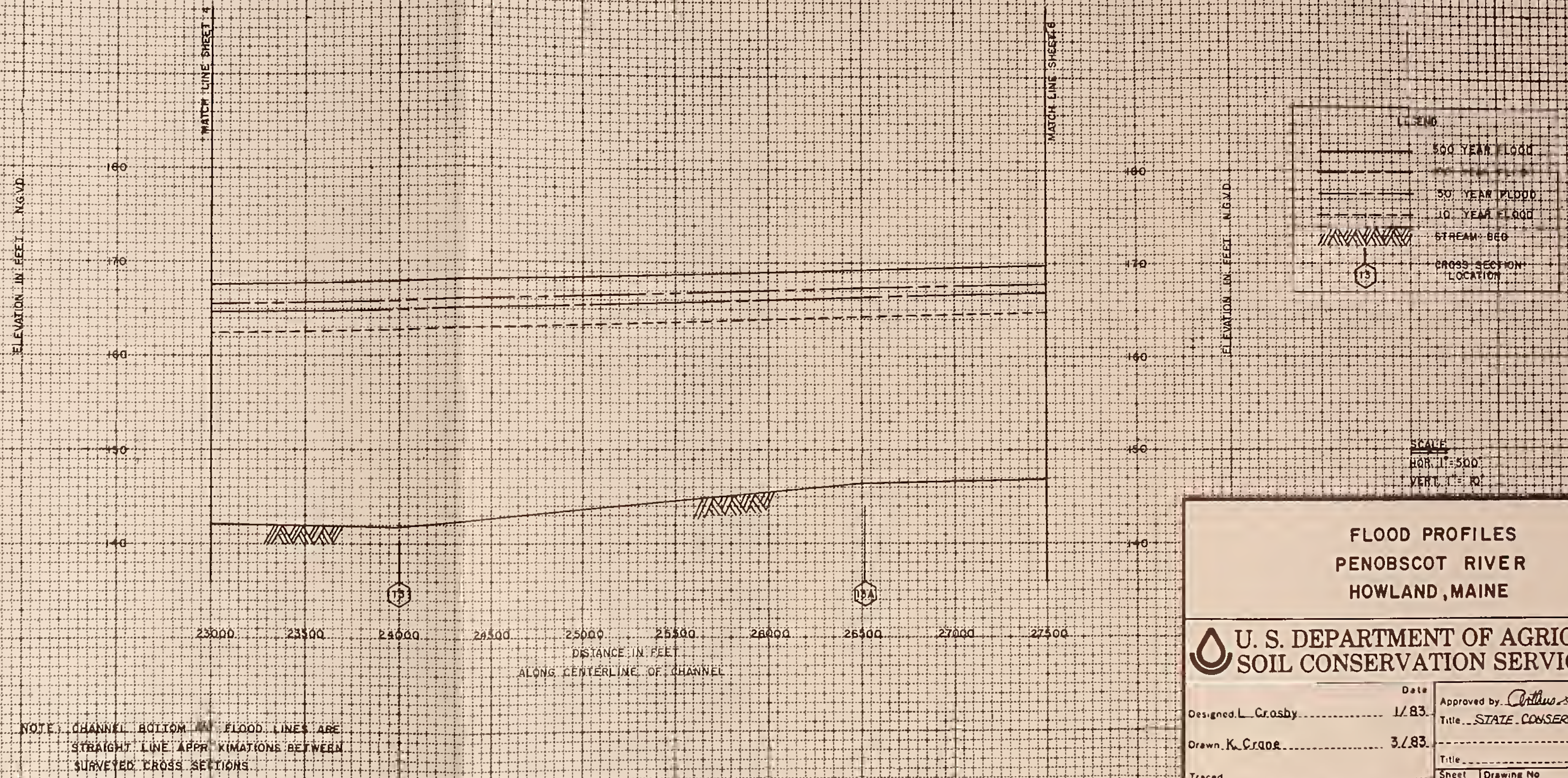
Drawn S. Dymond	3/83	Title
Traced		Sheet No. 4 of 12 — Drawing No.
Checked J. Bertolaccini	4/83	


LEGEND
500 YEAR FLOOD PLAIN
100 YEAR FLOOD PLAIN
10 YEAR FLOOD PLAIN
13 VALLEY CROSS SECTION
157 100 YEAR FLOOD ELEV.
U.S. ROUTE 2
13
SOIL CONSERVATION SERVICE
U S DEPARTMENT OF AGRICULTURE
FLOOD PLAIN MAP
FLOOD PLAIN MANAGEMENT STUDY
TOWN OF HOWLAND, MAINE
SHEET 5 OF 12



FLOOD PROFILES
PENOBSCOT RIVER
HOWLAND, MAINE

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

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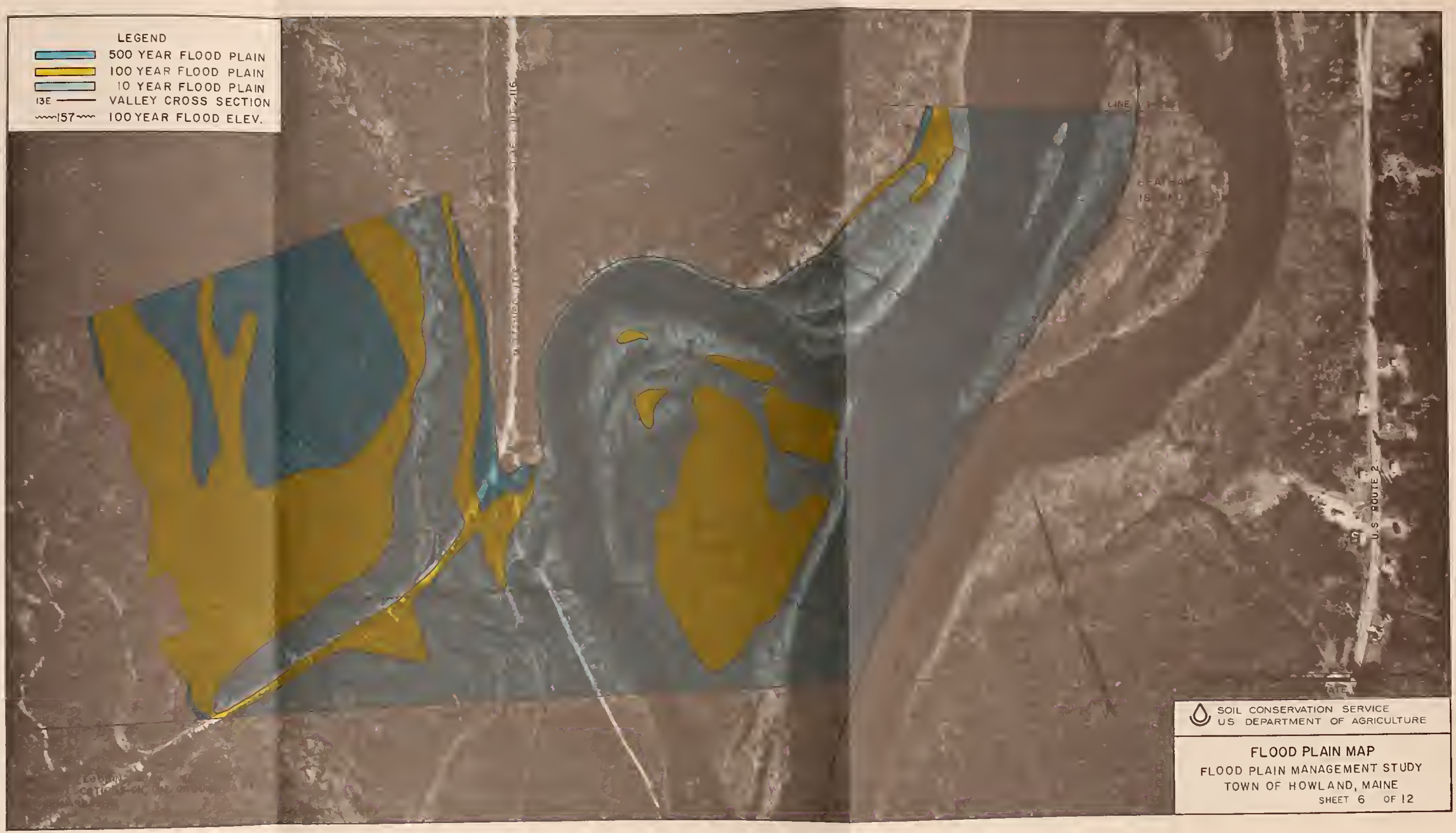
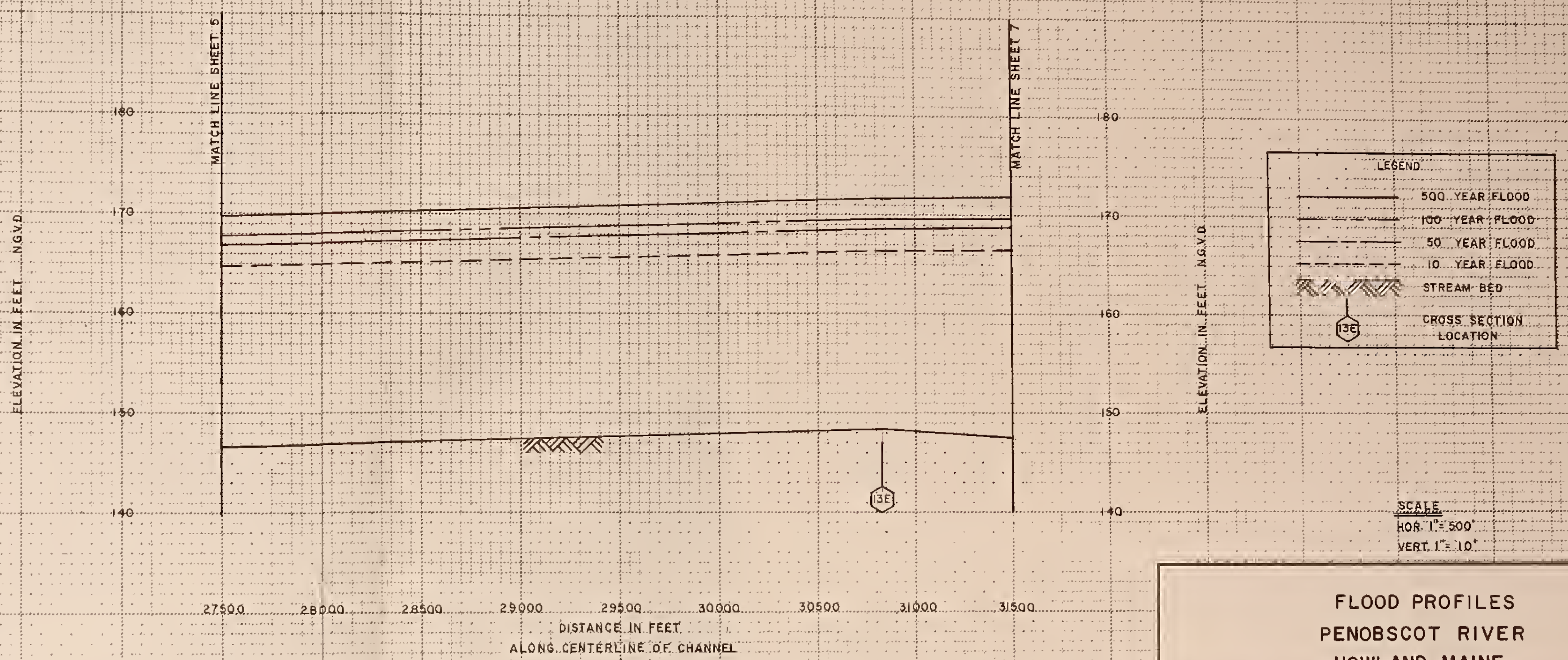

LEGEND
500 YEAR FLOOD PLAIN
100 YEAR FLOOD PLAIN
10 YEAR FLOOD PLAIN
13E VALLEY CROSS SECTION
157 100 YEAR FLOOD ELEV.
U.S. ROUTE 2
SOIL CONSERVATION SERVICE
US DEPARTMENT OF AGRICULTURE
FLOOD PLAIN MAP
FLOOD PLAIN MANAGEMENT STUDY
TOWN OF HOWLAND, MAINE
SHEET 6 OF 12



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FLOOD PROFILES
PENOBSCOT RIVER
HOWLAND, MAINE

U. S. DEPARTMENT OF AGRICULTURE
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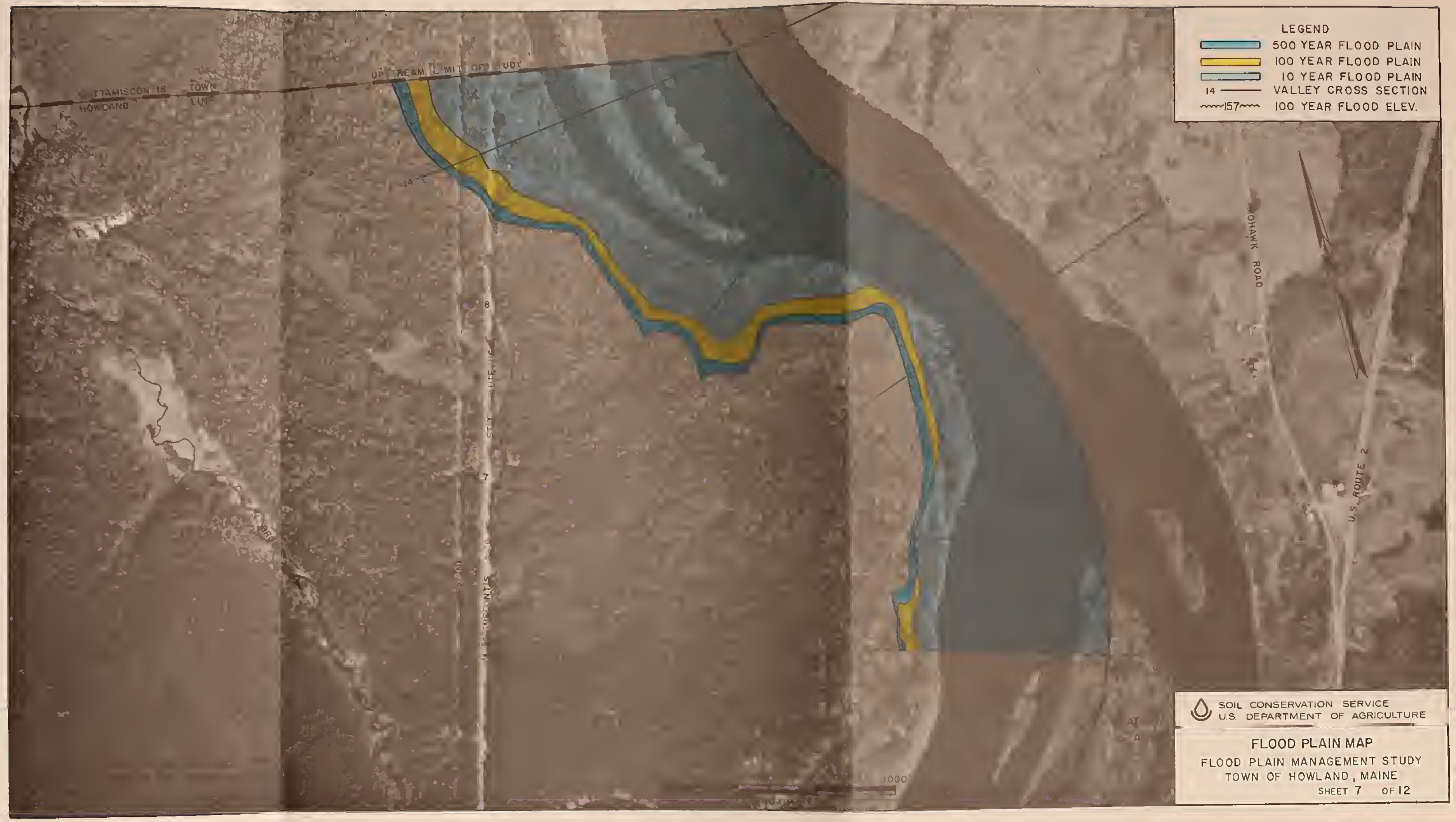
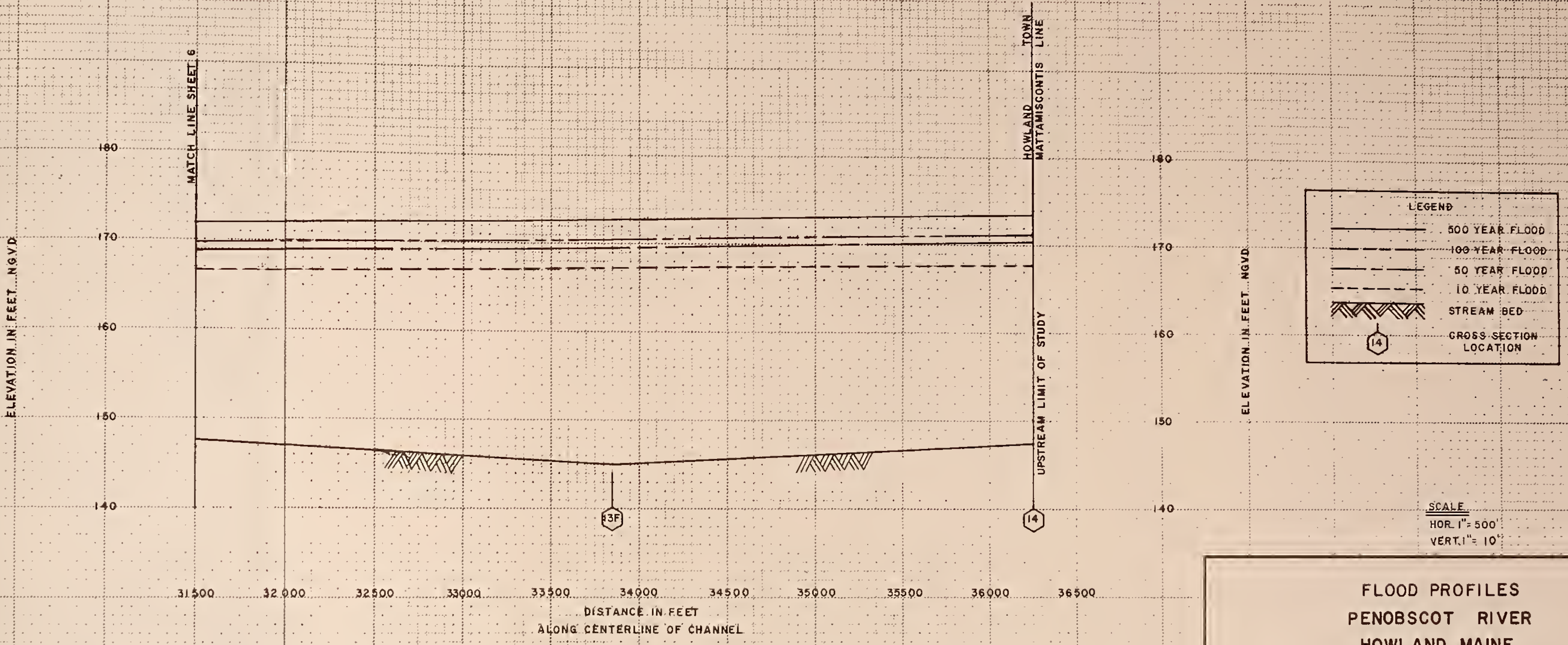

LEGEND
500 YEAR FLOOD PLAIN
100 YEAR FLOOD PLAIN
10 YEAR FLOOD PLAIN
14 VALLEY CROSS SECTION
157 100 YEAR FLOOD ELEV.
HOWLAND
14
8
7
MOHAWK ROAD
U.S. ROUTE 2
1000'
SOIL CONSERVATION SERVICE
U.S. DEPARTMENT OF AGRICULTURE
FLOOD PLAIN MAP
FLOOD PLAIN MANAGEMENT STUDY
TOWN OF HOWLAND, MAINE
SHEET 7 OF 12



NOTE: CHANNEL BOTTOM AND FLOOD LINES ARE STRAIGHT LINE APPROXIMATIONS BETWEEN SURVEYED CROSS SECTIONS.

FLOOD PROFILES
PENOBSCOT RIVER
HOWLAND, MAINE

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

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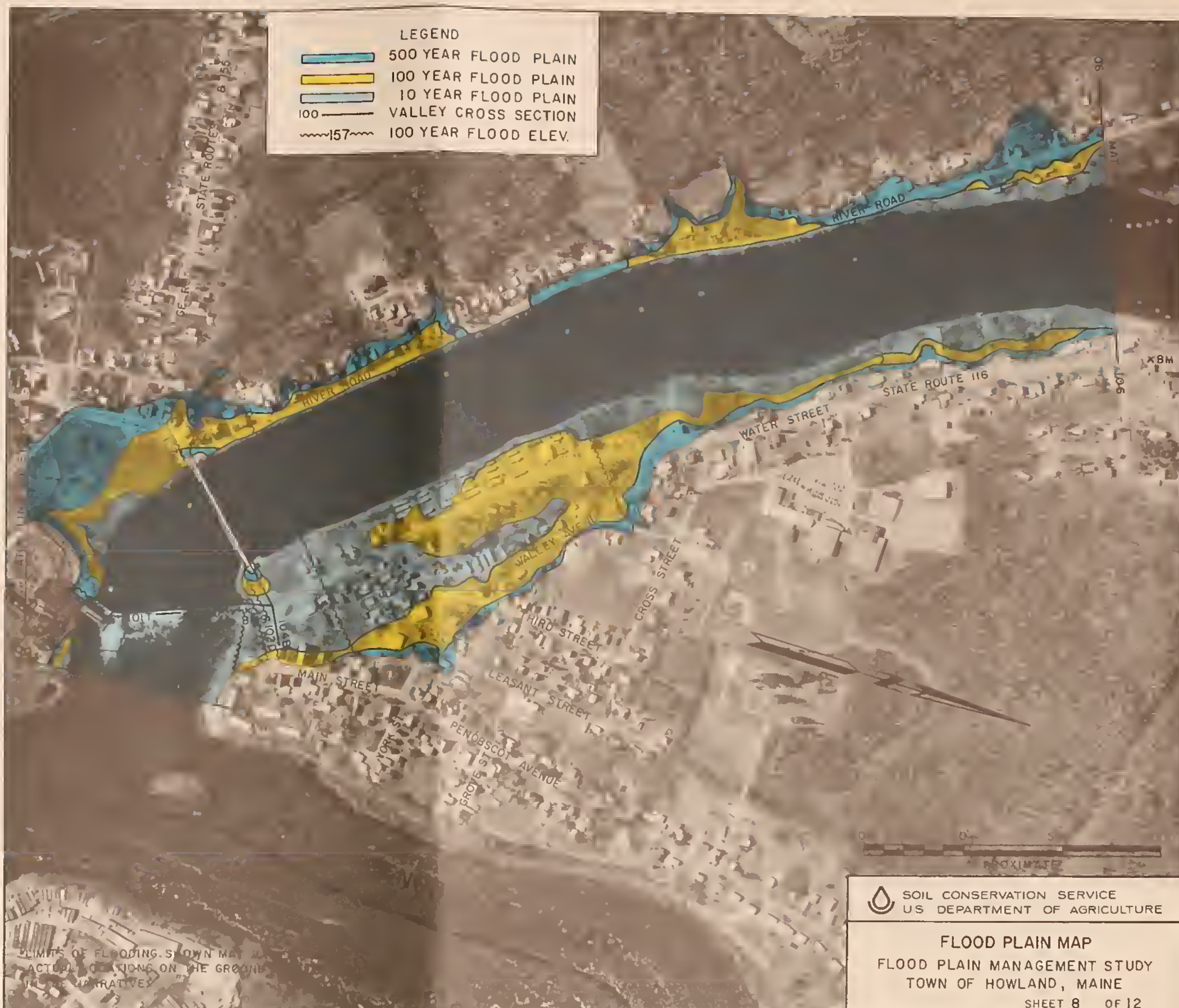
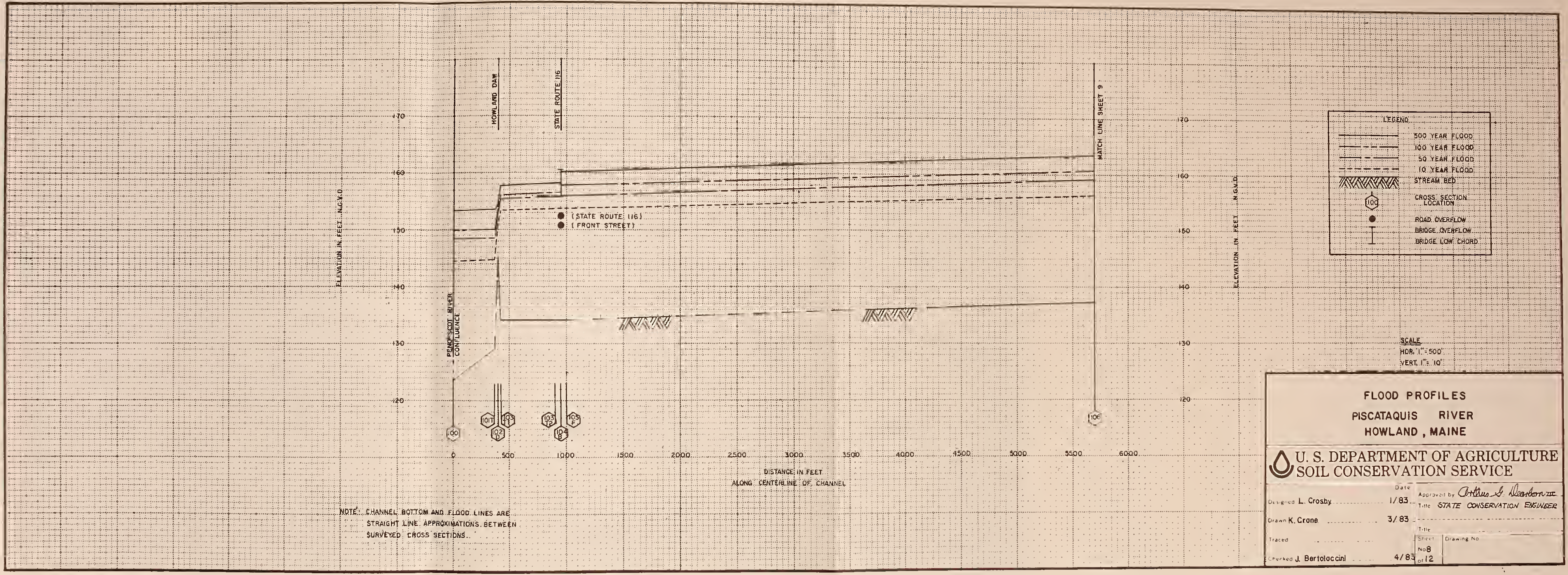
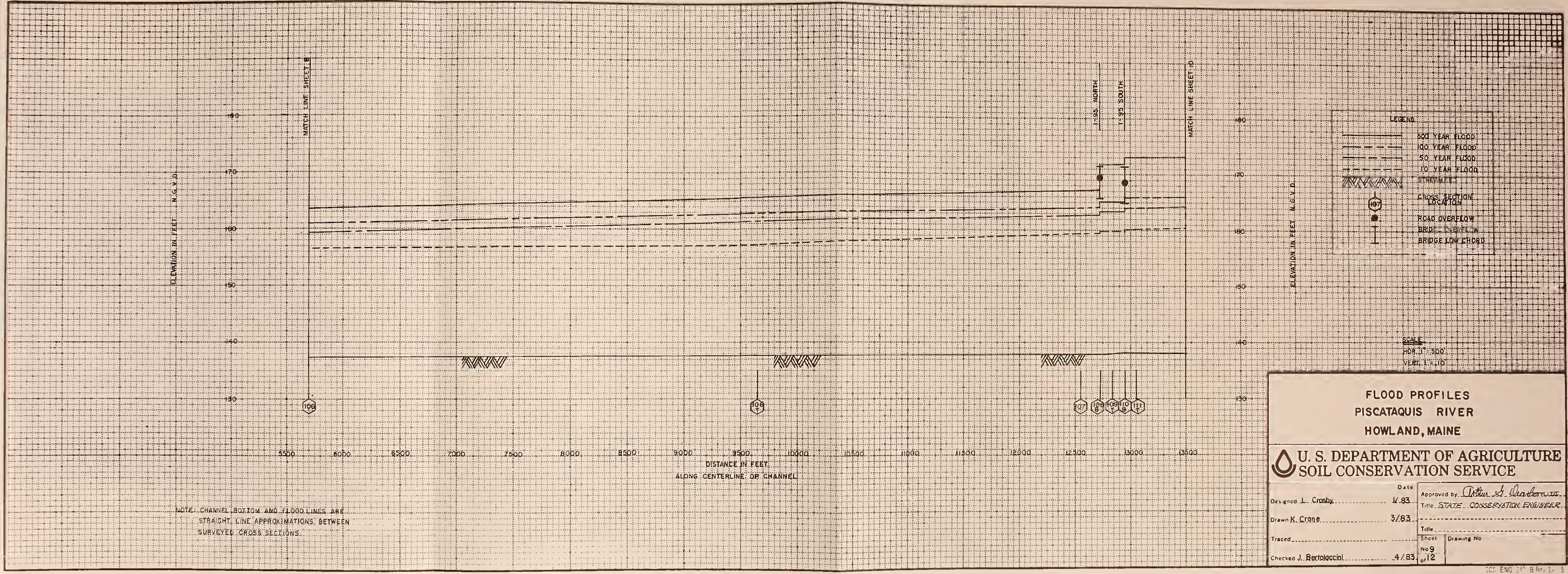
Checked J. Bertolaccini	4/83	Drawing No


LEGEND
500 YEAR FLOOD PLAIN
100 YEAR FLOOD PLAIN
10 YEAR FLOOD PLAIN
100 VALLEY CROSS SECTION
157 100 YEAR FLOOD ELEV.
STATE ROUTE
RIVER ROAD
RIVER ROAD
STATE ROUTE 116
WATER STREET
VALLEY AVE
CROSS STREET
MAIN STREET
PENOBSCOT AVENUE
YORK ST
GROVE ST
XBM
SOIL CONSERVATION SERVICE
US DEPARTMENT OF AGRICULTURE
FLOOD PLAIN MAP
FLOOD PLAIN MANAGEMENT STUDY
TOWN OF HOWLAND, MAINE
SHEET 8 OF 12



HOWLARD DAM
STATE ROUTE 116
MATCH LINE SHEET 9
ELEVATION IN FEET N.G.V.D.
PENOBSCOT RIVER CONFLUENCE
(STATE ROUTE 116)
(FRONT STREET)
170
160
150
140
130
120
0
500
1000
1500
2000
2500
3000
3500
4000
4500
5000
5500
6000
DISTANCE IN FEET
ALONG CENTERLINE OF CHANNEL
NOTE: CHANNEL BOTTOM AND FLOOD LINES ARE STRAIGHT LINE APPROXIMATIONS BETWEEN SURVEYED CROSS SECTIONS.
LEGEND
500 YEAR FLOOD
100 YEAR FLOOD
50 YEAR FLOOD
10 YEAR FLOOD
STREAM BED
CROSS SECTION LOCATION
ROAD OVERFLOW
BRIDGE OVERFLOW
BRIDGE LOW CHORD
SCALE
HOR. 1" = 500'
VERT. 1" = 10'
FLOOD PROFILES
PISCATAQUIS RIVER
HOWLAND, MAINE
U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
Designed L. Crosby 1/83
Drawn K. Crone 3/83
Traced
Checked J. Bertoloccini 4/83
Approved by Arthur G. Dearborn III
Title STATE CONSERVATION ENGINEER
Sheet No 8 of 12
Drawing No

LEGEND
500 YEAR FLOOD PLAIN
100 YEAR FLOOD PLAIN
10 YEAR FLOOD PLAIN
107 VALLEY CROSS SECTION
157 100 YEAR FLOOD ELEV.
SOIL CONSERVATION SERVICE
U.S. DEPARTMENT OF AGRICULTURE
FLOOD PLAIN MAP
FLOOD PLAIN MANAGEMENT STUDY
TOWN OF HOWLAND, MAINE
SHEET 9 OF 12
INTERSTATE 95 SOUTHBOUND
INTERSTATE 95 NORTHBOUND
RIVER ROAD
107
110
106
BM
BM 12
163



FLOOD PROFILES
PISCATAQUIS RIVER
HOWLAND, MAINE

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

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Designed L. Crosby	1/83	Approved by Arthur G. Dearborn III
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Drawn K. Crone	3/83	Title
Traced		Sheet No 9 of 12 — Drawing No
Checked J. Bertolaccini	4/83	

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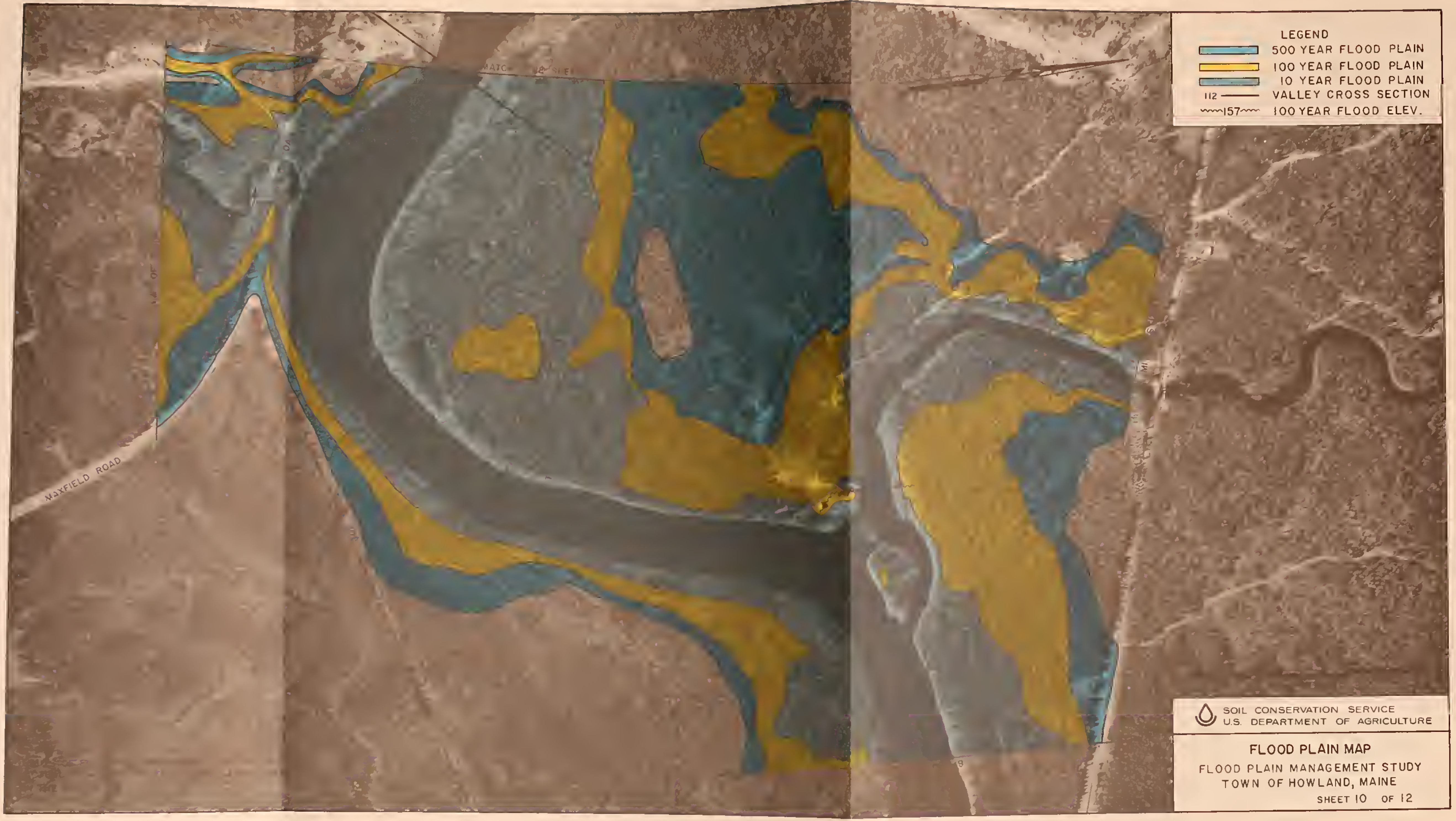
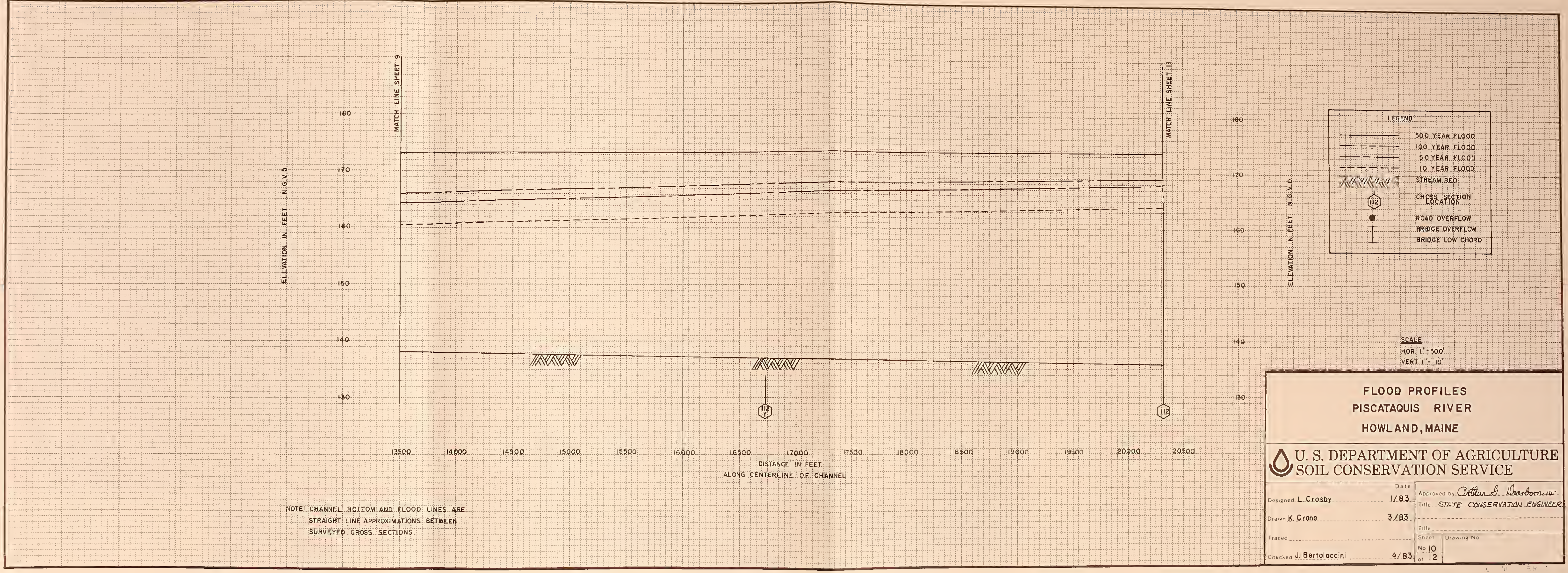

LEGEND
500 YEAR FLOOD PLAIN
100 YEAR FLOOD PLAIN
10 YEAR FLOOD PLAIN
112 VALLEY CROSS SECTION
157 100 YEAR FLOOD ELEV.
MAXFIELD ROAD
SOIL CONSERVATION SERVICE
U.S. DEPARTMENT OF AGRICULTURE
FLOOD PLAIN MAP
FLOOD PLAIN MANAGEMENT STUDY
TOWN OF HOWLAND, MAINE
SHEET 10 OF 12



FLOOD PROFILES
PISCATAQUIS RIVER
HOWLAND, MAINE

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

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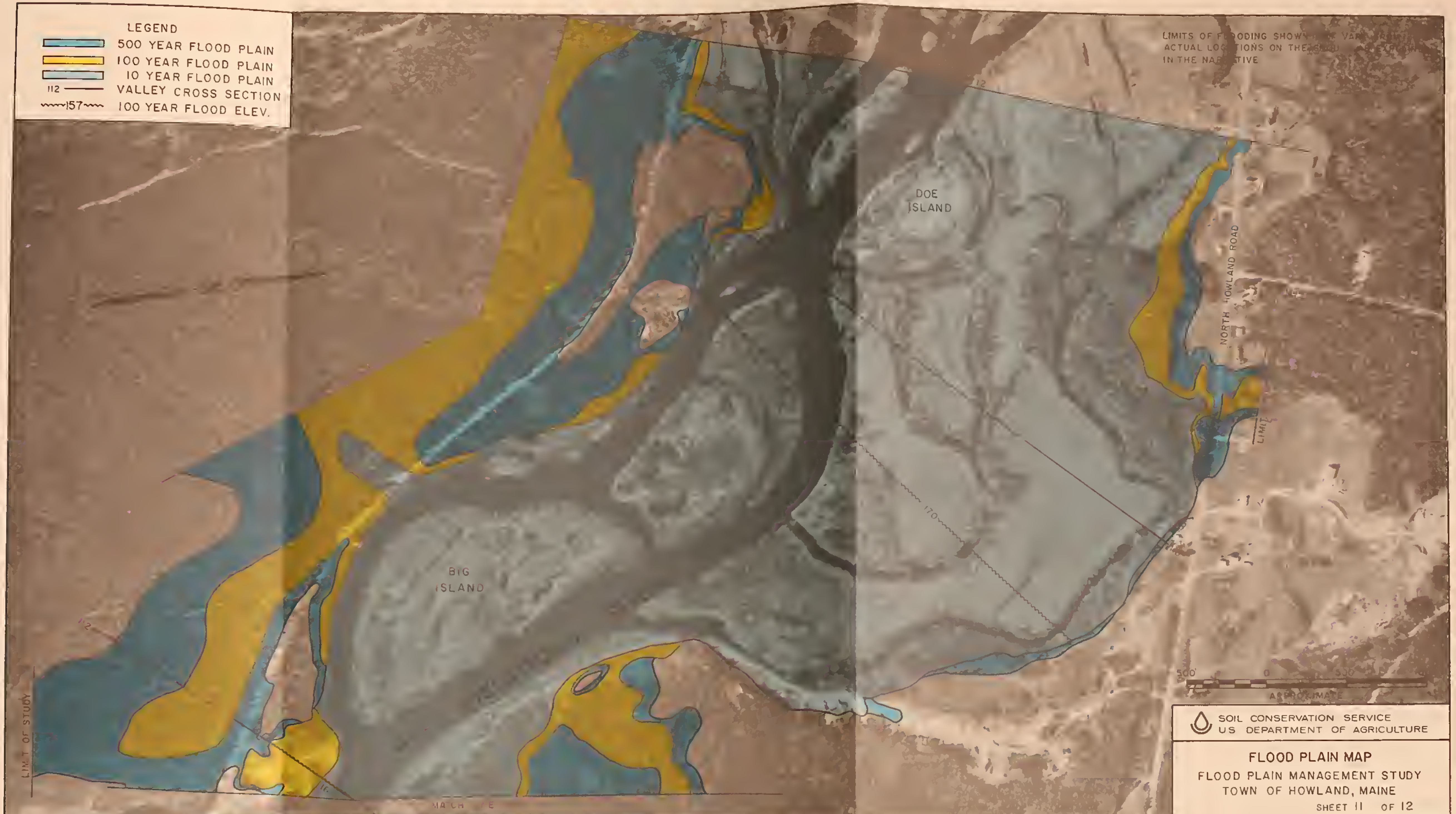
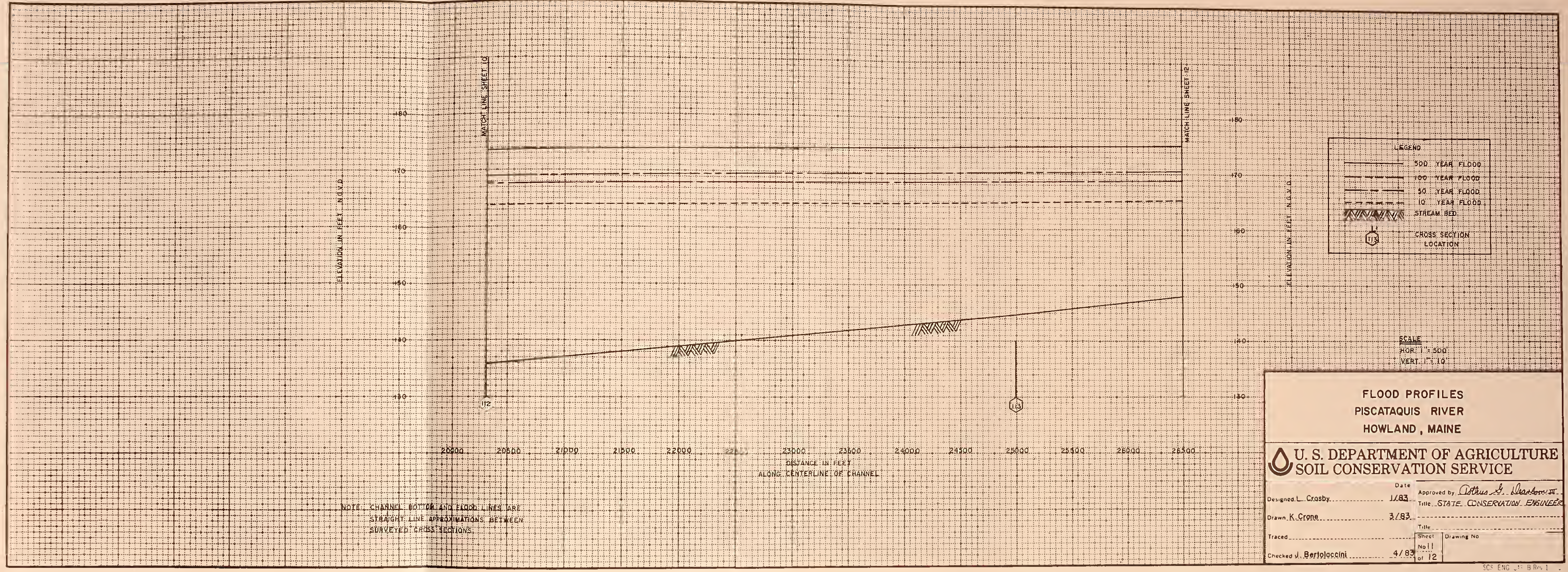
Drawn K. Crone	3/83	Title
Traced		Sheet No. 10 of 12 / Drawing No.
Checked J. Bertoloccini	4/83	


LEGEND
500 YEAR FLOOD PLAIN
100 YEAR FLOOD PLAIN
10 YEAR FLOOD PLAIN
112 VALLEY CROSS SECTION
157 100 YEAR FLOOD ELEV.
DOE ISLAND
BIG ISLAND
NORTH HOWLAND ROAD
LIMIT OF STUDY
170
SOIL CONSERVATION SERVICE
US DEPARTMENT OF AGRICULTURE
FLOOD PLAIN MAP
FLOOD PLAIN MANAGEMENT STUDY
TOWN OF HOWLAND, MAINE
SHEET 11 OF 12



FLOOD PROFILES
PISCATAQUIS RIVER
HOWLAND, MAINE

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

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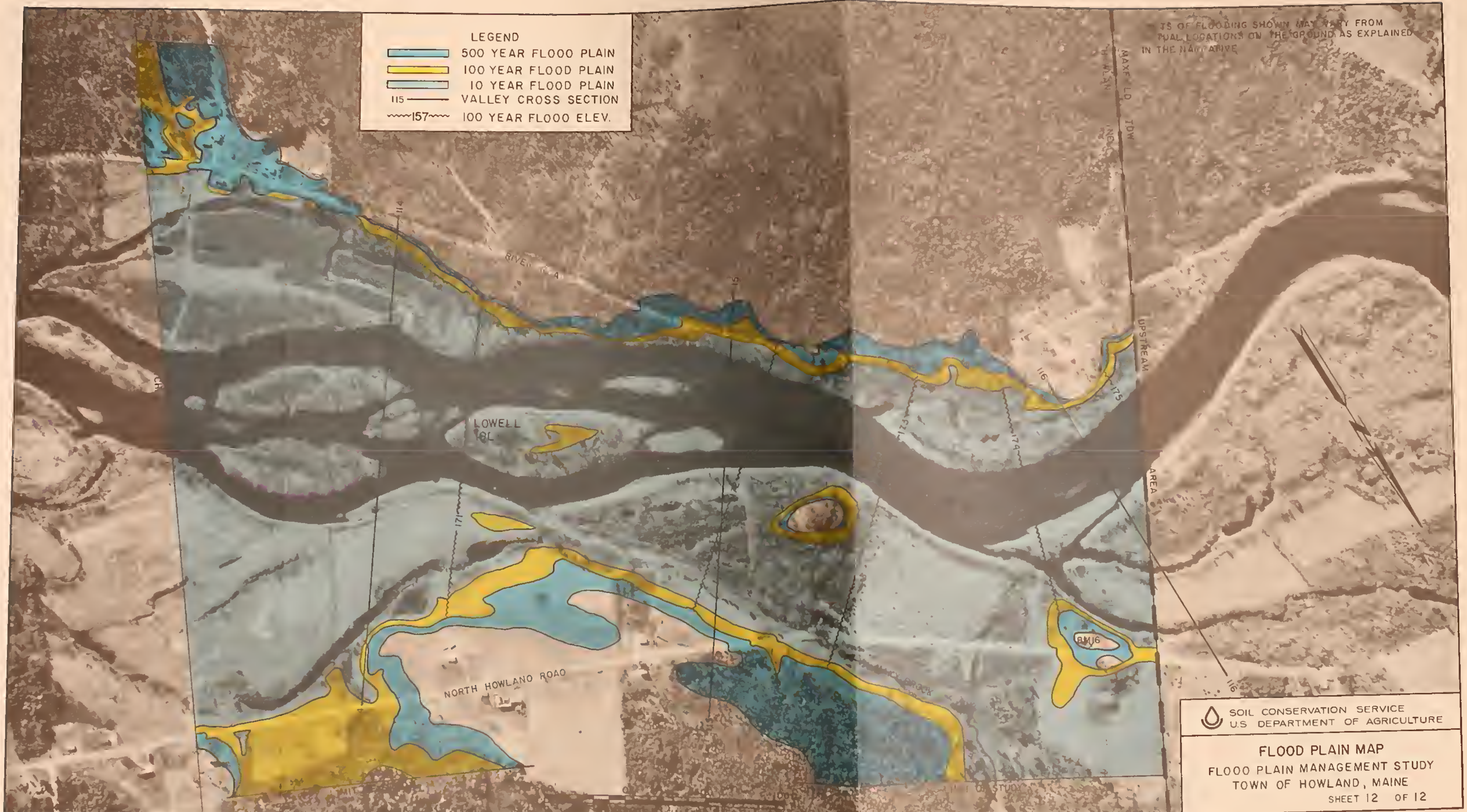
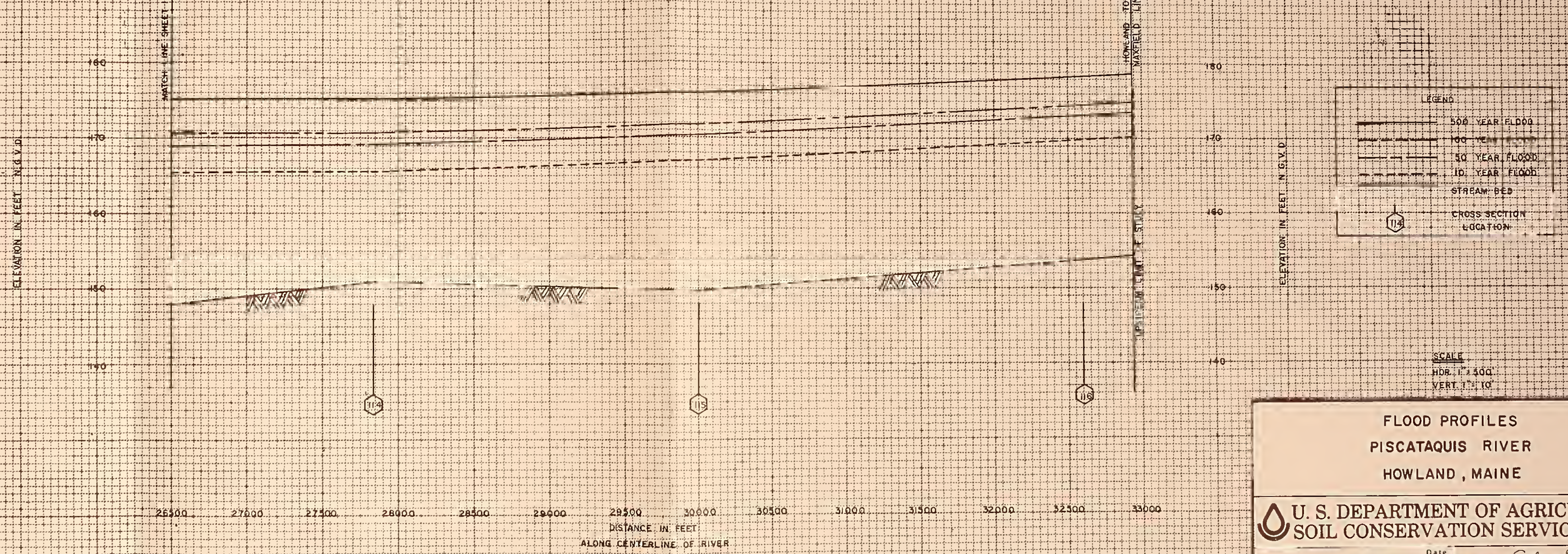
Traced		Title
Checked J. Bertoloccini	4/83	Sheet No. 11 of 12 · Drawing No.

SCS ENG 313 B Rev. 1


LEGEND
500 YEAR FLOOD PLAIN
100 YEAR FLOOD PLAIN
10 YEAR FLOOD PLAIN
115 VALLEY CROSS SECTION
157 100 YEAR FLOOD ELEV.
LOWELL ISL.
NORTH HOWLAND ROAD
UPSTREAM AREA
SOIL CONSERVATION SERVICE
U.S. DEPARTMENT OF AGRICULTURE
FLOOD PLAIN MAP
FLOOD PLAIN MANAGEMENT STUDY
TOWN OF HOWLAND, MAINE
SHEET 12 OF 12



NOTE: CHANNEL BOTTOM AND FLOOD LINES ARE STRAIGHT LINE APPROXIMATIONS BETWEEN SURVEYED CROSS SECTIONS

FLOOD PROFILES
PISCATAQUIS RIVER
HOWLAND, MAINE

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

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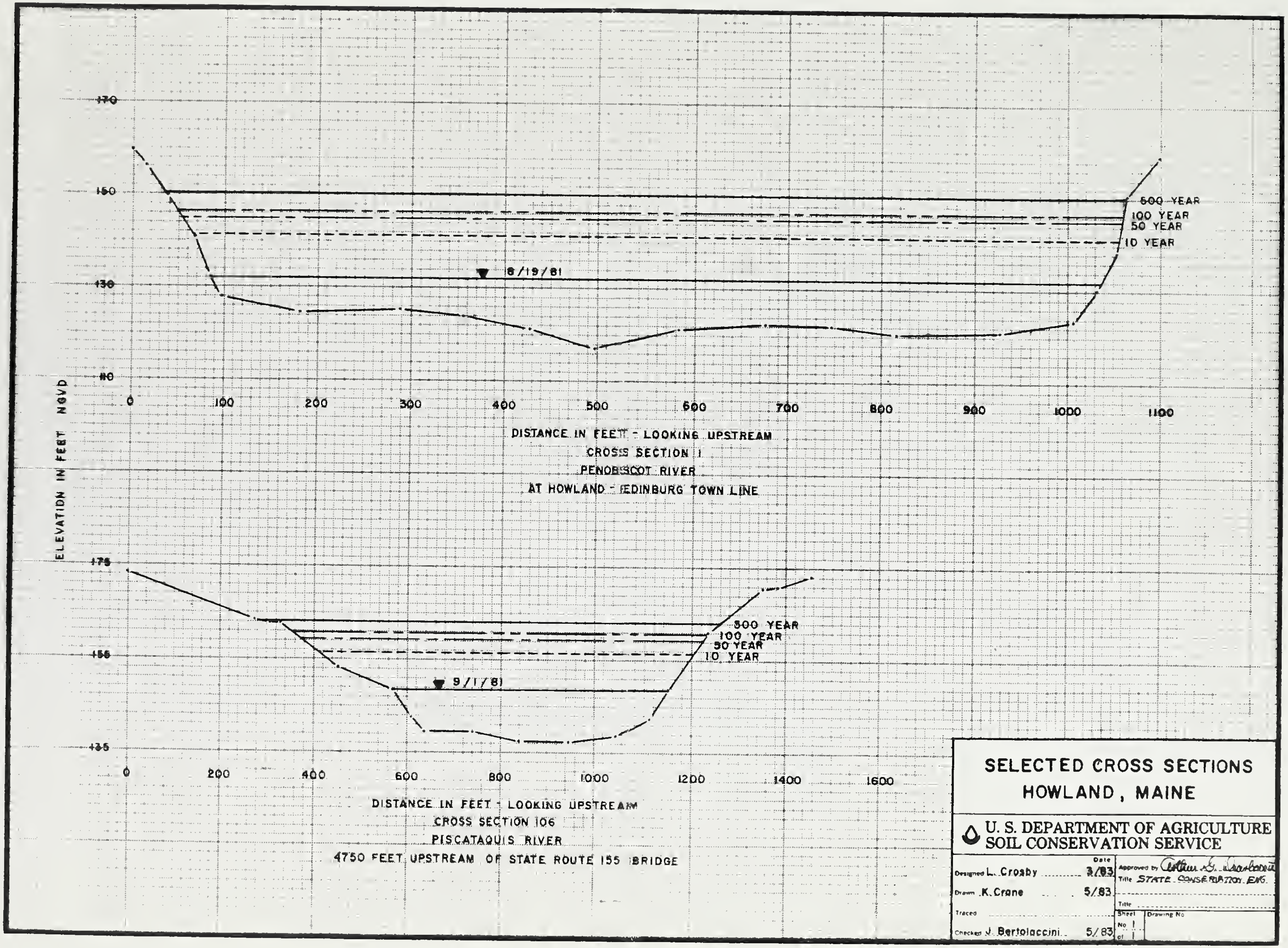

ELEVATION IN FEET NGVD
170
150
130
110
0
100
200
300
400
500
600
700
800
900
1000
1100
500 YEAR
100 YEAR
50 YEAR
10 YEAR
8/19/81
DISTANCE IN FEET - LOOKING UPSTREAM
CROSS SECTION 1
PENOBSCOT RIVER
AT HOWLAND - EDINBURG TOWN LINE
175
155
135
0
200
400
600
800
1000
1200
1400
1600
500 YEAR
100 YEAR
50 YEAR
10 YEAR
9/1/81
DISTANCE IN FEET - LOOKING UPSTREAM
CROSS SECTION 106
PISCATAQUIS RIVER
4750 FEET UPSTREAM OF STATE ROUTE 155 BRIDGE
SELECTED CROSS SECTIONS
HOWLAND, MAINE
U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
Designed L. Crosby
Date 3/83
Drawn K. Crane 5/83
Traced
Checked J. Bertolaccini 5/83
Approved by
Title STATE CONSERVATION. ENG.
Title
Sheet No. 1 of 1
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APPENDIX

Investigations and Analyses

Topographic data were obtained from surveyed and/or stereoplotted valley and bridge cross sections and 1" = 500' stereoplotted topographic maps with a 2-foot contour interval. Elevations are based upon National Geodetic Vertical Datum, 1929 (NGVD). Elevation bench marks that were used for this study are described in the Appendix and located on the Flood Plain Map Index and Flood Plain Maps.

Flood flows for various frequencies were determined from Log Pearson Type III analyses of four U.S.G.S. stream gages: #01030000 on the Penobscot River near Mattawamkeag - 42 years of record; #01030500 on the Mattawamkeag River near Mattawamkeag - 48 years of record; #01034000 on the Piscataquis River at Medford - 58 years of record; and #01034500 on the Penobscot River at West Enfield - 81 years of record. Discharge data within the study area were interpolated and extrapolated from the above gages using the equation:

$$Q_s = Q_g \left(\frac{A_s}{A_g}\right)^a$$

where Q_s is the peak discharge at the site, Q_g the peak discharge at the gage, A_s the drainage at the site, A_g the drainage area at the gage, and the exponent a equals 0.80.

A table of selected discharges is located on page A-4.

Water surface profiles were developed using the SCS WSP2 computer program (6). The profiles were started from an average water surface slope approximately 3,000 feet downstream of the study area on the Penobscot River in Edinburg, Maine. Flood profiles were drawn showing computed water surface elevations to an accuracy of 0.5 foot for floods of the selected recurrence intervals. Elevations were checked against historic data provided by U.S.G.S., Bangor Hydro-Electric Company, Maine Department of Transportation, and others.

The hydraulic analyses for this study are based on the effects of unobstructed flow. The flood elevations shown on the profiles are valid only if the hydraulic structures remain unobstructed and dams and other flood control structures operate properly and do not fail. It was assumed that the flashboards on both the Stanford and Howland Dams had failed for this analysis.

The boundaries of the 10-year, 100-year and 500-year floods as shown on the maps were delineated from flood elevations determined at each cross section; between cross sections, the boundaries were interpolated from stereoplotted topographic maps with a 2-foot contour interval.

Flooding caused by backwater from the Penobscot or Piscataquis River has also been delineated on the Flood Plain Maps for Emerson Runaround, Merrill Brook and Runaround, the lower portions of Gordon, Maxy and Meadow Brooks, and the lower portion of Seboeis Stream.

On September 7, 1983, a preliminary meeting was held with town officials to review a draft of the report and to solicit comments.

Field survey information, engineering computations, and other data pertinent to the study are on file with the Soil Conservation Service, USDA Office Building, University of Maine, Orono, Maine 04473, telephone (207) 866-2132.

SELECTED FLOOD DISCHARGES

Cross Section No.	Location	Drainage Area (Mi^2)	Flood Discharges (CFS)			
			10-Year	50-Year	100-Year	500-Year
PENOBSCOT RIVER						
4B	State Route 155	6671.00	93,400	133,300	148,800	186,800
10D	Stanford Dam	5217.05	64,000	86,500	96,500	121,000
14	Howland/Mattamiscontis town line	5199.41	63,800	86,300	96,200	120,700
PISCATAQUIS RIVER						
104B	State Route 116	1452.93	45,400	65,500	74,800	98,100
116	Howland/Maxfield town line	1267.79	40,700	58,700	67,000	88,000

BRIDGE DATA

Cross Section No.	Location	Channel Bottom Elevations	Low Chord Elevations	Road Overflow Elevations	Flood Elevations			
					10-Year	50-Year	100-Year	500-Year
PENOBSCOT RIVER								
4B	State Route 155	122.7	153.7	154.0	144.5	148.4	149.9	153.4
PICATAQUIS RIVER								
104B	State Route 116	134.2	155.9	150.7	153.8	156.0	157.8	160.1
108B	Interstate 95 N.B.	137.9	165.7	169.5	159.8	163.3	165.1	171.8
110B	Interstate 95 S.B.	138.2	164.8	168.8	160.1	164.0	165.9	173.1

Elevations refer to feet NGVD 1929, at upstream end of bridge opening.

Bench Mark Descriptions

1. C and GS BM, Elev. 178.290

   Howland; on State Route 116, 1.2 miles south of the west end of the Penobscot River bridge at Howland, 0.15 miles north of the Edinburg town line, in light woods 98 feet west of centerline of road, on top of 8 by 6 foot boulder, about 2 feet above road level; standard tablet stamped "Y 133 1958".

2. C and GS BM, Elev. 148.504

   Howland; 0.15 miles west along road from Penobscot River bridge in Howland 43 feet north of Terrio Street centerline, 90 yards south of State Route 155 centerline, on top of 3 by 5 foot section of exposed bedrock, level with road; standard tablet stamped "A 134 1958".

3. C and GS BM, Elev. 167.014

   West Enfield; on top of the southeast end of the wingwall at the northeast corner of the Penobscot River bridge, 20 feet north of the centerline of State Route 155, 5 feet northeast of the east end of steel bridge girder, about 1 foot below road level; standard tablet stamped "Y 83 RESET 1947".

4. SCS BM, Elev. 163.62

   West Enfield; at Stanford Dam on Penobscot River, at east end of dam, on top of northwest corner of granite wall leading to gatehouse; chiseled square.

5. USGS BM, Elev. 172.747

Howland; 3 miles northeast of Howland, 1,000 feet west of Penobscot River, 300 feet north of woods road crossing of small stream, 100 feet west of road in overgrown field, on granite boulder; standard tablet stamped "TT 87 K 1930".

6. C and GS BM, Elev. 172.687

Howland; 4.2 miles north along State Route 116 from the north end of the Piscataquis River bridge at Howland, 33 feet south of the centerline of the road, 2 feet above level of road, set in top of projecting concrete post; standard tablet stamped "E 136 1959".

7. C and GS BM, Elev. 188.602

Howland; 5.4 miles north along State Route 116 from the north end of the Piscataquis River bridge at Howland, near the northwest edge of cleared pipeline right-of-way, 186 feet northwest of the centerline of State Route 116, 19 feet southwest of the center-line of woods road, about level with woods road, set in top of projecting concrete post; standard tablet stamped "GORDEN 1958".

8. C and GS BM, Elev. 193.385

Howland; 5.6 miles north along State Route 116 from the north end of the Piscataquis River bridge at Howland, near the southwest edge of cleared pipeline right-of-way, 168 feet northwest of the centerline of State Route 116, 12 feet southwest of the center-line of woods road, about 1 foot above level of road, set in top of projecting concrete post; standard tablet stamped "GORDEN 1958", (AZI).

9. SCS BM, Elev. 150.53

Howland; at Howland, at north end of Howland Dam on Piscataquis River, on top of southeast corner of concrete abutment of Howland Dam, 25 feet downstream from crest of dam; chiseled square.

10. USGS BM, Elev. 161.315

Howland; on top of east end of north concrete abutment of State Route 116 bridge over Piscataquis River, 19 feet east of centerline of road, about 1 foot above bridge deck; standard tablet stamped "1 1940", (USGS).

11. C and GS BM, Elev. 173.937

Howland; 0.9 miles north along State Route 116 from the north end of the Piscataquis River bridge at Howland, 26 feet northeast of the centerline of the road, 3 feet north of power pole No. 31.1, 3 feet above level of road, set in top of projecting concrete post; standard tablet stamped "RIVER NO 2 1958".

12. C and GS BM, Elev. 170.393

Howland; 1.1 miles north along State Route 116 from the north end of the Piscataquis River bridge at Howland, 0.2 miles southeast of large sawmill, 24 feet east of centerline of road, 44 feet northeast of centerline of driveway leading west, 1 foot above level of road, set in top of projecting concrete post; standard tablet stamped "D 136 1959".

13. C and GS BM, Elev. 166.424

Howland; 2.0 miles north along State Route 116 from the north end of the Piscataquis River bridge at Howland, 0.2 miles southeast of "Y" junction of State Route 116 and road to Maxfield, 28 feet southwest of centerline of road, 1 foot below road level, set in top of projecting concrete post; standard tablet stamped "PISCAT 1958", (AZI).

14. USGS BM, Elev. 170.068

Howland; 2.9 miles northwest of, at bridge (built 1981) over Seboeis Stream, in south end of west abutment, 17 feet south of centerline of road; standard tablet stamped "2 S 1940" Reset 1981.

15. USGS BM, Elev. 197.30

Howland; 4.5 miles northwest of, 240 feet northeast on Seboeis Road, 15 feet southeast of road, in large granite boulder; standard tablet stamped "4 WA 1931".

16. NGS BM, Elev. 178.629

Howland; 5.7 miles northwest of a long road on north side of Piscataquis River, about 450 feet south of Maxfield town line, about 25 feet south of centerline of road, about 30 feet east of centerline of driveway southwest, encased in PVC pipe; standard tablet stamped "W 183 1978".

Glossary

Acquisition - Purchasing flood prone properties for the specific purpose of reducing flood damage by changing land use.

Bench Mark - A point of known elevation based on National Geodetic Vertical Datum (NGVD) that can be used to determine elevations at other desired locations in the area of concern.

C.F.S. - Cubic feet per second. Used to describe the amount of flow passing a given point in a stream channel. One cubic foot per second is equivalent to approximately 7.5 gallons per second.

Channel - A natural or artificial watercourse with definite bed and banks to confine and conduct flowing water.

Critical Area Treatment - The application of vegetative and mechancial practices used to reduce runoff and erosion. Practices normally consist of seeding, tree planting, grass waterways, diversions, gully stabilizations, etc.

Cross Sections - A graph or plot of ground elevation across a stream valley or a portion of it, usually along a line perpendicular to the stream or direction of flow.

Environmental Corridor - A strip of land, usually along one or both sides of a stream, which is set aside, regulated, or otherwise protected to preserve its environmental values.

Erosion - The group of processes whereby soil or rock material is loosened or dissolved and removed from any part of the earth's surface.

Flood - An overflow or inundation onto land areas not normally covered by water that are used or usable by people. Floods are usually characterized as temporarily inundating land areas which are adjacent to a body of water such as an ocean, lake, stream or river.

Flood Crest - The maximum stage or elevation reached by the waters of a flood at any location.

Flood Peak - The maximum instantaneous discharge of a flood at a given location usually occurring at the flood crest.

Flood Plain - The relatively flat area or lowlands adjoining the channel of a river, stream, or watercourse or ocean, lake, or other body of standing water which has been or may be covered by floodwater.

Flood Plain Management - The operation of a program intended to lessen the damaging effects of floods, maintain and enhance natural values, and make effective use of relative water and land resources within the flood plain. It is an attempt to balance values obtainable from use of flood plains with potential losses arising from such use. Flood plain management stresses consideration of the full range of measures potentially useful in achieving its objectives.

Flood Plain Map - A map showing the lateral extent of projected floods.

Flood Profile - A graph which shows the relationship of water surface elevation to distance along the centerline of channel. It is used in this report to show the crest elevations of specific floods.

Floodproofing - A combination of structural changes and adjustments to new or existing structures and facilities, their contents and/or their sites for the purpose of reducing or eliminating flood damages by protecting against structural failure, keeping water out, or reducing the effect of water entry.

Flood Warning - The issuance and dissemination of information about an imminent or current flood.

Floodway - That portion of the main stream channel plus any adjacent flood plain areas that must be kept free of encroachment in order that the 100-year flood can be carried without substantial increases in flood heights.

Frequency - A statistical measure of how often an event of a given size or magnitude should, on the average, be equalled or exceeded.

(a) A 500-year frequency flood is one that is equalled or exceeded, on the average, once in 500 years. It has a 0.2 percent chance of being equalled or exceeded in any given year.

(b) A 100-year frequency flood is one that is equalled or exceeded on the average, once in 100 years. It has a 1 percent chance of being equalled or exceeded in any given year.

(c) A 50-year frequency flood is one that is equalled or exceeded on the average once in 50 years and has a 2 percent chance of being equalled or exceeded in any year.

(d) A 10-year frequency flood is one that is equalled or exceeded, on the average, once in 10 years and has a 10 percent chance of being equalled or exceeded in any year.

Head - The height of water above any plane of reference.

Head Loss - The effect of obstructions, such as narrow bridge openings or buildings, that limit the area through which water must flow, raising the surface of the water upstream from the obstruction.

High Hazard Zone - An area, normally nearest the stream, where flooding may cause a significant risk to loss of life and property. This area is defined by flood velocities higher than 12 feet per second (fps), flood depths greater than 3 feet, or a combination of velocity and depth greater than 7.

Important Farmland -

Prime: Land that has the best combination of physical and chemical characteristics for producing food, feed, fiber, and oilseed crops, and is also available for these uses. This includes: cropland, pastureland, rangeland and forestlands. It does not include urbanized land or water. Land in this category has the soil quality, growing season, and moisture supply needed to produce sustained high yields of crops economically when treated and managed (including water management), according to modern agricultural methods.

Additional Farmland of Statewide Importance: Land, in addition to prime farmland, that is of statewide importance for the production of food, fiber, feed, forage, and oilseed crops. Criteria for defining and delineating these lands are to be determined by the appropriate state agency or agencies. Generally these lands include those that are nearly prime farmland and that can economically produce high yields of crops when treated and managed according to acceptable farming methods. Some may produce as high a yield as prime farmlands if conditions are favorable, and in some states these lands may include tracts of land that have been designated for agriculture by state laws.

Low Chord - The elevation at which the bridge girder first begins to reduce the flow area of the channel.

Low Hazard Zone - The area between the high hazard zone and the maximum extent of the 100-year frequency flood where the potential for loss of life and property damage is low.

Natural Values of Flood Plains - The desirable qualities of, or functions served by, flood plains including, but not limited to: water resources values (e.g., moderation of floods, water quality maintenance and groundwater recharge), living resources values (e.g., fish, wildlife and plant resources and habitat), cultural resources values (e.g., open space, natural beauty, scientific study, outdoor education, and recreation), and cultivated resource values (e.g., agriculture, aquaculture and forestry).

NGVD - National Geodetic Vertical Datum, formerly Mean Sea Level (MSL) 1929.

Nonstructural Measures - All flood plain management measures excepting structural flood control works. Examples of nonstructural measures are flood warning/preparedness systems, relocation, floodproofing, regulation, land acquisition, and public investment policy.

Normal River Flow - That condition which represents average low flow within channel banks.

Relocation - Moving a building from a flood prone area by physically placing it on a vehicle and transporting it from the flood plain.

Road Overflow - The elevation of the point at which water first starts to flow over the road.

Station - Distance in feet along the centerline of the existing channel, increasing in an upstream direction.

Structural Measures - Flood control works such as dams and reservoirs, dikes and floodwalls, channel alterations, and diversion channels which are designed to keep water away from specific developments and/or populated areas or to reduce flooding in such areas.

Wetland - An area where saturation with water is the dominant factor determining the nature of soil development and the types of plant and animal communities present; generally includes: swamps, marshes, bogs, shallow lakes, and similar areas.

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4. U.S. Department of Agriculture, Soil Conservation Service, Important Farmlands Maps, Penobscot County, Maine, Orono, Maine, March 1981.

5. U.S. Department of the Interior, National Park Service, and State of Maine, Department of Conservation, Maine Rivers Study (Draft Final List), Philadelphia, PA, February 1982.

6. U.S. Department of Agriculture, Soil Conservation Service, Technical Release 61, WSP-2 Computer Program, Washington, DC, 1976.