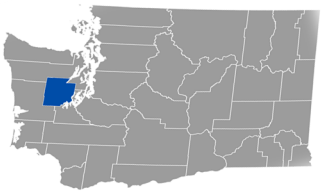
FLOOD INSURANCE STUDY

FEDERAL EMERGENCY MANAGEMENT AGENCY

VOLUME 1 OF 1



MASON COUNTY, WASHINGTON

AND INCORPORATED AREAS

COMMUNITY NAME	COMMUNITY NUMBER
MASON COUNTY (UNINCORPORATED AREAS)	530115
CITY OF SHELTON	530116
SKOKOMISH INDIAN RESERVATION	530326
SQUAXIN ISLAND TRIBE	530325

FEMA

REVISED:

FLOOD INSURANCE STUDY NUMBER
53045CV000A

Version Number 2.3.2.1

AUGUST 30, 2016

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Exhibits

Flood Profiles	Panel
Coffee Creek	01 P
Goldsborough Creek	02-03 P
Skokomish River	04-06 P
Tahuya River	07-10 P
Union River	11-12 P

Published Separately

Flood Insurance Rate Map (FIRM)

FLOOD INSURANCE STUDY REPORT
MASON COUNTY, WASHINGTON
AND INCORPORATED AREAS

SECTION 1.0 – INTRODUCTION

1.1 The National Flood Insurance Program

The National Flood Insurance Program (NFIP) is a voluntary Federal program that enables property owners in participating communities to purchase insurance protection against losses from flooding. This insurance is designed to provide an insurance alternative to disaster assistance to meet the escalating costs of repairing damage to buildings and their contents caused by floods.

For decades, the national response to flood disasters was generally limited to constructing flood-control works such as dams, levees, sea-walls, and the like, and providing disaster relief to flood victims. This approach did not reduce losses nor did it discourage unwise development. In some instances, it may have actually encouraged additional development. To compound the problem, the public generally could not buy flood coverage from insurance companies, and building techniques to reduce flood damage were often overlooked.

In the face of mounting flood losses and escalating costs of disaster relief to the general taxpayers, the U.S. Congress created the NFIP. The intent was to reduce future flood damage through community floodplain management ordinances, and provide protection for property owners against potential losses through an insurance mechanism that requires a premium to be paid for the protection.

The U.S. Congress established the NFIP on August 1, 1968, with the passage of the National Flood Insurance Act of 1968. The NFIP was broadened and modified with the passage of the Flood Disaster Protection Act of 1973 and other legislative measures. It was further modified by the National Flood Insurance Reform Act of 1994 and the Flood Insurance Reform Act of 2004. The NFIP is administered by the Federal Emergency Management Agency (FEMA), which is a component of the Department of Homeland Security (DHS).

Participation in the NFIP is based on an agreement between local communities and the Federal Government. If a community adopts and enforces floodplain management regulations to reduce future flood risks to new construction and substantially improved structures in Special Flood Hazard Areas (SFHAs), the Federal Government will make flood insurance available within the community as a financial protection against flood losses. The community's floodplain management regulations must meet or exceed criteria established in accordance with Title 44 Code of Federal Regulations (CFR) Part 60.3, *Criteria for Land Management and Use*.

SFHAs are delineated on the community's Flood Insurance Rate Maps (FIRMs). Under the NFIP, buildings that were built before the flood hazard was identified on the community's FIRMs are generally referred to as "Pre-FIRM" buildings. When the NFIP was created, the U.S. Congress recognized that insurance for Pre-FIRM buildings would be prohibitively expensive if the premiums were not subsidized by the Federal Government. Congress also recognized that most of these floodprone buildings were built by individuals who did not have sufficient knowledge of the flood hazard to make informed decisions. The NFIP requires that full actuarial rates reflecting the complete flood risk be charged on all buildings constructed or substantially improved on or after

the effective date of the initial FIRM for the community or after December 31, 1974, whichever is later. These buildings are generally referred to as "Post-FIRM" buildings.

1.2 Purpose of this Flood Insurance Study Report

This Flood Insurance Study (FIS) report revises and updates information on the existence and severity of flood hazards for the study area. The studies described in this report developed flood hazard data that will be used to establish actuarial flood insurance rates and to assist communities in efforts to implement sound floodplain management.

In some states or communities, floodplain management criteria or regulations may exist that are more restrictive than the minimum Federal requirements. Contact your State NFIP Coordinator to ensure that any higher State standards are included in the community's regulations.

1.3 Jurisdictions Included in the Flood Insurance Study Project

This FIS Report covers the entire geographic area of Mason County, Washington.

The jurisdictions that are included in this project area, along with the Community Identification Number (CID) for each community and the 8-digit Hydrologic Unit Codes (HUC-8) sub-basins affecting each, are shown in Table 1. The Flood Insurance Rate Map (FIRM) panel numbers that affect each community are listed. If the flood hazard data for the community is not included in this FIS Report, the location of that data is identified.

The location of flood hazard data for participating communities in multiple jurisdictions is also indicated in the table.

Jurisdictions that have no identified SFHAs as of the effective date of this study are indicated in the table. Changed conditions in these communities (such as urbanization or annexation) or the availability of new scientific or technical data about flood hazards could make it necessary to determine SFHAs in these jurisdictions in the future.

Table 1: Listing of NFIP Jurisdictions

Community	CID	HUC-8 Sub-Basin(s)	Located on FIRM Panel(s)	If Not Included, Location of Flood Hazard Data
City of Shelton	530116	17110019	53045C0582E, 53045C0584E, 53045C0585E, 53045C0603E, 53045C0604E, 53045C0605E	
Mason County (Unincorporated Areas)	530115	17100104, 17110017, 17110018, 17110019	53045C0050E, 53045C0075E, 53045C0100E, 53045C0110E, 53045C0120E, 53045C0125E, 53045C0150E, 53045C0165E, 53045C0175E*, 53045C0225E, 53045C0250E, 53045C0270E, 53045C0275E, 53045C0280E, 53045C0285E, 53045C0290E, 53045C0295E, 53045C0315E, 53045C0320E, 53045C0325E, 53045C0327E, 53045C0329E, 53045C0330E, 53045C0331E, 53045C0335E*, 53045C0345E, 53045C0350E, 53045C0375E*, 53045C0400E, 53045C0425E, 53045C0428E, 53045C0429E, 53045C0430E, 53045C0433E, 53045C0434E, 53045C0435E, 53045C0436E, 53045C0437E, 53045C0440E, 53045C0441E, 53045C0442E, 53045C0445E, 53045C0455E, 53045C0460E, 53045C0465E, 53045C0470E, 53045C0495E, 53045C0500E, 53045C0505E, 53045C0515E, 53045C0525E, 53045C0550E, 53045C0575E, 53045C0580E, 53045C0582E, 53045C0584E, 53045C0585E, 53045C0590E, 53045C0595E, 53045C0603E, 53045C0604E, 53045C0605E, 53045C0625E, 53045C0635E, 53045C0645E, 53045C0650E, 53045C0655E, 53045C0665E, 53045C0700E, 53045C0725E, 53045C0750E, 53045C0775E	
Skokomish Indian Reservation	530326	17110017, 17110018	53045C0433E, 53045C0434E, 53045C0435E, 53045C0441E, 53045C0442E, 53045C0455E	
Squaxin Island Tribe	530325	17110019	53045C0625E, 53045C0635E, 53045C0645E, 53045C0650E, 53045C0775E	

*Panel Not Printed

1.4 Considerations for using this Flood Insurance Study Report

The NFIP encourages State and local governments to implement sound floodplain management programs. To assist in this endeavor, each FIS Report provides floodplain data, which may include a combination of the following: 10-, 4-, 2-, 1-, and 0.2-percent annual chance flood elevations (the 1% annual chance flood elevation is also referred to as the Base Flood Elevation (BFE)); delineations of the 1% annual chance and 0.2% annual chance floodplains; and 1% annual chance floodway. This information is presented on the FIRM and/or in many components of the FIS Report, including Flood Profiles, Floodway Data tables, Summary of Non-Coastal Stillwater Elevations tables, and Coastal Transect Parameters tables (not all components may be provided for a specific FIS).

This section presents important considerations for using the information contained in this FIS Report and the FIRM, including changes in format and content. Figures 1, 2, and 3 present information that applies to using the FIRM with the FIS Report.

- Part or all of this FIS Report may be revised and republished at any time. In addition, part of this FIS Report may be revised by a Letter of Map Revision (LOMR), which does not involve republication or redistribution of the FIS Report. Refer to Section 6.5 of this FIS Report for information about the process to revise the FIS Report and/or FIRM.

  It is, therefore, the responsibility of the user to consult with community officials by contacting the community repository to obtain the most current FIS Report components. Communities participating in the NFIP have established repositories of flood hazard data for floodplain management and flood insurance purposes. Community map repository addresses are provided in Table 31, "Map Repositories," within this FIS Report.

- New FIS Reports are frequently developed for multiple communities, such as entire counties. A countywide FIS Report incorporates previous FIS Reports for individual communities and the unincorporated area of the county (if not jurisdictional) into a single document and supersedes those documents for the purposes of the NFIP.

  The initial Countywide FIS Report for Mason County became effective on _____. Refer to Table 28 for information about subsequent revisions to the FIRMs.

- Selected FIRM panels for the community may contain information (such as floodways and cross sections) that was previously shown separately on the corresponding Flood Boundary and Floodway Map panels. In addition, former flood hazard zone designations have been changed as follows:

Old Zone	New Zone
A1 through A30	AE
V1 through V30	VE
B	X (shaded)
C	X (unshaded)

- FEMA does not impose floodplain management requirements or special insurance ratings based on Limit of Moderate Wave Action (LiMWA) delineations at this time. The LiMWA represents the approximate landward limit of the 1.5-foot breaking wave. If the LiMWA is shown on the FIRM, it is being provided by FEMA as information only. For

communities that do adopt Zone VE building standards in the area defined by the LiMWA, additional Community Rating System (CRS) credits are available. Refer to Section 2.5.4 for additional information about the LiMWA.

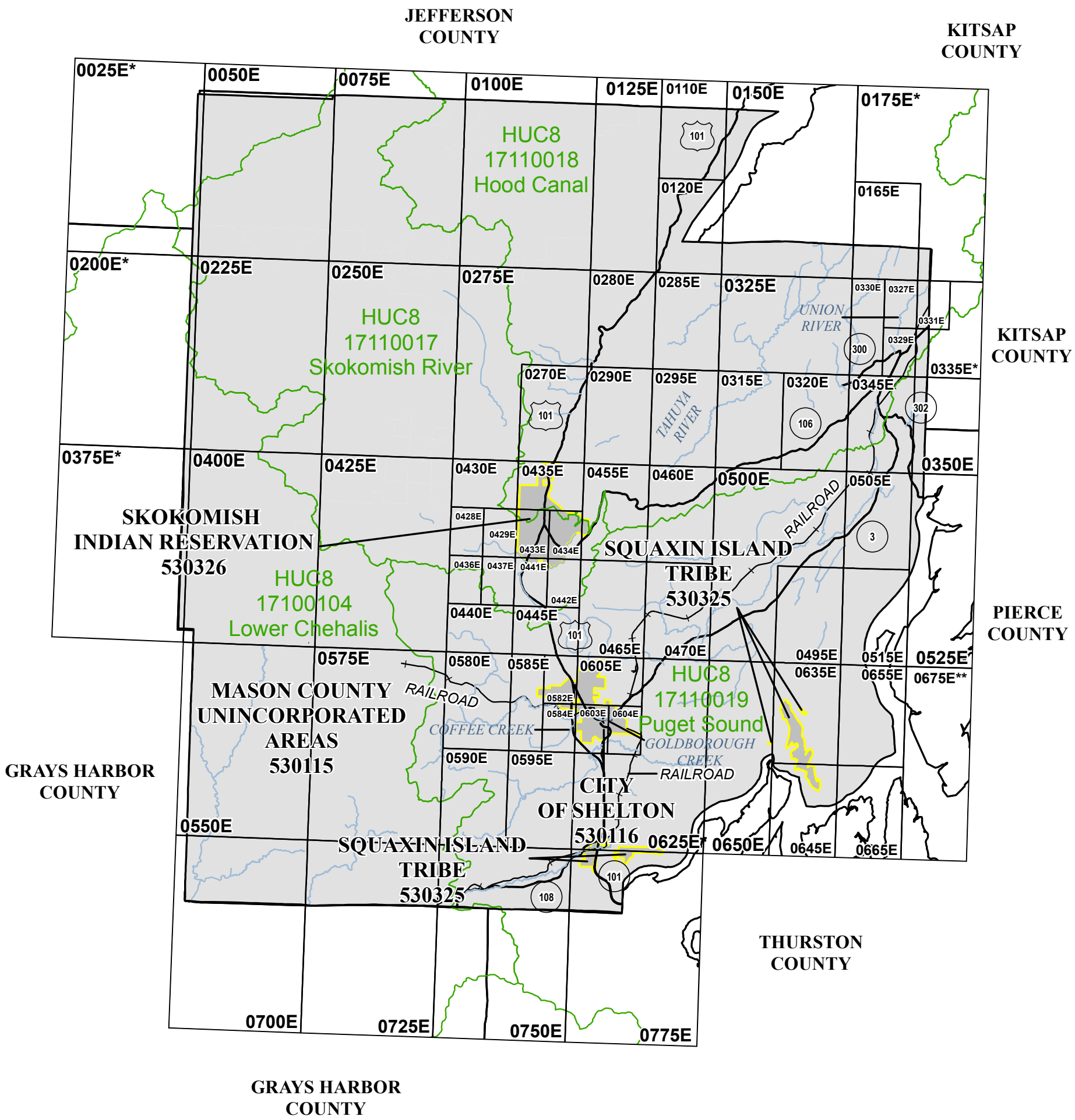
The CRS is a voluntary incentive program that recognizes and encourages community floodplain management activities that exceed the minimum NFIP requirements. Visit the FEMA Web site at http://www.fema.gov or contact your appropriate FEMA Regional Office for more information about this program.

- Previous FIS Reports and FIRMs may have included levees that were accredited as providing protection from the 1% annual chance flood based on the information available and the mapping standards of the NFIP at that time. For FEMA to continue to accredit the identified levees with providing protection from the base flood, the levees must meet the criteria of the Code of Federal Regulations, Title 44, Section 65.10 (44 CFR 65.10), titled "Mapping of Areas Protected by Levee Systems."

  Since the status of levees is subject to change at any time, the user should contact the appropriate agency for the latest information regarding levees presented in Table 9 of this FIS Report. For levees owned or operated by the U.S. Army Corps of Engineers (USACE), information may be obtained from the USACE national levee database. For all other levees, the user is encouraged to contact the appropriate local community.

- FEMA has developed a *Guide to Flood Maps* (FEMA 258) and online tutorials to assist users in accessing the information contained on the FIRM. These include how to read panels and step-by-step instructions to obtain specific information. To obtain this guide and other assistance in using the FIRM, visit the FEMA Web site at http://www.fema.gov.

Figure 1: FIRM Panel Index



1 inch = 5 miles

N

Miles
0 2.25 4.5 9

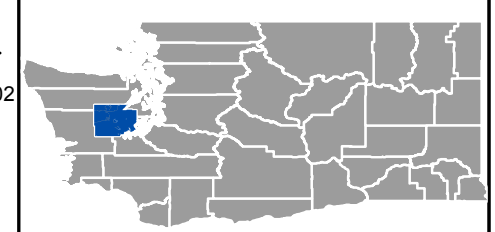
Map Projection:
NAD 1983 StatePlane Washington South FIPS 4602
North American Datum of 1983

THE INFORMATION DEPICTED ON THIS MAP AND SUPPORTING DOCUMENTATION ARE ALSO AVAILABLE IN DIGITAL FORMAT AT

HTTP://MSC.FEMA.GOV

SEE FIS REPORT FOR ADDITIONAL INFORMATION

* PANEL NOT PRINTED - AREA ALL IN ZONE X
** PANEL NOT PRINTED - AREA OUTSIDE OF COUNTY BOUNDARY



NATIONAL FLOOD INSURANCE PROGRAM

FLOOD INSURANCE RATE MAP INDEX

MASON COUNTY, WASHINGTON AND INCORPORATED AREAS

PANELS PRINTED:

0050, 0075, 0100, 0110, 0120, 0125, 0150, 0165, 0225, 0250, 0270, 0275, 0280, 0285, 0290, 0295, 0315, 0320, 0325, 0327, 0329, 0330, 0331, 0345, 0350, 0400, 0425, 0428, 0429, 0430, 0433, 0434, 0435, 0436, 0437, 0440, 0441, 0442, 0445, 0455, 0460, 0465, 0470, 0495, 0500, 0505, 0515, 0525, 0550, 0575, 0580, 0582, 0584, 0585, 0590, 0595, 0603, 0604, 0605, 0625, 0635, 0645, 0650, 0655, 0665, 0700, 0725, 0750, 0775

FEMA

MAP NUMBER
53045CIND0A

EFFECTIVE DATE

Figure 2: FIRM Notes to Users

NOTES TO USERS

For information and questions about this map, available products associated with this FIRM including historic versions of this FIRM, how to order products, or the National Flood Insurance Program in general, please call the FEMA Map Information eXchange at 1-877-FEMA-MAP (1-877-336-2627) or visit the FEMA Map Service Center website at http://msc.fema.gov. Available products may include previously issued Letters of Map Change, a Flood Insurance Study Report, and/or digital versions of this map. Many of these products can be ordered or obtained directly from the website. Users may determine the current map date for each FIRM panel by visiting the FEMA Map Service Center website or by calling the FEMA Map Information eXchange.

Communities annexing land on adjacent FIRM panels must obtain a current copy of the adjacent panel as well as the current FIRM Index. These may be ordered directly from the Map Service Center at the number listed above.

For community and countywide map dates, refer to Table 28 in this FIS Report.

To determine if flood insurance is available in the community, contact your insurance agent or call the National Flood Insurance Program at 1-800-638-6620.

The map is for use in administering the NFIP. It may not identify all areas subject to flooding, particularly from local drainage sources of small size. Consult the community map repository to find updated or additional flood hazard information.

BASE FLOOD ELEVATIONS: For more detailed information in areas where Base Flood Elevations (BFEs) and/or floodways have been determined, consult the Flood Profiles and Floodway Data and/or Summary of Stillwater Elevations tables within this FIS Report. Use the flood elevation data within the FIS Report in conjunction with the FIRM for construction and/or floodplain management.

Coastal Base Flood Elevations shown on the map apply only landward of 0.0' North American Vertical Datum of 1988 (NAVD88). Coastal flood elevations are also provided in the Summary of Stillwater Elevations table in the FIS Report for this jurisdiction. Elevations shown in the Summary of Stillwater Elevations table should be used for construction and/or floodplain management purposes when they are higher than the elevations shown on the FIRM.

FLOODWAY INFORMATION: Boundaries of the floodways were computed at cross sections and interpolated between cross sections. The floodways were based on hydraulic considerations with regard to requirements of the National Flood Insurance Program. Floodway widths and other pertinent floodway data are provided in the FIS Report for this jurisdiction.

Figure 2: FIRM Notes to Users *(continued)*

FLOOD CONTROL STRUCTURE INFORMATION: Certain areas not in Special Flood Hazard Areas may be protected by flood control structures. Refer to Section 4.3 "Non-Levee Flood Protection Measures" of this FIS Report for information on flood control structures for this jurisdiction.

PROJECTION INFORMATION: The projection used in the preparation of the map was State Plane Washington South FIPS 4602. The horizontal datum was NAD83. Differences in datum, spheroid, projection or State Plane zones used in the production of FIRMs for adjacent jurisdictions may result in slight positional differences in map features across jurisdiction boundaries. These differences do not affect the accuracy of the FIRM.

ELEVATION DATUM: Flood elevations on the FIRM are referenced to NAVD88. These flood elevations must be compared to structure and ground elevations referenced to the same vertical datum. For information regarding conversion between the National Geodetic Vertical Datum of 1929 and North American Vertical Datum of 1988, visit the National Geodetic Survey website at http://www.ngs.noaa.gov/ or contact the National Geodetic Survey at the following address:

NGS Information Services
NOAA, N/NGS12
National Geodetic Survey
SSMC-3, #9202
1315 East-West Highway
Silver Spring, Maryland 20910-3282
(301) 713-3242

Local vertical monuments may have been used to create the map. To obtain current monument information, please contact the appropriate local community listed in Table 31 of this FIS Report.

BASE MAP INFORMATION: Base map information shown on the FIRM was in digital format by the United States Geological Survey (USGS). This information was derived from digital orthophotography at a 2-foot resolution from photography dated 2010. For information about base maps, refer to Section 6.2 “Base Map” in this FIS Report.

The map reflects more detailed and up-to-date stream channel configurations than those shown on the previous FIRM for this jurisdiction. The floodplains and floodways that were transferred from the previous FIRM may have been adjusted to conform to these new stream channel configurations. As a result, the Flood Profiles and Floodway Data tables may reflect stream channel distances that differ from what is shown on the map.

Corporate limits shown on the map are based on the best data available at the time of publication. Because changes due to annexations or de-annexations may have occurred after the map was published, map users should contact appropriate community officials to verify current corporate limit locations.

NOTES FOR FIRM INDEX

REVISIONS TO INDEX: As new studies are performed and FIRM panels are updated within Mason County, Washington, corresponding revisions to the FIRM Index will be incorporated within the FIS Report to reflect the effective dates of those panels. Please refer to Table 28 of this FIS Report to determine the most recent FIRM revision date for each community. The most recent FIRM panel effective date will correspond to the most recent index date.

Figure 2: FIRM Notes to Users *(continued)*

SPECIAL NOTES FOR SPECIFIC FIRM PANELS This Notes to Users section was created specifically for Mason County, Washington, effective
FLOOD RISK REPORT: A Flood Risk Report (FRR) may be available for many of the flooding sources and communities referenced in this FIS Report. The FRR is provided to increase public awareness of flood risk by helping communities identify the areas within their jurisdictions that have the greatest risks. Although non-regulatory, the information provided within the FRR can assist communities in assessing and evaluating mitigation opportunities to reduce these risks. It can also be used by communities developing or updating flood risk mitigation plans. These plans allow communities to identify and evaluate opportunities to reduce potential loss of life and property. However, the FRR is not intended to be the final authoritative source of all flood risk data for a project area; rather, it should be used with other data sources to paint a comprehensive picture of flood risk.

Figure 3: Map Legend for FIRM

SPECIAL FLOOD HAZARD AREAS: *The 1% annual chance flood, also known as the base flood or 100-year flood, has a 1% chance of happening or being exceeded each year. Special Flood Hazard Areas are subject to flooding by the 1% annual chance flood. The Base Flood Elevation is the water-surface elevation of the 1% annual chance flood. The floodway is the channel of a stream plus any adjacent floodplain areas that must be kept free of encroachment so that the 1% annual chance flood can be carried without substantial increases in flood heights. See note for specific types. If the floodway is too narrow to be shown, a note is shown.*

	Special Flood Hazard Areas subject to inundation by the 1% annual chance flood (Zones A, AE, AH, AO, AR, A99, V and VE)
Zone A	The flood insurance rate zone that corresponds to the 1% annual chance floodplains. No base (1% annual chance) flood elevations (BFEs) or depths are shown within this zone.
Zone AE	The flood insurance rate zone that corresponds to the 1% annual chance floodplains. Base flood elevations derived from the hydraulic analyses are shown within this zone, either at cross section locations or as static whole-foot elevations that apply throughout the zone.
Zone AH	The flood insurance rate zone that corresponds to the areas of 1% annual chance shallow flooding (usually areas of ponding) where average depths are between 1 and 3 feet. Whole-foot BFEs derived from the hydraulic analyses are shown at selected intervals within this zone.
Zone AO	The flood insurance rate zone that corresponds to the areas of 1% annual chance shallow flooding (usually sheet flow on sloping terrain) where average depths are between 1 and 3 feet. Average whole-foot depths derived from the hydraulic analyses are shown within this zone.
Zone AR	The flood insurance rate zone that corresponds to areas that were formerly protected from the 1% annual chance flood by a flood control system that was subsequently decertified. Zone AR indicates that the former flood control system is being restored to provide protection from the 1% annual chance or greater flood.
Zone A99	The flood insurance rate zone that corresponds to areas of the 1% annual chance floodplain that will be protected by a Federal flood protection system where construction has reached specified statutory milestones. No base flood elevations or flood depths are shown within this zone.
Zone V	The flood insurance rate zone that corresponds to the 1% annual chance coastal floodplains that have additional hazards associated with storm waves. Base flood elevations are not shown within this zone.
Zone VE	Zone VE is the flood insurance rate zone that corresponds to the 1% annual chance coastal floodplains that have additional hazards associated with storm waves. Base flood elevations derived from the coastal analyses are shown within this zone as static whole-foot elevations that apply throughout the zone.
	Regulatory Floodway determined in Zone AE.

Figure 3: Map Legend for FIRM *(continued)*

OTHER AREAS OF FLOOD HAZARD	
	Shaded Zone X: Areas of 0.2% annual chance flood hazards and areas of 1% annual chance flood hazards with average depths of less than 1 foot or with drainage areas less than 1 square mile.
	Future Conditions 1% Annual Chance Flood Hazard – Zone X: The flood insurance rate zone that corresponds to the 1% annual chance floodplains that are determined based on future-conditions hydrology. No base flood elevations or flood depths are shown within this zone.
	Zone X Protected by Accredited Levee: Areas protected by an accredited levee, dike or other flood control structures. See Notes to Users for important information.
OTHER AREAS	
	Zone D (Areas of Undetermined Flood Hazard): The flood insurance rate zone that corresponds to unstudied areas where flood hazards are undetermined, but possible
NO SCREEN	Unshaded Zone X: Areas determined to be outside the 0.2% annual chance floodplain
FLOOD HAZARD AND OTHER BOUNDARY LINES	
	Flood Zone Boundary (white line)
	Limit of Study
	Jurisdiction Boundary
	Limit of Moderate Wave Action (LiMWA): Indicates the inland limit of the area affected by waves greater than 1.5 feet
GENERAL STRUCTURES	
Aqueduct *Channel* *Culvert* *Storm Sewer*	Channel, Culvert, Aqueduct, or Storm Sewer
Dam *Jetty* *Weir*	Dam, Jetty, Weir
	Levee, Dike or Floodwall accredited or provisionally accredited to provide protection from the 1% annual chance flood
	Levee, Dike or Floodwall not accredited to provide protection from the 1% annual chance flood.
Bridge	Bridge

Figure 3: Map Legend for FIRM *(continued)*

REFERENCE MARKERS	
22.0	River mile Markers
CROSS SECTION & TRANSECT INFORMATION	
B 20.2	Lettered Cross Section with Regulatory Water Surface Elevation (BFE)
5280 21.1	Numbered Cross Section with Regulatory Water Surface Elevation (BFE)
17.5	Unlettered Cross Section with Regulatory Water Surface Elevation (BFE)
8	Coastal Transect
	Profile Baseline: Indicates the modeled flow path of a stream and is shown on FIRM panels for all valid studies with profiles or otherwise established base flood elevation.
	Coastal Transect Baseline: Used in the coastal flood hazard model to represent the 0.0-foot elevation contour and the starting point for the transect and the measuring point for the coastal mapping.
513	Base Flood Elevation Line
ZONE AE (EL 16)	Static Base Flood Elevation value (shown under zone label)
ZONE AO (DEPTH 2)	Zone designation with Depth
ZONE AO (DEPTH 2) (VEL 15 FPS)	Zone designation with Depth and Velocity

Figure 3: Map Legend for FIRM *(continued)*

BASE MAP FEATURES	
Missouri Creek	River, Stream or Other Hydrographic Feature
234	Interstate Highway
234	U.S. Highway
234	State Highway
234	County Highway
MAPLE LANE	Street, Road, Avenue Name, or Private Drive if shown on Flood Profile
RAILROAD	Railroad
	Horizontal Reference Grid Line
—	Horizontal Reference Grid Ticks
+	Secondary Grid Crosshairs
Land Grant	Name of Land Grant
7	Section Number
R. 43 W. T. 22 N.	Range, Township Number
$^{42}76^{000m}$E	Horizontal Reference Grid Coordinates (UTM)
365000 FT	Horizontal Reference Grid Coordinates (State Plane)
80° 16’ 52.5”	Corner Coordinates (Latitude, Longitude)

SECTION 2.0 – FLOODPLAIN MANAGEMENT APPLICATIONS

2.1 Floodplain Boundaries

To provide a national standard without regional discrimination, the 1% annual chance (100-year) flood has been adopted by FEMA as the base flood for floodplain management purposes. The 0.2% annual chance (500-year) flood is employed to indicate additional areas of flood hazard in the community.

Each flooding source included in the project scope has been studied and mapped using professional engineering and mapping methodologies that were agreed upon by FEMA and Mason County as appropriate to the risk level. Flood risk is evaluated based on factors such as known flood hazards and projected impact on the built environment. Engineering analyses were performed for each studied flooding source to calculate its 1% annual chance flood elevations; elevations corresponding to other floods (e.g., 10-, 4-, 2-, 0.2-percent annual chance, etc.) may have also been computed for certain flooding sources. Engineering models and methods are described in detail in Section 5.0 of this FIS Report. The modeled elevations at cross sections were used to delineate the floodplain boundaries on the FIRM; between cross sections, the boundaries were interpolated using elevation data from various sources. More information on specific mapping methods is provided in Section 6.0 of this FIS Report.

Depending on the accuracy of available topographic data (Table 23), study methodologies employed (Section 5.0), and flood risk, certain flooding sources may be mapped to show both the 1% and 0.2% annual chance floodplain boundaries, regulatory water surface elevations (BFEs), and/or a regulatory floodway. Similarly, other flooding sources may be mapped to show only the 1% annual chance floodplain boundary on the FIRM, without published water surface elevations. In cases where the 1% and 0.2% annual chance floodplain boundaries are close together, only the 1% annual chance floodplain boundary is shown on the FIRM. Figure 3, "Map Legend for FIRM", describes the flood zones that are used on the FIRMs to account for the varying levels of flood risk that exist along flooding sources within the project area. Table 2 and Table 3 indicate the flood zone designations for each flooding source and each community within Mason County, respectively.

Table 2, "Flooding Sources Included in this FIS Report," lists each flooding source, including its study limits, affected communities, mapped zone on the FIRM, and the completion date of its engineering analysis from which the flood elevations on the FIRM and in the FIS Report were derived. Descriptions and dates for the latest hydrologic and hydraulic analyses of the flooding sources are shown in Table 13. Floodplain boundaries for these flooding sources are shown on the FIRM (published separately) using the symbology described in Figure 3. On the map, the 1% annual chance floodplain corresponds to the SFHAs. The 0.2% annual chance floodplain shows areas that, although out of the regulatory floodplain, are still subject to flood hazards.

Small areas within the floodplain boundaries may lie above the flood elevations but cannot be shown due to limitations of the map scale and/or lack of detailed topographic data. The procedures to remove these areas from the SFHA are described in Section 6.5 of this FIS Report.

2.2 Floodways

Encroachment on floodplains, such as structures and fill, reduces flood-carrying capacity, increases flood heights and velocities, and increases flood hazards in areas beyond the

encroachment itself. One aspect of floodplain management involves balancing the economic gain from floodplain development against the resulting increase in flood hazard.

For purposes of the NFIP, a floodway is used as a tool to assist local communities in balancing floodplain development against increasing flood hazard. With this approach, the area of the 1% annual chance floodplain on a river is divided into a floodway and a floodway fringe based on hydraulic modeling. The floodway is the channel of a stream, plus any adjacent floodplain areas, that must be kept free of encroachment in order to carry the 1% annual chance flood. The floodway fringe is the area between the floodway and the 1% annual chance floodplain boundaries where encroachment is permitted. The floodway must be wide enough so that the floodway fringe could be completely obstructed without increasing the water-surface elevation of the 1% annual chance flood more than 1 foot at any point. Typical relationships between the floodway and the floodway fringe and their significance to floodplain development are shown in Figure 4.

To participate in the NFIP, Federal regulations require communities to limit increases caused by encroachment to 1.0 foot, provided that hazardous velocities are not produced, require communities in Mason County to limit increases caused by encroachment to 1.0 feet and several communities have adopted additional restrictions. The floodways in this project are presented to local agencies as minimum standards that can be adopted directly or that can be used as a basis for additional floodway projects.

Figure 4: Floodway Schematic

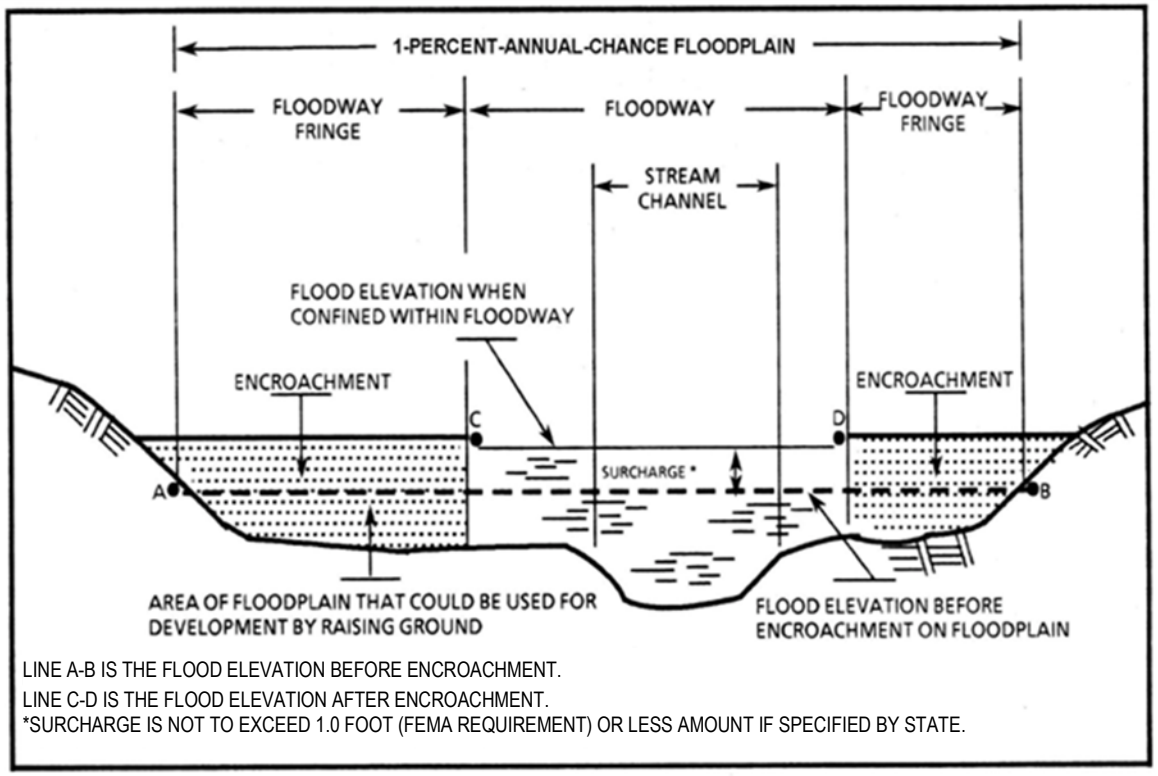


Table 2: Flooding Sources Included in this FIS Report

Flooding Source	Community	Downstream Limit	Upstream Limit	HUC-8 Sub-Basin(s)	Length (mi) (streams or coastlines)	Area (mi^2) (estuaries or ponding)	Floodway (Y/N)	Zone shown on FIRM	Date of Analysis
Coffee Creek	Mason County (Unincorporated Areas)	Confluence with Goldsborough Creek	Approximately 1,520 feet upstream of West Deegan Road	17110019	2.0	-	Y	AE	2014
Goldsborough Creek	City of Shelton, Mason County (Unincorporated Areas)	Approximately 950 feet downstream of a Wooden Foot Bridge	Approximately 900 feet upstream of U.S. Highway 101	17110019	4.6	-	Y	AE	2014
Puget Sound	City of Shelton, Mason County (Unincorporated Areas), Skokomish Indian Reservation	Approximately 550 feet south of Rocky Point Lane in Mason County	Approximately 200 feet north of U.S. Highway 101 in Mason County	17110017, 17110018, 17110019	146	-	N	AE, VE	2014
Skokomish River	Mason County (Unincorporated Areas), Skokomish Indian Reservation	Approximately 4,320 feet downstream of State Route 106	Approximately 19,000 feet upstream of U.S Highway 101	17110017	14.4	-	Y	AE	2014
Tahuya River	Mason County (Unincorporated Areas)	Approximately 50 feet downstream of North Shore Road	Approximately 330 feet upstream of Haven Way	17110018	16.8	-	Y	AE	2014
Union River	Mason County (Unincorporated Areas)	Approximately 75 feet downstream of State Route 300	Mason County boundary	17110018	8.8	-	Y	AE	2014
Anderson Lake	Mason County (Unincorporated Areas)	Entire Shoreline	Entire Shoreline	17110019	-	0.07	N	A	2016

Table 2: Flooding Sources Included in this FIS Report *(continued)*

Flooding Source	Community	Downstream Limit	Upstream Limit	HUC-8 Sub-Basin(s)	Length (mi) (streams or coastlines)	Area (mi^2) (estuaries or ponding)	Floodway (Y/N)	Zone shown on FIRM	Date of Analysis
Lake Arrowhead	Mason County (Unincorporated Areas)	Entire Shoreline	Entire Shoreline	17100104	-	0.05	N	A	2016
Big Timberlake	Mason County (Unincorporated Areas)	Entire Shoreline	Entire Shoreline	17110019	-	0.13	N	A	2016
Bingham Creek	Mason County (Unincorporated Areas)	Confluence with East Fork Satsop River	Approximately 12.6 miles upstream of confluence with East Fork Satsop River	17100104	12.6	-	N	A	1998
Campbell Creek	Mason County (Unincorporated Areas)	Confluence with Puget Sound	Approximately 6.0 miles upstream of confluence with Puget Sound	17110019	6.0	-	N	A	2014
Catfish Lake	Mason County (Unincorporated Areas)	Entire Shoreline	Entire Shoreline	17110019	-	0.04	N	A	2014
Clark Creek	Mason County (Unincorporated Areas)	Confluence with Hood Canal	Approximately 1.9 miles upstream of confluence with Hood Canal	17110018	1.9	-	N	A	2014
Cloquallum Creek	Mason County (Unincorporated Areas)	Mason County boundary	Approximately 3,600 feet upstream of GD 3300 Road	17100104	13.9	-	N	A	2014
Cloquallum Creek Tributary 3	Mason County (Unincorporated Areas)	Confluence with Cloquallum Creek	Outflow of Star Lake	17100104	2.1	-	N	A	2014

Table 2: Flooding Sources Included in this FIS Report *(continued)*

Flooding Source	Community	Downstream Limit	Upstream Limit	HUC-8 Sub-Basin(s)	Length (mi) (streams or coastlines)	Area (mi^2) (estuaries or ponding)	Floodway (Y/N)	Zone shown on FIRM	Date of Analysis
Cloquallum Creek Tributary 3.1	Mason County (Unincorporated Areas)	Confluence with Cloquallum Creek Tributary 3	Outflow of Lake Arrowhead	17100104	0.4	-	N	A	2014
Coffee Creek	Mason County (Unincorporated Areas)	Approximately 1,750 feet above Deegan Rd W	Shelton Valley Road	17110019	1.5	-	N	A	1998
Coulter Creek	Mason County (Unincorporated Areas)	Confluence with Case Inlet	Approximately 2,565 feet upstream of the confluence with Coulter Creek Tributary 2	17110019	1.0	-	N	A	2014
Coulter Creek Tributary 1	Mason County (Unincorporated Areas)	Confluence with Coulter Creek	Approximately 1,900 feet upstream of Coulter Creek Rd	17110019	0.4	-	N	A	2014
Coulter Creek Tributary 2	Mason County (Unincorporated Areas)	Confluence with Coulter Creek	Approximately 55 feet upstream of Odessa Place	17110019	0.4	-	N	A	2014
Cranberry Creek	Mason County (Unincorporated Areas)	Confluence with Puget Sound	Approximately 4,245 feet upstream of Cranberry Lake	17110019	7.6	-	N	A	2014
Cranberry Creek Tributary 1	Mason County (Unincorporated Areas)	Confluence with Cranberry Creek	Approximately 2,830 feet upstream of Limerick Road	17110019	1.4	-	N	A	2014

Table 2: Flooding Sources Included in this FIS Report *(continued)*

Flooding Source	Community	Downstream Limit	Upstream Limit	HUC-8 Sub-Basin(s)	Length (mi) (streams or coastlines)	Area (mi^2) (estuaries or ponding)	Floodway (Y/N)	Zone shown on FIRM	Date of Analysis
Cranberry Creek Tributary 2	Mason County (Unincorporated Areas)	Confluence with Cranberry Creek	Approximately 5,500 feet upstream of St. Andrews Rd N	17110019	1.5	-	N	A	2014
Danny Walker Creek	Mason County (Unincorporated Areas)	Confluence with Rabbit Creek	Approximately 2,470 feet upstream of Beeville Loop Rd	17100104	1.3	-	N	A	1998
Decker Creek	Mason County (Unincorporated Areas)	Confluence with East Fork Satsop River	Approximately 2 miles upstream of Deckerville Road	17100104	14.2	-	N	A	2014
Deer Creek	Mason County (Unincorporated Areas)	Confluence with Puget Sound	Approximately 3,215 feet upstream of Mason Benson Rd	17110019	8.9	-	N	A	2014
Deer Creek Tributary	Mason County (Unincorporated Areas)	Confluence with Deer Creek	Approximately 3,980 feet upstream of GD 2100 Road	17110019	1.1	-	N	A	2014
Devereaux Lake	Mason County (Unincorporated Areas)	Entire Shoreline	Entire Shoreline	17110018	-	0.15	N	A	2014
Dewatto River	Mason County (Unincorporated Areas)	Confluence with Hood Canal	Mason County boundary	17110018	7.8	-	N	A	2014
Dewatto River Tributary 1	Mason County (Unincorporated Areas)	Confluence with Dewatto River	Approximately 1,375 feet upstream of Dewatto Holly Rd	17110018	0.7	-	N	A	2014

Table 2: Flooding Sources Included in this FIS Report *(continued)*

Flooding Source	Community	Downstream Limit	Upstream Limit	HUC-8 Sub-Basin(s)	Length (mi) (streams or coastlines)	Area (mi^2) (estuaries or ponding)	Floodway (Y/N)	Zone shown on FIRM	Date of Analysis
Dry Bed Creek	Mason County (Unincorporated Areas)	Confluence with Decker Creek	Approximately 300 feet upstream of Beeville Road	17100104	11.6	-	N	A	2014
Dry Creek	Mason County (Unincorporated Areas)	Confluence with Dry Bed Creek	Approximately 70 feet upstream of GD 1800 Road	17110017	3.5	-	N	A	2014
Dry Run Creek	Mason County (Unincorporated Areas)	Confluence with East Fork Satsop River	Satsop Cloquallum Road	17100104	4.8	-	N	A	2014
East Fork Satsop River	Mason County (Unincorporated Areas)	Mason County boundary	Confluence with Stillwater Creek and Phillips Creek	17100104	16.2	-	N	A	1983
Fawn Lake	Mason County (Unincorporated Areas)	Entire Shoreline	Entire Shoreline	17110019	-	0.03	N	A	2016
Finch Creek	Mason County (Unincorporated Areas)	Confluence with Hood Canal	Approximately 3,315 feet upstream of Finch Creek Road	17110018	1.1	-	N	A	2014
Goldsborough Creek	Mason County (Unincorporated Areas)	Approximately 980 feet upstream of US Highway 101	Little Egypt Road	17110019	8.2	-	N	A	2014
Gosnell Creek	Mason County (Unincorporated Areas)	Outflow of Isabella Lake	Approximately 4.9 miles upstream of Badger Lane	17110019	10.1	-	N	A	2014
Haven Lake	Mason County (Unincorporated Areas)	Entire Shoreline	Entire Shoreline	17110018	-	0.11	N	A	2016

Table 2: Flooding Sources Included in this FIS Report *(continued)*

Flooding Source	Community	Downstream Limit	Upstream Limit	HUC-8 Sub-Basin(s)	Length (mi) (streams or coastlines)	Area (mi^2) (estuaries or ponding)	Floodway (Y/N)	Zone shown on FIRM	Date of Analysis
Hamma Hamma River	Mason County (Unincorporated Areas)	Confluence with Puget Sound	Approximately 7 miles upstream of USFS 2480	17110018	14.6	-	N	A	1983
Hiawata Creek	Mason County (Unincorporated Areas)	Confluence with Pickering Passage	Approximately 1.7 miles upstream of Island View Road	17110019	2.0	-	N	A	2014
Isabella Lake	Mason County (Unincorporated Areas)	Entire Shoreline	Entire Shoreline	17110019	-	0.33	N	A	2016
Island Lake	Mason County (Unincorporated Areas)	Entire Shoreline	Entire Shoreline	17110019	-	0.16	N	A	2016
Jarrell Creek	Mason County (Unincorporated Areas)	Confluence with Pickering Passage	Approximately 5,035 feet upstream of Thornton Road	17110019	2.3	-	N	A	2014
Jefferson Creek	Mason County (Unincorporated Areas)	Confluence with Hamma Hamma River	Approximately 445 feet upstream of USFS 2401	17110018	3.5	-	N	A	1998
Johns Creek	Mason County (Unincorporated Areas)	Confluence with Puget Sound	Approximately 60 feet downstream of Melissa Lane	17110019	10.6	-	N	A	2014
Kennedy Creek	Mason County (Unincorporated Areas)	Coastline	Mason County boundary	17110019	2.5	-	N	A	1998
Lake Limerick	Mason County (Unincorporated Areas)	Entire Shoreline	Entire Shoreline	17110019	-	0.21	N	A	2016

Table 2: Flooding Sources Included in this FIS Report *(continued)*

Flooding Source	Community	Downstream Limit	Upstream Limit	HUC-8 Sub-Basin(s)	Length (mi) (streams or coastlines)	Area (mi^2) (estuaries or ponding)	Floodway (Y/N)	Zone shown on FIRM	Date of Analysis
Little Mission Creek	Mason County (Unincorporated Areas)	Confluence with Hood Canal	Approximately 2.2 miles upstream of North Shore Road	17110018	2.6	-	N	A	2014
Lost Lake	Mason County (Unincorporated Areas)	Entire Shoreline	Entire Shoreline	17110019	-	0.19	N	A	2016
Mason Lake	Mason County (Unincorporated Areas)	Entire Shoreline	Entire Shoreline	17110019	-	1.53	N	A	2016
Malaney Creek	Mason County (Unincorporated Areas)	Confluence with Puget Sound	Approximately 875 feet downstream of Spencer Lake Road	17110019	4.9	-	N	A	2014
Middle Fork Satsop River	Mason County (Unincorporated Areas)	Confluence with Rabbit Creek	Approximately 6.9 miles above the confluence with Rabbit Creek	17100104	6.9	-	N	A	1983
Mill Creek	Mason County (Unincorporated Areas)	Confluence with Puget Sound	Outflow of Isabella Lake	17110019	11.1	-	N	A	2014
Miller Creek	Mason County (Unincorporated Areas)	Confluence with Hood Canal	Approximately 3.3 miles above US Highway 101	17110018	3.3	-	N	A	2014
Mission Creek	Mason County (Unincorporated Areas)	Confluence with Hood Canal	Mason County boundary	17110018	9.5	-	N	A	2014
Nahwatzel Lake	Mason County (Unincorporated Areas)	Entire Shoreline	Entire Shoreline	17100104	-	0.44	N	A	2014

Table 2: Flooding Sources Included in this FIS Report *(continued)*

Flooding Source	Community	Downstream Limit	Upstream Limit	HUC-8 Sub-Basin(s)	Length (mi) (streams or coastlines)	Area (mi^2) (estuaries or ponding)	Floodway (Y/N)	Zone shown on FIRM	Date of Analysis
North Fork Goldsborough Creek	Mason County (Unincorporated Areas)	Confluence with Goldsborough Creek	Approximately 1 mile upstream of the confluence with Winter Creek	17110019	4.3	-	N	A	2014
North Fork Skokomish River	Mason County (Unincorporated Areas)	Confluence with Skokomish River	Approximately 6 miles upstream of Fourstream Road	17110017	7.6	-	N	A	2014
Phillips Creek	Mason County (Unincorporated Areas)	Confluence with East Fork Satsop River	Approximately 2.3 miles upstream of the confluence with East Fork Satsop River	17100104	2.3	-	N	A	1998
Purdy Creek	Mason County (Unincorporated Areas)	Confluence with Skokomish River	Approximately 1,675 feet upstream of US Highway 101	17110017 17110019	2.5	-	N	A	2014
Rabbit Creek	Mason County (Unincorporated Areas)	Confluence with Middle Fork Satsop River	Approximately 1.2 miles upstream of Beeville Loop Rd	17100104	3.7	-	N	A	2014
Rendsland Creek	Mason County (Unincorporated Areas)	Confluence with Hood Canal	Approximately 1.1 miles upstream of North Shore Road	17110018	1.1	-	N	A	2014
Rock Creek	Mason County (Unincorporated Areas)	Confluence with Gosnell Creek	Approximately 2.3 miles upstream of Cloquallum Road	17110019	2.6	-	N	A	2014
Schumacher Creek	Mason County (Unincorporated Areas)	Outflow of Mason Lake	Approximately 5.2 miles upstream of Mason Lake Drive West	17110019	10.3	-	N	A	1983

Table 2: Flooding Sources Included in this FIS Report *(continued)*

Flooding Source	Community	Downstream Limit	Upstream Limit	HUC-8 Sub-Basin(s)	Length (mi) (streams or coastlines)	Area (mi^2) (estuaries or ponding)	Floodway (Y/N)	Zone shown on FIRM	Date of Analysis
Sherwood Creek	Mason County (Unincorporated Areas)	Confluence with Case Inlet	Outflow of Mason Lake	17110019	9.7	-	N	A	2014
Skookum Creek	Mason County (Unincorporated Areas)	Confluence with Puget Sound	Approximately 1,150 feet upstream of GD 3800 Road	17110019	10.4	-	N	A	2014
South Fork Goldsborough Creek	Mason County (Unincorporated Areas)	Confluence with Goldsborough Creek	Approximately 290 feet upstream of Gallagher Road	17110019	5.2	-	N	A	2014
South Fork Goldsborough Creek Tributary 1	Mason County (Unincorporated Areas)	Confluence with South Fork Goldsborough Creek	Approximately 1.3 miles upstream of the confluence with South Fork Goldsborough Creek	17110019	1.3	-	N	A	2014
South Fork Skokomish River	Mason County (Unincorporated Areas)	Confluence with Skokomish River	Approximately 19.7 miles upstream of USFS 2340	17110017	26.4	-	N	A	2014
Spencer Lake	Mason County (Unincorporated Areas)	Entire Shoreline	Entire Shoreline	17110019	-	0.33	N	A	2016
Star Lake	Mason County (Unincorporated Areas)	Entire Shoreline	Entire Shoreline	17100104	-	0.07	N	A	2016
Stillwater Creek	Mason County (Unincorporated Areas)	Confluence with East Fork Satsop River	Approximately 2.6 miles upstream of the confluence with East Fork Satsop River	17100104	2.6	-	N	A	1998

Table 2: Flooding Sources Included in this FIS Report *(continued)*

Flooding Source	Community	Downstream Limit	Upstream Limit	HUC-8 Sub-Basin(s)	Length (mi) (streams or coastlines)	Area (mi^2) (estuaries or ponding)	Floodway (Y/N)	Zone shown on FIRM	Date of Analysis
Stimson Creek	Mason County (Unincorporated Areas)	Confluence with Hood Canal	Approximately 0.5 miles upstream of Belfair Tahuya Rd	17110018	2.5	-	N	A	2014
Sund Creek	Mason County (Unincorporated Areas)	Confluence with Hood Canal	Approximately 3.1 miles upstream of the confluence with Hood Canal	17110018	3.1	-	N	A	2014
Tahuya River	Mason County (Unincorporated Areas)	Approximately 350 ft upstream of Belfair Tahuya Road	Mason County Boundary	17110018	9.6	-	N	A	2014
Tahuya River Tributary 1	Mason County (Unincorporated Areas)	Confluence with Tahuya River	Approximately 1,340 feet upstream of Belfair Tahuya Road	17110018	0.5	-	N	A	2014
Tahuya River Tributary 2	Mason County (Unincorporated Areas)	Confluence with Tahuya River	Approximately 3,700 feet upstream of Mountain View Dr	17110018	2.9	-	N	A	2014
Tahuya River Tributary 3	Mason County (Unincorporated Areas)	Confluence with Tahuya River	Horseshoe Drive	17110018	2.6	-	N	A	2014
Tahuya River Tributary 4	Mason County (Unincorporated Areas)	Confluence with Tahuya River	Approximately 4,500 feet upstream of Blacksmith Drive	17110018	2.9	-	N	A	2014
Tahuya River Tributary 5	Mason County (Unincorporated Areas)	Confluence with Tahuya River	Approximately 4,470 feet upstream of Bear Creek Dewatto Rd	17110018	1.9	-	N	A	2014

Table 2: Flooding Sources Included in this FIS Report *(continued)*

Flooding Source	Community	Downstream Limit	Upstream Limit	HUC-8 Sub-Basin(s)	Length (mi) (streams or coastlines)	Area (mi^2) (estuaries or ponding)	Floodway (Y/N)	Zone shown on FIRM	Date of Analysis
Tee Lake	Mason County (Unincorporated Areas)	Entire Shoreline	Entire Shoreline	17110018	-	0.07	N	A	2016
Tiger Lake	Mason County (Unincorporated Areas)	Entire Shoreline	Entire Shoreline	17110018	-	0.16	N	A	2016
Trails End Lake	Mason County (Unincorporated Areas)	Entire Shoreline	Entire Shoreline	17110019	-	0.11	N	A	2016
Trib to Lake Limerick	Mason County (Unincorporated Areas)	Entire Shoreline	Entire Shoreline	17110019	-	0.01	N	A	2016
Uncle John Creek	Mason County (Unincorporated Areas)	Confluence with Puget Sound	Approximately 570 feet upstream of Agate Loop Road	17110019	0.5	-	N	A	2014
Unnamed River	Mason County (Unincorporated Areas)	Confluence with Pickering Passage	Approximately 4,210 feet upstream of Grapeview Loop Road	17110019	2.2	-	N	A	2014
Unnamed River Tributary 1	Mason County (Unincorporated Areas)	Confluence with Unnamed River	Approximately 1.3 miles upstream of Grapeview Loop Road	17110019	2.1	-	N	A	2014
Vance Creek	Mason County (Unincorporated Areas)	Confluence with Skokomish River	Approximately 1.8 miles above Skokomish Valley Road	17110017	3.7	-	N	A	1983

Table 2: Flooding Sources Included in this FIS Report *(continued)*

Flooding Source	Community	Downstream Limit	Upstream Limit	HUC-8 Sub-Basin(s)	Length (mi) (streams or coastlines)	Area (mi^2) (estuaries or ponding)	Floodway (Y/N)	Zone shown on FIRM	Date of Analysis
Winter Creek	Mason County (Unincorporated Areas)	Confluence with North Fork Goldsborough Creek	Approximately 3.6 miles upstream of Dayton Airport Road	17110019	4.1	-	N	A	2014

Floodway widths presented in this FIS Report and on the FIRM were computed at cross sections. Between cross sections, the floodway boundaries were interpolated. For certain stream segments, floodways were adjusted so that the amount of floodwaters conveyed on each side of the floodplain would be reduced equally. The results of the floodway computations have been tabulated for selected cross sections and are shown in Table 24, "Floodway Data."

All floodways that were developed for this FIS project are shown on the FIRM using the symbology described in Figure 3. In cases where the floodway and l% annual chance floodplain boundaries are either close together or collinear, only the floodway boundary has been shown on the FIRM. For information about the delineation of floodways on the FIRM, refer to Section 6.3.

2.3 Base Flood Elevations

The hydraulic characteristics of flooding sources were analyzed to provide estimates of the elevations of floods of the selected recurrence intervals. The Base Flood Elevation (BFE) is the elevation of the 1% annual chance flood. These BFEs are most commonly rounded to the whole foot, as shown on the FIRM, but in certain circumstances or locations they may be rounded to 0.1 foot. Cross section lines shown on the FIRM may also be labeled with the BFE rounded to 0.1 foot. Whole-foot BFEs derived from engineering analyses that apply to coastal areas, areas of ponding, or other static areas with little elevation change may also be shown at selected intervals on the FIRM.

Cross sections with BFEs shown on the FIRM correspond to the cross sections shown in the Floodway Data table and Flood Profiles in this FIS Report. BFEs are primarily intended for flood insurance rating purposes. For construction and/or floodplain management purposes, users are cautioned to use the flood elevation data presented in this FIS Report in conjunction with the data shown on the FIRM.

2.4 Non-Encroachment Zones

Some States and communities use non-encroachment zones to manage floodplain development. While not a FEMA designated floodway, the non-encroachment zone represents that area around the stream that should be reserved to convey the 1% annual chance flood event.

2.5 Coastal Flood Hazard Areas

For most areas along rivers, streams, and small lakes, BFEs and floodplain boundaries are based on the amount of water expected to enter the area during a 1% annual chance flood and the geometry of the floodplain. Floods in these areas are typically caused by storm events. However, for areas on or near ocean coasts, large rivers, or large bodies of water, BFE and floodplain boundaries may need to be based on additional components, including storm surges and waves. Communities on or near ocean coasts face flood hazards caused by offshore seismic events as well as storm events.

Coastal flooding sources that are included in this FIS project are shown in Table 2.

2.5.1 Water Elevations and the Effects of Waves

Specific terminology is used in coastal analyses to indicate which components have been included in evaluating flood hazards.

The stillwater elevation (SWEL or still water level) is the surface of the water resulting from astronomical tides, storm surge, and freshwater inputs, but excluding wave setup contribution or the effects of waves.

- *Astronomical tides* are periodic rises and falls in large bodies of water caused by the rotation of the earth and by the gravitational forces exerted by the earth, moon and sun.
- *Storm surge* is the additional water depth that occurs during large storm events. These events can bring air pressure changes and strong winds that force water up against the shore.
- *Freshwater inputs* include rainfall that falls directly on the body of water, runoff from surfaces and overland flow, and inputs from rivers.

The 1% annual chance stillwater elevation is the stillwater elevation that has been calculated for a storm surge from a 1% annual chance storm. The 1% annual chance storm surge can be determined from analyses of tidal gage records, statistical study of regional historical storms, or other modeling approaches. Stillwater elevations for storms of other frequencies can be developed using similar approaches.

The total stillwater elevation (also referred to as the mean water level) is the stillwater elevation plus wave setup contribution but excluding the effects of waves.

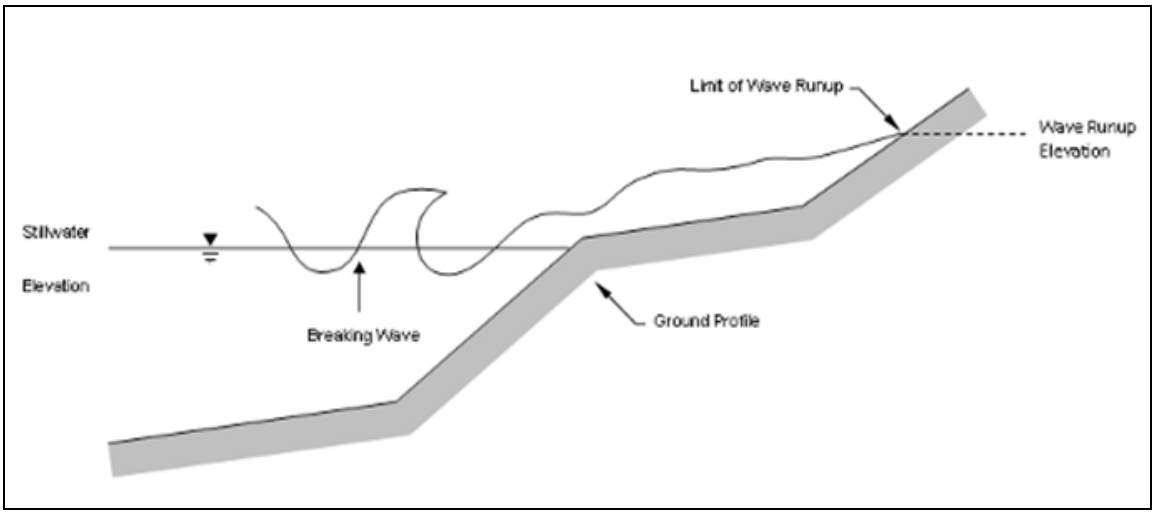
- *Wave setup* is the increase in stillwater elevation at the shoreline caused by the reduction of waves in shallow water. It occurs as breaking wave momentum is transferred to the water column.

Like the stillwater elevation, the total stillwater elevation is based on a storm of a particular frequency, such as the 1% annual chance storm. Wave setup is typically estimated using standard engineering practices or calculated using models, since tidal gages are often sited in areas sheltered from wave action and do not capture this information.

Coastal analyses may examine the effects of overland waves by analyzing storm-induced erosion, overland wave propagation, wave runup, and/or wave overtopping.

- *Overland wave propagation* describes the combined effects of variation in ground elevation, vegetation, and physical features on wave characteristics as waves move onshore.
- *Wave runup* is the uprush of water from wave action on a shore barrier. It is a function of the roughness and geometry of the shoreline at the point where the stillwater elevation intersects the land.

Figure 5: Wave Runup Transect Schematic



2.5.2 Floodplain Boundaries and BFEs for Coastal Areas

For coastal communities along the Atlantic and Pacific Oceans, the Gulf of Mexico, the Great Lakes, and the Caribbean Sea, flood hazards must take into account how storm surges, waves, and extreme tides interact with factors such as topography and vegetation. Storm surge and waves must also be considered in assessing flood risk for certain communities on rivers or large inland bodies of water.

Beyond areas that are affected by waves and tides, coastal communities can also have riverine floodplains with designated floodways, as described in previous sections.

Floodplain Boundaries

In many coastal areas, storm surge is the principle component of flooding. The extent of the 1% annual chance floodplain in these areas is derived from the total stillwater elevation (stillwater elevation including storm surge plus wave setup) for the 1% annual chance storm. The methods that were used for calculation of total stillwater elevations for coastal areas are described in Section 5.3 of this FIS Report. Location of total stillwater elevations for coastal areas are shown in Figure 8, "1% Annual Chance Total Stillwater Levels for Coastal Areas."

In some areas, the 1% annual chance floodplain is determined based on the limit of wave runup or wave overtopping for the 1% annual chance storm surge. The methods that were used for calculation of wave hazards are described in Section 5.3 of this FIS Report.

Table 26 presents the types of coastal analyses that were used in mapping the 1% annual chance floodplain in coastal areas.

Coastal BFEs

Coastal BFEs are calculated as the total stillwater elevation (stillwater elevation including storm surge plus wave setup) for the 1% annual chance storm plus the additional flood hazard from overland wave effects (storm-induced erosion, overland wave propagation, wave runup and wave overtopping).

Where they apply, coastal BFEs are calculated along transects extending from offshore to the limit of coastal flooding onshore. Results of these analyses are accurate until local topography, vegetation, or development type and density within the community undergoes major changes.

Parameters that were included in calculating coastal BFEs for each transect included in this FIS Report are presented in Table 17, "Coastal Transect Parameters." The locations of transects are shown in Figure 9, "Transect Location Map." More detailed information about the methods used in coastal analyses and the results of intermediate steps in the coastal analyses are presented in Section 5.3 of this FIS Report. Additional information on specific mapping methods is provided in Section 6.4 of this FIS Report.

2.5.3 Coastal High Hazard Areas

Certain areas along the open coast and other areas may have higher risk of experiencing structural damage caused by wave action and/or high-velocity water during the 1% annual chance flood. These areas will be identified on the FIRM as Coastal High Hazard Areas.

- *Coastal High Hazard Area (CHHA)* is a SFHA extending from offshore to the inland limit of the primary frontal dune (PFD) or any other area subject to damages caused by wave action and/or high-velocity water during the 1% annual chance flood.

- *Primary Frontal Dune (PFD)* is a continuous or nearly continuous mound or ridge of sand with relatively steep slopes immediately landward and adjacent to the beach. The PFD is subject to erosion and overtopping from high tides and waves during major coastal storms.

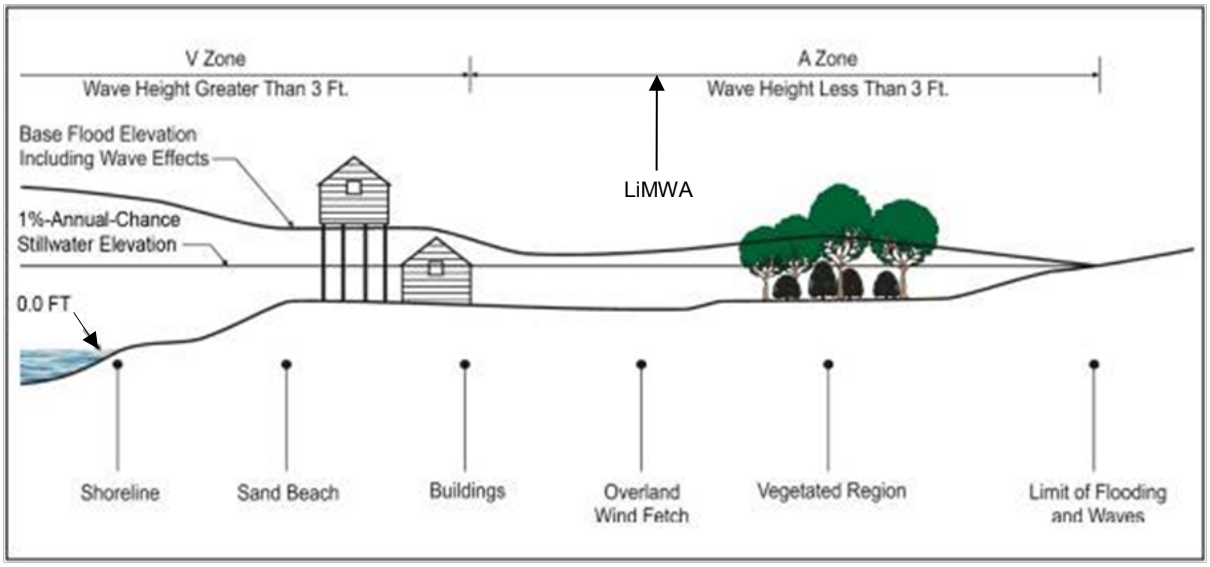
CHHAs are designated as "V" zones (for "velocity wave zones") and are subject to more stringent regulatory requirements and a different flood insurance rate structure. The areas of greatest risk are shown as VE on the FIRM. Zone VE is further subdivided into elevation zones and shown with BFEs on the FIRM.

The landward limit of the PFD occurs at a point where there is a distinct change from a relatively steep slope to a relatively mild slope; this point represents the landward extension of Zone VE. Areas of lower risk in the CHHA are designated with Zone V on the FIRM. More detailed information about the identification and designation of Zone VE is presented in Section 6.4 of this FIS Report.

Areas that are not within the CHHA but are SFHAs may still be impacted by coastal flooding and damaging waves; these areas are shown as "A" zones on the FIRM.

Figure 6, "Coastal Transect Schematic," illustrates the relationship between the base flood elevation, the 1% annual chance stillwater elevation, and the ground profile as well as the location of the Zone VE and Zone AE areas in an area without a PFD subject to overland wave propagation. This figure also illustrates energy dissipation and regeneration of a wave as it moves inland.

Figure 6: Coastal Transect Schematic



Methods used in coastal analyses in this FIS project are presented in Section 5.3 and mapping methods are provided in Section 6.4 of this FIS Report.

Coastal floodplains are shown on the FIRM using the symbology described in Figure 3, "Map Legend for FIRM." In many cases, the BFE on the FIRM is higher than the stillwater elevations shown in Table 17 due to the presence of wave effects. The higher elevation should be used for construction and/or floodplain management purposes.

2.5.4 Limit of Moderate Wave Action

This section is not applicable to this FIS project.

SECTION 3.0 – INSURANCE APPLICATIONS

3.1 National Flood Insurance Program Insurance Zones

For flood insurance applications, the FIRM designates flood insurance rate zones as described in Figure 3, "Map Legend for FIRM." Flood insurance zone designations are assigned to flooding sources based on the results of the hydraulic or coastal analyses. Insurance agents use the zones shown on the FIRM and depths and base flood elevations in this FIS Report in conjunction with information on structures and their contents to assign premium rates for flood insurance policies.

The 1% annual chance floodplain boundary corresponds to the boundary of the areas of special flood hazards (e.g. Zones A, AE, V, VE, etc.), and the 0.2% annual chance floodplain boundary corresponds to the boundary of areas of additional flood hazards.

Table 3 lists the flood insurance zones in the unincorporated and incorporated areas of Mason County.

Table 3: Flood Zone Designations by Community

Community	Flood Zone(s)
City of Shelton	A, AE, X
Mason County (Unincorporated Areas)	A, AE, AO, VE, X
Skokomish Indian Reservation	AE, X
Squaxin Island Tribe	A, AE, X

3.2 Coastal Barrier Resources System

The Coastal Barrier Resources Act (CBRA) of 1982 was established by Congress to create areas along the Atlantic and Gulf coasts and the Great Lakes, where restrictions for Federal financial assistance including flood insurance are prohibited. In 1990, Congress passed the Coastal Barrier Improvement Act (CBIA), which increased the extent of areas established by the CBRA and added "Otherwise Protected Areas" (OPA) to the system. These areas are collectively referred to as the John H. Chafee Coastal Barrier Resources System (CBRS). The CBRS boundaries that have been identified in the project area are in Table 4, "Coastal Barrier Resource System Information."

Table 4: Coastal Barrier Resources System Information

[Not Applicable to this FIS Project]

SECTION 4.0 – AREA STUDIED

4.1 Basin Description

Table 5 contains a description of the characteristics of the HUC-8 sub-basins within which each community falls. The table includes the main flooding sources within each basin, a brief description of the basin, and its drainage area.

Table 5: Basin Characteristics

HUC-8 Sub-Basin Name	HUC-8 Sub-Basin Number	Primary Flooding Source	Description of Affected Area	Drainage Area (SqMi)
Hood Canal	17110018	Hood Canal	Hood Canal covers most of Mason County's coastal flooding	808
Skokomish	17110017	Skokomish River	The Skokomish River is contained in the Skokomish Subbasin	244
Puget Sound	17110019	Puget Sound Estuary	Puget Sound Estuary covers mostly the southeastern portion of Mason County	1,020

4.2 Principal Flood Problems

Table 6 contains a description of the principal flood problems that have been noted for Mason County by flooding source.

Table 6: Principal Flood Problems

Flooding Source	Description of Flood Problems
Goldsborough Creek	Goldsborough Creek has had several peak flows in the past 30 years. On January 19, 1968, a flow of 1,430 cubic feet per second (cfs) was recorded. On January 22, 1961, the peak flow was 1,420 cfs. On January 20, 1972, the peak flow was 1,420 cfs. On January 20, 1972, a peak flow of 1,410 cfs was recorded. Shelton has experienced flooding from overflow of Goldsborough and Shelton Creeks and from high tides in Oakland Bay. Flooding from Shelton Creek has been eliminated by a USACE project, completed in 1978, that diverts flood flows into Goldsborough Creek. The diversion increases 1% annual chance peak discharge on Goldsborough Creek by less than 10 percent and does not significantly increase the depth and extent of flooding on Goldsborough Creek. Although a complete record of damaging floods on Goldsborough Creek is not available, evidence indicates that flooding occurred in 1935, 1951, 1972, and probably in 1933.
Skokomish River	The Skokomish River floods several times annually. The highest peak flow on the river occurred on November 3, 1955, at 27,000 cfs. During that flood, an estimated 5,800 cfs flowed to the overbank area south of the river channel upstream from U.S. Highway 101. The estimated return period for a flood of this magnitude is 30 years. The flood of January 20-21, 1972, had a flow of 18,500 cfs with a recurrence interval of 4 years. Yearly averages have been estimated as to probable flooding down-stream from U.S. Highway 101. These averages are 1 day in November, 3 days in both December and January, 2 days in February, and 1 day in March. Many homes, pastures, and personal property are damaged annually by smaller flows than those that occurred in 1955 and 1972.
Tahuya River	On the Tahuya River, peak flows were measured at the gaging station near Belfair on November 3, 1955 (1,210 cfs); February 22, 1949 (900 cfs); and January 5, 1954 (854 cfs). A flow of approximately 3,000 cfs occurred in December 1980. Several homes on the riverbank incurred damage, ranging from bank washouts to silt damage and shifting of a mobile home by several inches.
Union River	Peak flows on the Union River occurred on February 22, 1949 (1,610 cfs); February 9, 1951 (1,230 cfs); and January 21, 1951 (1,160 cfs). These flows were measured at the gaging station near Belfair. Through discussion of past floods with agency representatives from Mason County, it was found that the damage from the Union River was minimal. Annually the river will have high flows, yet minimal overbank flooding.

Table 7 contains information about historic flood elevations in the communities within Mason County.

Table 7: Historic Flooding Elevations

[Not Applicable to this FIS Project]

4.3 Non-Levee Flood Protection Measures

Table 8 contains information about non-levee flood protection measures within Mason County such as dams, jetties, and or dikes. Levees are addressed in Section 4.4 of this FIS Report.

Table 8: Non-Levee Flood Protection Measures

Flooding Source	Structure Name	Type of Measure	Location	Description of Measure
Shelton Creek	Diversion Structure	U.S. Geological Survey (USGS)	Seventh and Laurel Streets	Constructed in 1978 by the USACE

The berms located along the Skokomish River do not fall under the definition of levee according to the code of federal regulations, 44CFR59.1. These berms are not hydraulically significant on the 1% event.

4.4 Levees

This section is not applicable to this FIS project.

Table 9: Levees

[Not Applicable to this FIS Project]

SECTION 5.0 – ENGINEERING METHODS

For the flooding sources in the community, standard hydrologic and hydraulic study methods were used to determine the flood hazard data required for this study. Flood events of a magnitude that are expected to be equaled or exceeded at least once on the average during any 10-, 25-, 50-, 100-, or 500-year period (recurrence interval) have been selected as having special significance for floodplain management and for flood insurance rates. These events, commonly termed the 10-, 25-, 50-, 100-, and 500-year floods, have a 10-, 4-, 2-, 1-, and 0.2% annual chance, respectively, of being equaled or exceeded during any year.

Although the recurrence interval represents the long-term, average period between floods of a specific magnitude, rare floods could occur at short intervals or even within the same year. The risk of experiencing a rare flood increases when periods greater than 1 year are considered. For

example, the risk of having a flood that equals or exceeds the 100-year flood (1-percent chance of annual exceedance) during the term of a 30-year mortgage is approximately 26 percent (about 3 in 10); for any 90-year period, the risk increases to approximately 60 percent (6 in 10). The analyses reported herein reflect flooding potentials based on conditions existing in the community at the time of completion of this study. Maps and flood elevations will be amended periodically to reflect future changes.

The engineering analyses described here incorporate the results of previously issued Letters of Map Change (LOMCs) listed in Table 27, "Incorporated Letters of Map Change", which include Letters of Map Revision (LOMRs). For more information about LOMRs, refer to Section 6.5, "FIRM Revisions."

5.1 Hydrologic Analyses

Hydrologic analyses were carried out to establish the peak elevation-frequency relationships for floods of the selected recurrence intervals for each flooding source studied. Hydrologic analyses are typically performed at the watershed level. Depending on factors such as watershed size and shape, land use and urbanization, and natural or man-made storage, various models or methodologies may be applied. A summary of the hydrologic methods applied to develop the discharges used in the hydraulic analyses for each stream is provided in Table 13. Greater detail (including assumptions, analysis, and results) is available in the archived project documentation.

A summary of the discharges is provided in Table 10. Frequency Discharge-Drainage Area Curves used to develop the hydrologic models may also be shown in Figure 7 for selected flooding sources. A summary of stillwater elevations developed for non-coastal flooding sources is provided in Table 11. (Coastal stillwater elevations are discussed in Section 5.3 and shown in Table 17.) Stream gage information is provided in Table 12.

Table 10: Summary of Discharges

Flooding Source	Location	Drainage Area (Square Miles)	Peak Discharge (cfs)				
			10% Annual Chance	4% Annual Chance	2% Annual Chance	1% Annual Chance	0.2% Annual Chance
Coffee Creek	Confluence with Goldsborough Creek	5.04	495	*	680	765	950
Goldsborough Creek	Below confluence with Coffee Creek	49.1	1,850	*	2,520	2,795	3,450
Goldsborough Creek	Confluence with Puget Sound	50.7	1,965	*	2,660	2,935	3,585
Skokomish River	Confluence with Hood Canal	236.9	26,900	*	33,500	36,000	41,000
Tahuya River	300 Feet downstream of North Shore Road	47.5	4,965	*	6,390	6,900	8,195
Union River	Confluence with Hood Canal	25.5	1,940	*	2,605	2,785	3,415

Figure 7: Frequency Discharge-Drainage Area Curves

[Not Applicable to this FIS Project]

Table 11: Summary of Non-Coastal Stillwater Elevations

[Not Applicable to this FIS Project]

Table 12: Stream Gage Information used to Determine Discharges

Flooding Source	Gage Identifier	Agency that Maintains Gage	Site Name	Drainage Area (Square Miles)	Period of Record	
					From	To
Dewatto River near Dewatto, Washington	12068500	USGS	USGS gage on Dewatto River near Dewatto, Washington	18.4	10/19/1947	12/20/1994
East Fork Satsop near Elma, Washington	12034200	USGS	USGS gage on East Fork Satsop near Elma, Washington	65.9	1/17/1958	12/26/1972
Goldsborough Creek near Shelton, Washington	12076500	USGS	USGS gage on Goldsborough Creek near Shelton, Washington	39.3	1/31/1952	3/4/1979
Kennedy Creek near Kamilche, Washington	12078400	USGS	USGS gage on Kennedy Creek near Kamilche, Washington	17.4	2/21/1961	1/31/1993
North Fork Skokomish River near Hoodsport, Washington	12057500	USGS	USGS gage on North Fork Skokomish River near Hoodsport, Washington	93.7	1/6/1914	10/3/1929
North Fork Skokomish River near Potlatch, Washington	12059500	USGS	USGS gage on North Fork Skokomish River near Potlatch, Washington	117	2/7/1945	11/23/2011
South Fork Skokomish River near Union, Washington	12060500	USGS	USGS gage on South Fork Skokomish River near Union, Washington	76.3	2/26/1932	11/23/2011
Tahuya River near Belfair, Washington	12067500	USGS	USGS gage on Tahuya River near Belfair, Washington	15	4/11/1946	11/3/1955

Table 12: Stream Gage Information used to Determine Discharges (*continued*)

Flooding Source	Gage Identifier	Agency that Maintains Gage	Site Name	Drainage Area (Square Miles)	Period of Record	
					From	To
Union River near Belfair, Washington	12063500	USGS	USGS gage on Union River near Belfair, Washington	19.8	10/19/1947	4/30/1959

5.2 Hydraulic Analyses

Analyses of the hydraulic characteristics of flooding from the sources studied were carried out to provide estimates of the elevations of floods of the selected recurrence intervals. Base flood elevations on the FIRM represent the elevations shown on the Flood Profiles and in the Floodway Data tables in the FIS Report. Rounded whole-foot elevations may be shown on the FIRM in coastal areas, areas of ponding, and other areas with static base flood elevations. These whole-foot elevations may not exactly reflect the elevations derived from the hydraulic analyses. Flood elevations shown on the FIRM are primarily intended for flood insurance rating purposes. For construction and/or floodplain management purposes, users are cautioned to use the flood elevation data presented in this FIS Report in conjunction with the data shown on the FIRM. The hydraulic analyses for this FIS were based on unobstructed flow. The flood elevations shown on the profiles are thus considered valid only if hydraulic structures remain unobstructed, operate properly, and do not fail.

For streams for which hydraulic analyses were based on cross sections, locations of selected cross sections are shown on the Flood Profiles (Exhibit 1). For stream segments for which a floodway was computed (Section 6.3), selected cross sections are also listed on Table 24, “Floodway Data.”

A summary of the methods used in hydraulic analyses performed for this project is provided in Table 13. Roughness coefficients are provided in Table 14. Roughness coefficients are values representing the frictional resistance water experiences when passing overland or through a channel. They are used in the calculations to determine water surface elevations. Greater detail (including assumptions, analysis, and results) is available in the archived project documentation.

Table 13: Summary of Hydrologic and Hydraulic Analyses

Flooding Source	Study Limits		Hydrologic Model or Method Used	Hydraulic Model or Method Used	Date Analyses Completed	Flood Zone on FIRM	Special Considerations
	Downstream Limit	Upstream Limit					
Coffee Creek	Confluence with Goldsborough Creek	Approximately 1,520 feet upstream of West Deegan Road	HEC-1	HEC-2	12/08/1998	AE with Floodway	Redelineated for this flood risk project
Goldsborough Creek	Approximately 950 feet downstream of a Wooden Foot Bridge	Approximately 900 feet, upstream of U.S. Highway 101	Statistical Analysis of gage records	HEC-2	06/01/1983	AE with Floodway	Redelineated for this flood risk project
Puget Sound	Approximately 550 feet south of Rocky Point Lane in Mason County	Approximately 200 feet north of U.S. Highway 101 in Mason County	ADCIRC (2003)	RUN-UP	06/16/2014	AE,VE	
Skokomish River	Approximately 4,320 feet downstream of State Route 106	Approximately 19,000 feet upstream of U.S Highway 101	HEC-1	HEC-RAS 3.1.1 and up	06/16/2014	AE with Floodway	Floodway was developed based on SRH- 2D model for 100-500 year flooding events.
Tahuya River	300 Feet downstream of North Shore Road	Approximately 330 feet upstream of Haven Way	HEC-1	HEC-2	12/08/1998	AE with Floodway	Redelineated for this flood risk project
Union River	Confluence with Hood Canal	Mason County and Kitsap County boundary	HEC-1	HEC-2	12/08/1998	AE with Floodway	Redelineated for this flood risk project
Anderson Lake	Entire Shoreline	Entire Shoreline	HEC-HMS 4.1	HEC-HMS 4.1	4/13/2016	A	Effects of hydraulic structures were not considered in the model
Lake Arrowhead	Entire Shoreline	Entire Shoreline	HEC-HMS 4.1	HEC-HMS 4.1	4/13/2016	A	Effects of hydraulic structures were not considered in the model

Table 13: Summary of Hydrologic and Hydraulic Analyses *(continued)*

Flooding Source	Study Limits		Hydrologic Model or Method Used	Hydraulic Model or Method Used	Date Analyses Completed	Flood Zone on FIRM	Special Considerations
	Downstream Limit	Upstream Limit					
Big Timberlake	Entire Shoreline	Entire Shoreline	HEC-HMS 4.1	HEC-HMS 4.1	4/13/2016	A	Effects of hydraulic structures were not considered in the model
Bingham Creek	Confluence with East Fork Satsop River	Approximately 12.6 miles upstream of confluence with East Fork Satsop River	Other	HEC-2	12/8/1998	A	
Campbell Creek	Confluence with Puget Sound	Approximately 6.0 miles upstream of confluence with Puget Sound	Regression Equations	HECRAS 4.1	6/16/2014	A	Effects of hydraulic structures were not considered in the model
Catfish Lake	Entire Shoreline	Entire Shoreline	Regression Equations	HECRAS 4.1	6/16/2014	A	Effects of hydraulic structures were not considered in the model
Clark Creek	Confluence with Hood Canal	Approximately 1.9 miles upstream of confluence with Hood Canal	Regression Equations	HECRAS 4.1	6/16/2014	A	Effects of hydraulic structures were not considered in the model
Cloquallum Creek	Mason County Boundary	Approximately 3,600 feet upstream of GD 3300 Road	Regression Equations	HECRAS 4.1	6/16/2014	A	Effects of hydraulic structures were not considered in the model
Cloquallum Creek Tributary 3	Confluence with Cloquallum Creek	Outflow of Star Lake	Regression Equations	HECRAS 4.1	6/16/2014	A	Effects of hydraulic structures were not considered in the model
Cloquallum Creek Tributary 3.1	Confluence with Cloquallum Creek	Confluence with Cloquallum Creek Tributary 3	Regression Equations	HECRAS 4.1	6/16/2014	A	Effects of hydraulic structures were not considered in the model

Table 13: Summary of Hydrologic and Hydraulic Analyses *(continued)*

Flooding Source	Study Limits		Hydrologic Model or Method Used	Hydraulic Model or Method Used	Date Analyses Completed	Flood Zone on FIRM	Special Considerations
	Downstream Limit	Upstream Limit					
Coffee Creek	Approximately 1,750 feet above Deegan Rd W	Shelton Valley Road	Other	HEC-2	12/8/1998	A	
Coulter Creek	Confluence with Case Inlet	Approximately 2,565 feet upstream of the confluence with Coulter Creek Tributary 2	Regression Equations	HECRAS 4.1	6/16/2014	A	Effects of hydraulic structures were not considered in the model
Coulter Creek Tributary 1	Confluence with Coulter Creek	Approximately 1,900 feet upstream of Coulter Creek Road	Regression Equations	HECRAS 4.1	6/16/2014	A	Effects of hydraulic structures were not considered in the model
Coulter Creek Tributary 2	Confluence with Coulter Creek	Approximately 55 feet upstream of Odessa Place	Regression Equations	HECRAS 4.1	6/16/2014	A	Effects of hydraulic structures were not considered in the model
Cranberry Creek	Confluence with Puget Sound	Approximately 4,245 feet upstream of Cranberry Lake	Regression Equations	HECRAS 4.1	6/16/2014	A	Effects of hydraulic structures were not considered in the model
Cranberry Creek Tributary 1	Confluence with Cranberry Creek	Approximately 2,830 feet upstream of Limerick Road	Regression Equations	HECRAS 4.1	6/16/2014	A	Effects of hydraulic structures were not considered in the model
Cranberry Creek Tributary 2	Confluence with Cranberry Creek	Approximately 5,500 feet upstream of St. Andrews Rd N	Regression Equations	HECRAS 4.1	6/16/2014	A	Effects of hydraulic structures were not considered in the model
Danny Walker Creek	Confluence with Cranberry Creek	Approximately 5,500 feet upstream of St. Andrews Rd N	Other	HEC-2	12/8/1998	A	

Table 13: Summary of Hydrologic and Hydraulic Analyses *(continued)*

Flooding Source	Study Limits		Hydrologic Model or Method Used	Hydraulic Model or Method Used	Date Analyses Completed	Flood Zone on FIRM	Special Considerations
	Downstream Limit	Upstream Limit					
Decker Creek	Confluence with East Fork Satsop River	Approximately 2 miles upstream of Deckerville Rd	Regression Equations	HECRAS 4.1	6/16/2014	A	Effects of hydraulic structures were not considered in the model
Deer Creek	Confluence with Puget Sound	Approximately 3,215 feet upstream of Mason Benson Road	Regression Equations	HECRAS 4.1	6/16/2014	A	Effects of hydraulic structures were not considered in the model
Deer Creek Tributary	Confluence with Deer Creek	Approximately 3,980 feet upstream of GD 2100 Road	Regression Equations	HECRAS 4.1	6/16/2014	A	Effects of hydraulic structures were not considered in the model
Devereaux Lake	Entire Shoreline	Entire Shoreline	Regression Equations	HECRAS 4.1	6/16/2014	A	Effects of hydraulic structures were not considered in the model
Dewatto River	Confluence with Hood Canal	Mason County boundary	Gage Analysis	HECRAS 4.1	6/16/2014	A	Effects of hydraulic structures were not considered in the model
Dewatto River Tributary 1	Confluence with Dewatto River	Approximately 1,375 feet upstream of Dewatto Holly Rd	Regression Equations	HECRAS 4.1	6/16/2014	A	Effects of hydraulic structures were not considered in the model
Dry Bed Creek	Confluence with Decker Creek	Approximately 300 feet upstream of Beeville Road	Regression Equations	HECRAS 4.1	6/16/2014	A	Effects of hydraulic structures were not considered in the model
Dry Creek	Confluence with Dry Bed Creek	Approximately 70 feet upstream of GD 1800 Road	Other	HEC-2	12/8/1998	A	
Dry Run Creek	Confluence with East Fork Satsop River	Satsop Cloquallum Road	Regression Equations	HECRAS 4.1	6/16/2014	A	Effects of hydraulic structures were not considered in the model

Table 13: Summary of Hydrologic and Hydraulic Analyses *(continued)*

Flooding Source	Study Limits		Hydrologic Model or Method Used	Hydraulic Model or Method Used	Date Analyses Completed	Flood Zone on FIRM	Special Considerations
	Downstream Limit	Upstream Limit					
East Fork Satsop River	Mason County boundary	Confluence with Stillwater Creek and Phillips Creek	Gage Analysis	HECRAS 4.1	6/16/2014	A	Effects of hydraulic structures were not considered in the model
Fawn Lake	Entire Shoreline	Entire Shoreline	HEC-HMS 4.1	HEC-HMS 4.1	4/13/2016	A	Effects of hydraulic structures were not considered in the model
Finch Creek	Confluence with Hood Canal	Approximately 3,315 feet upstream of Finch Creek Road	Regression Equations	Other	6/16/2014	A	Effects of hydraulic structures were not considered in the model
Goldsborough Creek	Approximately 980 feet upstream of US Highway 101	Little Egypt Road	Gage Analysis	HECRAS 4.1	6/1620/14	A	Effects of hydraulic structures were not considered in the model
Gosnell Creek	Outflow of Isabella Lake	Approximately 4.9 miles upstream of Badger Lane	Regression Equations	HECRAS 4.1	6/16/2014	A	Effects of hydraulic structures were not considered in the model
Haven Lake	Entire Shoreline	Entire Shoreline	HEC-HMS 4.1	HEC-HMS 4.1	4/13/2016	A	Effects of hydraulic structures were not considered in the model
Hamma Hamma River	Confluence with Puget Sound	Approximately 7 miles upstream of USFS 2480	HEC1	HEC2	5/1983	A	Effects of hydraulic structures were not considered in the model
Hiawata Creek	Confluence with Pickering Passage	Approximately 1.7 miles upstream of Island View Road	Regression Equations	HECRAS 4.1	6/16/2014	A	Effects of hydraulic structures were not considered in the model
Isabella Lake	Entire Shoreline	Entire Shoreline	HEC-HMS 4.1	HEC-HMS 4.1	4/13/2016	A	Effects of hydraulic structures were not considered in the model
Island Lake	Entire Shoreline	Entire Shoreline	HEC-HMS 4.1	HEC-HMS 4.1	4/13/2016	A	Effects of hydraulic structures were not considered in the model

Table 13: Summary of Hydrologic and Hydraulic Analyses *(continued)*

Flooding Source	Study Limits		Hydrologic Model or Method Used	Hydraulic Model or Method Used	Date Analyses Completed	Flood Zone on FIRM	Special Considerations
	Downstream Limit	Upstream Limit					
Jarrell Creek	Confluence with Pickering Passage	Approximately 5,035 feet upstream of Thornton Road	Regression Equations	HECRAS 4.1	6/16/2014	A	Effects of hydraulic structures were not considered in the model
Jefferson Creek	Confluence with Hamma Hamma River	Approximately 445 feet upstream of USFS 2401	Other	HEC-2	12/8/1998	A	
Johns Creek	Confluence with Puget Sound	Approximately 60 feet downstream of Melissa Lane	Regression Equations	HECRAS 4.1	6/16/2014	A	Effects of hydraulic structures were not considered in the model
Kennedy Creek	Coastal	Mason County boundary	Other	HEC-2	12/8/1998	A	
Lake Limerick	Entire Shoreline	Entire Shoreline	HEC-HMS 4.1	HEC-HMS 4.1	4/13/2016	A	Effects of hydraulic structures were not considered in the model
Little Mission Creek	Confluence with Hood Canal	Approximately 2.2 miles upstream of North Shore Road	Regression Equations	Other	6/16/2014	A	Effects of hydraulic structures were not considered in the model
Lost Lake	Entire Shoreline	Entire Shoreline	N/A	N/A	6/16/2014	A	Redlineation based on using 2003 PSLC
Mason Lake	Entire Shoreline	Entire Shoreline	HEC-HMS 4.1	HEC-HMS 4.1	4/13/2016	A	Effects of hydraulic structures were not considered in the model
Malaney Creek	Confluence with Puget Sound	Approximately 875 feet downstream of Spencer Lake Road	Regression Equations	HECRAS 4.1	6/16/2014	A	Effects of hydraulic structures were not considered in the model

Table 13: Summary of Hydrologic and Hydraulic Analyses *(continued)*

Flooding Source	Study Limits		Hydrologic Model or Method Used	Hydraulic Model or Method Used	Date Analyses Completed	Flood Zone on FIRM	Special Considerations
	Downstream Limit	Upstream Limit					
Middle Fork Satsop River	Confluence with Rabbit Creek	Approximately 6.9 miles above the confluence with Rabbit Creek	HEC-1	HEC-2	5/1983	A	Effects of hydraulic structures were not considered in the model
Mill Creek	Confluence with Puget Sound	Outflow of Isabella Lake	Regression Equations	HECRAS 4.1	6/16/2014	A	Effects of hydraulic structures were not considered in the model
Miller Creek	Confluence with Hood Canal	Approximately 3.3 miles above US Highway 101	Regression Equations	HECRAS 4.1	6/16/2014	A	Effects of hydraulic structures were not considered in the model
Mission Creek	Confluence with Hood Canal	Mason County boundary	Regression Equations	HECRAS 4.1	6/16/2014	A	Effects of hydraulic structures were not considered in the model
Nahwatzel Lake	Entire Shoreline	Entire Shoreline	Regression Equations	Other	6/16/2014	A	Effects of hydraulic structures were not considered in the model
North Fork Goldsborough Creek	Confluence with Goldsborough Creek	Approximately 1 mile upstream of the confluence with Winter Creek	Other	HEC-2	6/16/2014	A	
North Fork Skokomish River	Confluence with Skokomish River	Approximately 6 miles upstream of Foustream Road	Regression Equations	HECRAS 4.1	4/13/2016	A	Effects of hydraulic structures were not considered in the model
Phillips Creek	Confluence with East Fork Satsop River	Approximately 2.3 miles upstream of the confluence with East Fork Satsop River	Other	HEC-2	12/8/1998	A	

Table 13: Summary of Hydrologic and Hydraulic Analyses *(continued)*

Flooding Source	Study Limits		Hydrologic Model or Method Used	Hydraulic Model or Method Used	Date Analyses Completed	Flood Zone on FIRM	Special Considerations
	Downstream Limit	Upstream Limit					
Purdy Creek	Confluence with Skokomish River	Approximately 1,675 feet upstream of US Highway 101	Regression Equations	HECRAS 4.1	6/16/2014	A	Effects of hydraulic structures were not considered in the model
Rabbit Creek	Confluence with Middle Fork Satsop River	Approximately 1.2 miles upstream of Beeville Loop Road	Other	HEC-2	12/8/1998	A	
Rendsland Creek	Confluence with Hood Canal	Approximately 1.1 miles upstream of North Shore Road	Regression Equations	HECRAS 4.1	6/16/2014	A	Effects of hydraulic structures were not considered in the model
Rock Creek	Confluence with Gosnell Creek	Approximately 2.3 miles upstream of Cloquallum Road	Regression Equations	HECRAS 4.1	6/16/2014	A	Effects of hydraulic structures were not considered in the model
Schumacher Creek	Outflow of Mason Lake	Approximately 5.2 miles upstream of Mason Lake Drive West	Regression Equations	HECRAS 4.1	6/16/2014	A	Effects of hydraulic structures were not considered in the model
Sherwood Creek	Confluence with Case Inlet	Outflow of Mason Lake	HEC-1	HEC-2	5/1983	A	Effects of hydraulic structures were not considered in the model
Skookum Creek	Confluence with Puget Sound	Approximately 1,150 feet upstream of GD 3800 Road	Regression Equations	HECRAS 4.1	6/16/2014	A	Effects of hydraulic structures were not considered in the model
South Fork Goldsborough Creek	Confluence with Goldsborough Creek	Approximately 290 feet upstream of Gallagher Road	Regression Equations	HECRAS 4.1	6/16/2014	A	Effects of hydraulic structures were not considered in the model

Table 13: Summary of Hydrologic and Hydraulic Analyses *(continued)*

Flooding Source	Study Limits		Hydrologic Model or Method Used	Hydraulic Model or Method Used	Date Analyses Completed	Flood Zone on FIRM	Special Considerations
	Downstream Limit	Upstream Limit					
South Fork Goldsborough Creek Tributary 1	Confluence with South Fork Goldsborough Creek	Approximately 1.3 miles upstream of the confluence with South Fork Goldsborough Creek	Regression Equations	HECRAS 4.1	6/16/2014	A	Effects of hydraulic structures were not considered in the model
South Fork Skokomish River	Confluence with Skokomish River	Approximately 19.7 miles upstream of USFS 2340	Gage Analysis	HECRAS 4.1	6/16/2014	A	Effects of hydraulic structures were not considered in the model
Spencer Lake	Entire Shoreline	Entire Shoreline	HEC-HMS 4.1	HEC-HMS 4.1	4/13/2016	A	Effects of hydraulic structures were not considered in the model
Star Lake	Entire Shoreline	Entire Shoreline	HEC-HMS 4.1	HEC-HMS 4.1	4/13/2016	A	Effects of hydraulic structures were not considered in the model
Stillwater Creek	Confluence with East Fork Satsop River	Approximately 2.6 miles upstream of the confluence with East Fork Satsop River	Other	HEC-2	12/8/1998	A	
Stimson Creek	Confluence with Hood Canal	Approximately 0.5 miles upstream of Belfair Tahuya Rd	Regression Equations	Other	6/16/2014	A	Effects of hydraulic structures were not considered in the model
Sund Creek	Confluence with Hood Canal	Approximately 3.1 miles upstream of the confluence with Hood Canal	Regression Equations	HECRAS 4.1	6/16/2014	A	Effects of hydraulic structures were not considered in the model

Table 13: Summary of Hydrologic and Hydraulic Analyses *(continued)*

Flooding Source	Study Limits		Hydrologic Model or Method Used	Hydraulic Model or Method Used	Date Analyses Completed	Flood Zone on FIRM	Special Considerations
	Downstream Limit	Upstream Limit					
Tahuya River	Approximately 350 ft upstream of Belfair Tahuya Road	Mason County boundary	Gage Analysis	HECRAS 4.1	6/16/2014	A	Effects of hydraulic structures were not considered in the model
Tahuya River Tributary 1	Confluence with Tahuya River	Approximately 1,340 feet upstream of Belfair Tahuya Road	Regression Equations	HECRAS 4.1	6/16/2014	A	Effects of hydraulic structures were not considered in the model
Tahuya River Tributary 2	Confluence with Tahuya River	Approximately 3,700 feet upstream of Mountain View Drive	Regression Equations	HECRAS 4.1	6/16/2014	A	Effects of hydraulic structures were not considered in the model
Tahuya River Tributary 3	Confluence with Tahuya River	Horseshoe Drive	Regression Equations	HECRAS 4.1	6/16/2014	A	Effects of hydraulic structures were not considered in the model
Tahuya River Tributary 4	Confluence with Tahuya River	Approximately 4,500 feet upstream of Blacksmith Drive	Regression Equations	HECRAS 4.1	6/16/2014	A	Effects of hydraulic structures were not considered in the model
Tahuya River Tributary 5	Confluence with Tahuya River	Approximately 4,470 feet upstream of Bear Creek Dewatto Road	Regression Equations	HECRAS 4.1	6/16/2014	A	Effects of hydraulic structures were not considered in the model
Tee Lake	Entire Shoreline	Entire Shoreline	HEC-HMS 4.1	HEC-HMS 4.1	4/13/2016	A	Effects of hydraulic structures were not considered in the model
Tiger Lake	Entire Shoreline	Entire Shoreline	HEC-HMS 4.1	HEC-HMS 4.1	4/13/2016	A	Effects of hydraulic structures were not considered in the model
Trails End Lake	Entire Shoreline	Entire Shoreline	HEC-HMS 4.1	HEC-HMS 4.1	4/13/2016	A	Effects of hydraulic structures were not considered in the model
Trib to Lake Limerick	Entire Shoreline	Entire Shoreline	HEC-HMS 4.1	HEC-HMS 4.1	4/13/2016	A	Effects of hydraulic structures were not considered in the model

Table 13: Summary of Hydrologic and Hydraulic Analyses *(continued)*

Flooding Source	Study Limits		Hydrologic Model or Method Used	Hydraulic Model or Method Used	Date Analyses Completed	Flood Zone on FIRM	Special Considerations
	Downstream Limit	Upstream Limit					
Uncle John Creek	Confluence with Puget Sound	Approximately 570 feet upstream of Agate Loop Road	Regression Equations	HECRAS 4.1	6/16/2014	A	Effects of hydraulic structures were not considered in the model
Unnamed River	Confluence with Pickering Passage	Approximately 4,210 feet upstream of Grapeview Loop Road	Regression Equations	HECRAS 4.1	6/16/2014	A	Effects of hydraulic structures were not considered in the model
Unnamed River Tributary 1	Confluence with Unnamed River	Approximately 1.3 miles upstream of Grapeview Loop Road	Regression Equations	HECRAS 4.1	6/16/2014	A	Effects of hydraulic structures were not considered in the model
Vance Creek	Confluence with Skokomish River	Approximately 1.8 miles above Skokomish Valley Road	HEC-1	HEC-2	5/1983	A	Effects of hydraulic structures were not considered in the model
Winter Creek	Confluence with North Fork Goldsborough Creek	Approximately 3.6 miles upstream of Dayton Airport Road	Regression Equations	HECRAS 4.1	6/16/2014	A	Effects of hydraulic structures were not considered in the model

Table 14: Roughness Coefficients

Flooding Source	Channel "n"	Overbank "n"
Coffee Creek	0.020 – 0.052	0.065 – 0.110
Goldsborough Creek	0.045 – 0.052	0.075 – 0.110
Skokomish River	0.030 – 0.045	0.045 – 0.120
Tahuya River	0.033 – 0.062	0.057 – 0.115
Union River	0.035 – 0.115	0.044 – 0120

5.3 Coastal Analyses

For the areas of Mason County that are impacted by coastal flooding processes, coastal flood hazard analyses were performed to provide estimates of coastal BFEs. Coastal BFEs reflect the increase in water levels during a flood event due to extreme tides and storm surge as well as overland wave effects.

The following subsections provide summaries of how each coastal process was considered for this FIS Report. Greater detail (including assumptions, analysis, and results) is available in the archived project documentation. Table 15 summarizes the methods and/or models used for the coastal analyses. Refer to Section 2.5.1 for descriptions of the terms used in this section.

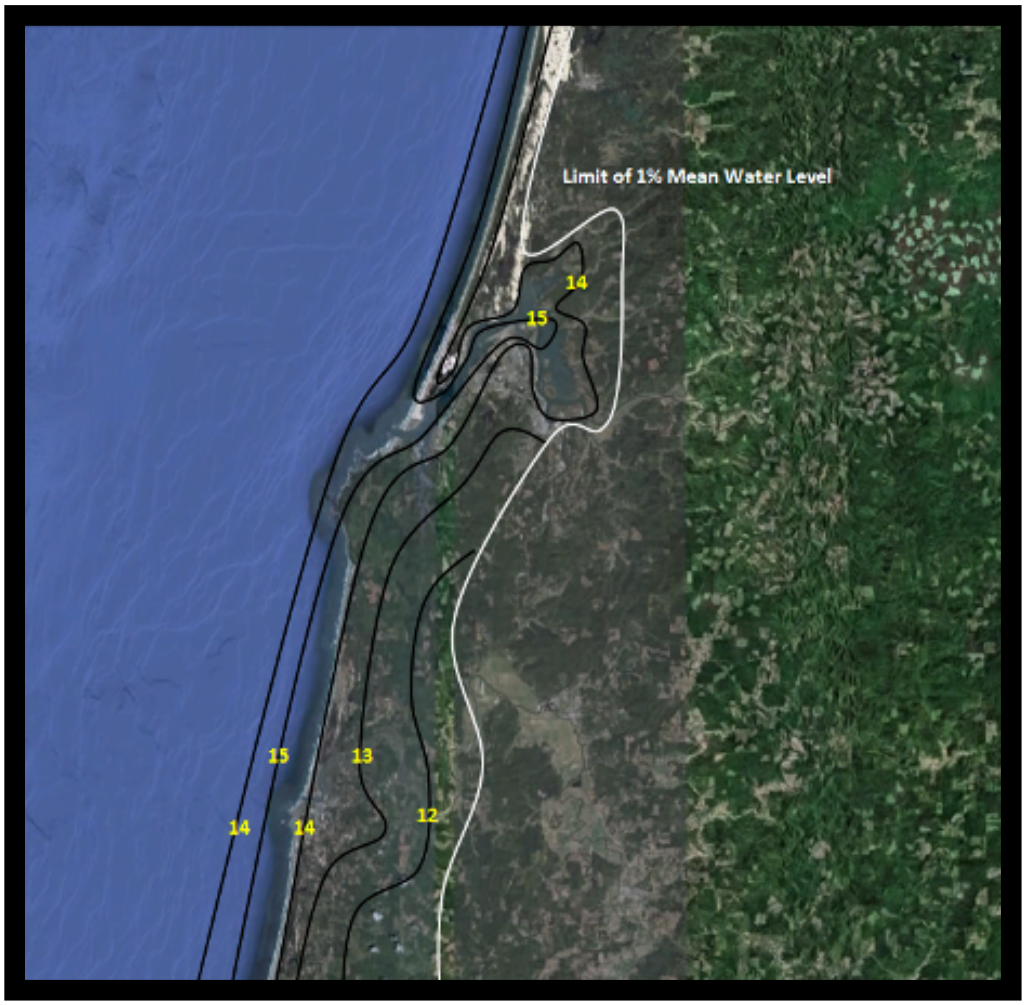
Table 15: Summary of Coastal Analyses

Flooding Source	Study Limits		Hazard Evaluated	Model or Method Used	Date Analysis was Completed
	From	To			
Case Inlet	Approximately 560 feet south of State Route 302	Approximately 2,250 feet south of Linburg Lane	AE,VE	ADCIRC (2003)	11/01/2012
Hood Canal	Approximately 275 feet southeast of State Route 101	Approximately 3,660 feet west of Forest Spring Road	AE,VE	ADCIRC (2003)	11/01/2012
Peale Passage	Approximately 5,060 feet southeast of Pickering Road	Approximately 530 feet west of Dana Drive	AE	ADCIRC (2003)	11/01/2012
Pickering Passage	Approximately 275 feet south from Grapeview Loop Road	Approximately 1,130 feet southeast of Scott Drive	AE,VE	ADCIRC (2003)	11/01/2012
Puget Sound	Approximately 1,130 feet southeast of Scott Drive	Approximately 2,420 feet north of U.S. Highway 101	AE,VE	ADCIRC (2003)	11/01/2012

5.3.1 Total Stillwater Elevations

The total stillwater elevations (stillwater including storm surge plus wave setup) for the 1% annual chance flood were determined for areas subject to coastal flooding. The models and methods that were used to determine storm surge and wave setup are listed in Table 15. The stillwater elevation that was used for each transect in coastal analyses is shown in Table 17, "Coastal Transect Parameters." Figure 8 shows the total stillwater elevations for the 1% annual chance flood that was determined for this coastal analysis.

Figure 8: 1% Annual Chance Total Stillwater Elevations for Coastal Areas



Astronomical Tide

Astronomical tidal statistics were generated directly from local tidal constituents by sampling the predicted tide at random times throughout the tidal epoch.

Storm Surge Statistics

Storm surge is modeled based on characteristics of actual storms responsible for significant coastal flooding. The characteristics of these storms are typically determined by statistical study of the regional historical record of storms or by statistical study of tidal gages.

When historic records are used to calculate storm surge, characteristics such as the strength, size,

track, etc., of storms are identified by site. Storm data was used in conjunction with numerical hydrodynamic models to determine the corresponding storm surge levels. An extreme value analysis was performed on the storm surge modeling results to determine a stillwater elevation for the 1% annual chance event.

The tidal circulation model (ADCIRC) simulations were used to predict water levels for this study. A total of 150 events were selected for simulation. These events were selected based on the highest 150 water levels at the Seattle NOAA gage station between 1959 and 2010. Concurrent data from Neah Bay was used as the boundary input for each ADCIRC simulation. For each selected event the total duration was approximately 10 days. The peak water levels from each storm were extracted at each transect and statistically analyzed to determine 1%-annual-chance flood surge elevations.

Combined Riverine and Tidal Effects

Riverine and surge rates for the lower reaches of the Inundation River were combined by developing curves for rate of occurrence vs. flood level for each flood source.

Wave Setup Analysis

Wave setup was computed during the storm surge modeling through the methods and models listed in Table 15 and included in the frequency analysis for the determination of the total stillwater elevations. The oscillating component of wave setup, dynamic wave setup, was calculated for areas subject to wave runup hazards.

Table 16: Tide Gage Analysis Specifics

[Not Applicable to this FIS Project]

5.3.2 Waves

In Mason County, an unstructured wave model grid was created. The grid covers the southern portion of the Puget Sound. A total of 150 potential flooding events which correspond to the same time period as the events selected for water level analysis were simulated using the Simulating Waves Nearshore (SWAN) wave model [2]. The primary inputs at each time step were: water level, wind speed and wind direction. Model outputs (significant wave height, spectral wave period, mean wave direction, etc.) were saved at points along each transect.

5.3.3 Wave Hazard Analyses

Overland wave hazards were evaluated to determine the combined effects of ground elevation, vegetation, and physical features on overland wave propagation and wave runup. These analyses were performed at representative transects along all shorelines for which waves were expected to be present during the floods of the selected recurrence intervals. The results of these analyses were used to determine elevations for the 1% annual chance flood.

Transect locations were chosen with consideration given to the physical land characteristics as well as development type and density so that they would closely represent conditions in their locality. Additional consideration was given to changes in the total stillwater elevation. Transects were spaced close together in areas of complex topography and dense development or where total stillwater elevations varied. In areas having more uniform characteristics, transects were spaced at larger intervals. Transects shown in Figure 9, “Transect Location Map,” are also

depicted on the FIRM. Table 17 provides the location, stillwater elevations, and starting wave conditions for each transect evaluated for overland wave hazards. In this table, "starting" indicates the parameter value at the beginning of the transect.

Peaks-over-threshold (POT) analyses were performed on flood elevations (i.e., total water levels, TWLs) resulting from flood-producing events occurring over the period 1959 – 2010. The POT analyses were conducted at 25 cross-shore transects. The flood events were hindcast using state-of-the-art numerical modeling tools. The POT method consists of analyzing TWLs exceeding some high threshold, over the hindcast period. Exceedances over sufficiently high thresholds follow a generalized Pareto distribution, from which return periods can be inferred.

Flooding in Mason County is governed by a combination of different physical processes. The severity of flooding experienced is dependent on the magnitude of local storm winds, the tidal elevations coincident with storm conditions, et cetera.

For the above reasons, it not always possible to tell a priori which meteorological or hydrological event produces the largest TWL. The workaround is to hindcast a large number of events, carefully selected to adequately populate the multidimensional sample space. In Mason County, a set of 150 events were selected based on the highest wind speeds over the period of record. The flooding resulting from these 150 events were modeled using a wave model, and one-dimensional transect-based empirical wave setup and wave runup formulae.

The wave conditions saved at each transect, in conjunction with the water level coincident with the wave conditions, were used to compute wave runup on the transects. TWLs were computed at hourly intervals over the duration of each event. The definition of event duration was for the length of the entire storm except for the first 24 hours of the storm in which waves are still building. The maximum TWLs for each storm event were saved at each transect. At each transect, the TWLs were fit to the generalized Pareto distribution in order to determine flood elevations for the 1% annual chance event.

Table 17: Coastal Transect Parameters

Flood Source	Coastal Transect	Starting Wave Conditions for the 1% Annual Chance		Starting Stillwater Elevations (ft NAVD88) Range of Stillwater Elevations (ft NAVD88)				
		Significant Wave Height H_s (feet)	Peak Wave Period T_p (sec)	10% Annual Chance	4% Annual Chance	2% Annual Chance	1% Annual Chance	0.2% Annual Chance
Hood Canal	1	*	*	12.3 12.3-12.3	* *	12.5 12.5-12.5	12.5 12.5-12.5	12.6 12.6-12.6
Hood Canal	2	*	*	12.4 12.4-12.4	* *	12.5 12.5-12.5	12.6 12.6-12.6	12.6 12.6-12.6
Hood Canal	3	*	*	12.4 12.4-12.4	* *	12.6 12.6-12.6	12.6 12.6-12.6	12.6 12.6-12.6
Hood Canal	4	*	*	12.4 12.4-12.4	* *	12.6 12.6-12.6	12.6 12.6-12.6	12.7 12.7-12.7
Hood Canal	5	*	*	12.4 12.4-12.4	* *	12.6 12.6-12.6	12.6 12.6-12.6	12.7 12.7-12.7
Hood Canal	6	*	*	12.4 12.4-12.4	* *	12.6 12.6-12.6	12.6 12.6-12.6	12.7 12.7-12.7
Hood Canal	7	*	*	12.4 12.4-12.4	* *	12.6 12.6-12.6	12.7 12.7-12.7	12.7 12.7-12.7

*Not calculated for this FIS project

Table 17: Coastal Transect Parameters (*continued*)

Flood Source	Coastal Transect	Starting Wave Conditions for the 1% Annual Chance		Starting Stillwater Elevations (ft NAVD88) Range of Stillwater Elevations (ft NAVD88)				
		Significant Wave Height H_s (feet)	Peak Wave Period T_p (sec)	10% Annual Chance	4% Annual Chance	2% Annual Chance	1% Annual Chance	0.2% Annual Chance
Hood Canal	8	*	*	12.4 12.4-12.4	* *	12.6 12.6-12.6	12.7 12.7-12.7	12.7 12.7-12.7
Hood Canal	9	*	*	12.5 12.5-12.5	* *	12.7 12.7-12.7	12.7 12.7-12.7	12.8 12.8-12.8
Hood Canal	10	*	*	12.6 12.6-12.6	* *	12.8 12.8-12.8	12.9 12.9-12.9	12.9 12.9-12.9
Hood Canal	11	*	*	12.6 12.6-12.6	* *	12.8 12.8-12.8	12.9 12.9-12.9	13.0 13.0-13.0
Hood Canal	12	*	*	12.6 12.6-12.6	* *	12.8 12.8-12.8	12.8 12.8-12.8	12.9 12.9-12.9
Hood Canal	13	*	*	12.4 12.4-12.4	* *	12.6 12.6-12.6	12.6 12.6-12.6	12.7 12.7-12.7
Hood Canal	14	*	*	12.4 12.4-12.4	* *	12.6 12.6-12.6	12.6 12.6-12.6	12.7 12.7-12.7
Case Inlet	15	*	*	13.1 13.1-13.1	* *	13.3 13.3-13.3	13.3 13.3-13.3	13.4 13.4-13.4

*Not calculated for this FIS project

Table 17: Coastal Transect Parameters (*continued*)

Flood Source	Coastal Transect	Starting Wave Conditions for the 1% Annual Chance		Starting Stillwater Elevations (ft NAVD88) Range of Stillwater Elevations (ft NAVD88)				
		Significant Wave Height H_s (feet)	Peak Wave Period T_p (sec)	10% Annual Chance	4% Annual Chance	2% Annual Chance	1% Annual Chance	0.2% Annual Chance
Case Inlet	16	*	*	13.1 13.1-13.1	* *	13.3 13.3-13.3	13.3 13.3-13.3	13.4 13.4-13.4
Pickering Passage	17	*	*	13.0 13.0-13.0	* *	13.2 13.2-13.2	13.3 13.3-13.3	13.3 13.3-13.3
Pickering Passage	18	*	*	13.2 13.2-13.2	* *	13.3 13.3-13.3	13.4 13.4-13.4	13.4 13.4-13.4
Pickering Passage	19	*	*	13.1 13.1-13.1	* *	13.3 13.3-13.3	13.3 13.3-13.3	13.4 13.4-13.4
Case Inlet	20	*	*	13.1 13.1-13.1	* *	13.3 13.3-13.3	13.3 13.3-13.3	13.3 13.3-13.3
Case Inlet	21	*	*	13.1 13.1-13.1	* *	13.3 13.3-13.3	13.3 13.3-13.3	13.3 13.3-13.3
Case Inlet	22	*	*	13.1 13.1-13.1	* *	13.2 13.2-13.2	13.2 13.2-13.2	13.3 13.3-13.3
Puget Sound	23	*	*	13.0 13.0-13.0	* *	13.2 13.2-13.2	13.2 13.2-13.2	13.3 13.3-13.3

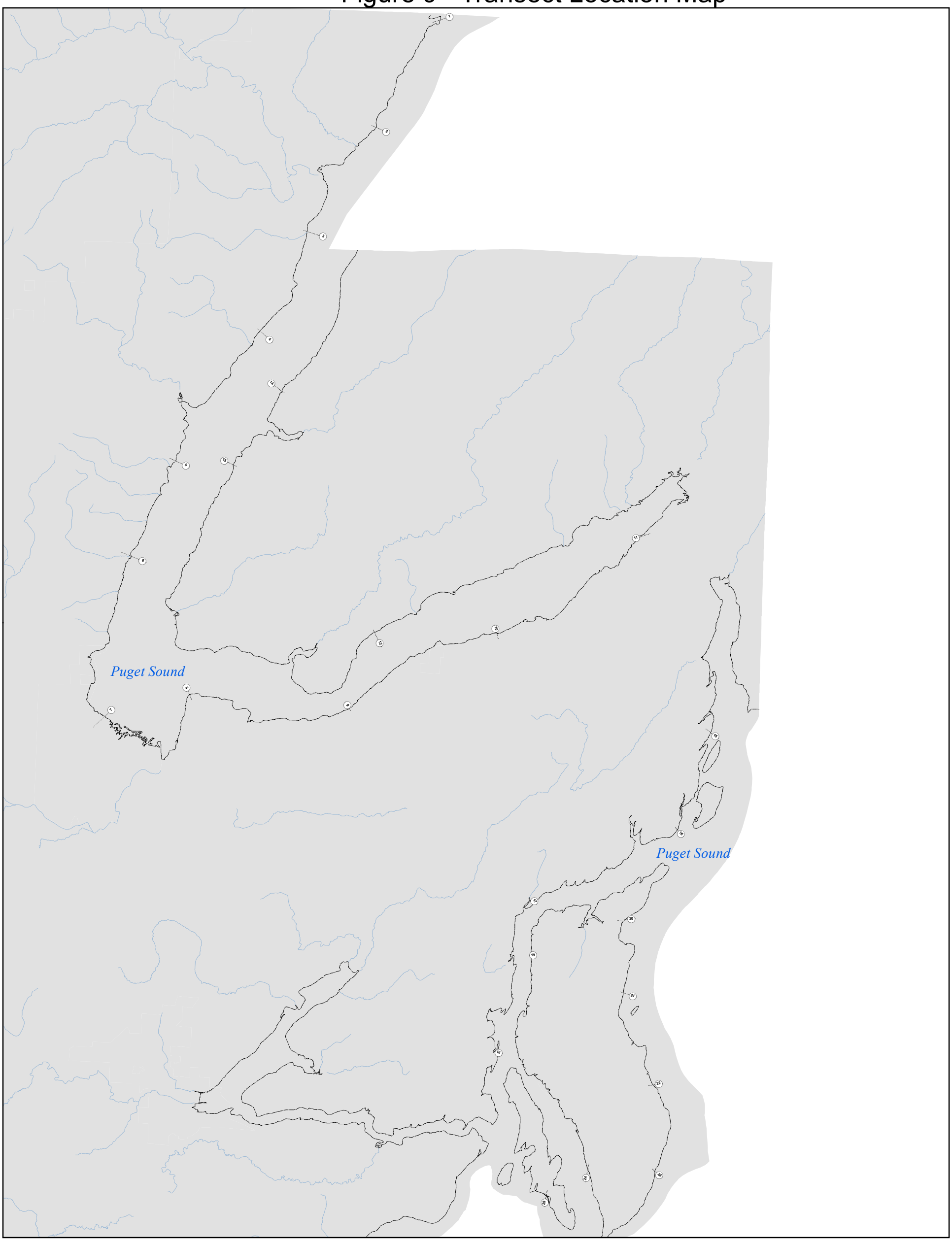
*Not calculated for this FIS Project

Table 17: Coastal Transect Parameters (*continued*)

Flood Source	Coastal Transect	Starting Wave Conditions for the 1% Annual Chance		Starting Stillwater Elevations (ft NAVD88) Range of Stillwater Elevations (ft NAVD88)				
		Significant Wave Height H_s (feet)	Peak Wave Period T_p (sec)	10% Annual Chance	4% Annual Chance	2% Annual Chance	1% Annual Chance	0.2% Annual Chance
Peale Passage	24	*	*	13.1 13.1-13.1	* *	13.3 13.3-13.3	13.3 13.3-13.3	13.4 13.4-13.4
Puget Sound	25	*	*	13.1 13.1-13.1	* *	13.3 13.3-13.3	13.4 13.4-13.4	13.4 13.4-13.4

*Not calculated for this FIS project

Figure 9 - Transect Location Map



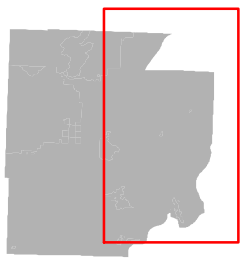
N

1 inch = 12,500 feet

0 0.5 1 2 3 4 Miles

Map Projection:
State Plane Washington South FIPS 4602 Feet
North American Datum 1983

COUNTY LOCATOR



NATIONAL FLOOD INSURANCE PROGRAM

Transect Locator Map

PANELS PRINTED:

0110E	0495E
0120E	0505E
0150E	0515E
0270E	0635E
0280E	0645E
0285E	0655E
0295E	
0315E	
0345E	
0435E	
0455E	
0460E	

FEMA

5.4 Alluvial Fan Analyses

This section is not applicable to this FIS project.

Table 18: Summary of Alluvial Fan Analyses
[Not Applicable to this FIS Project]

Table 19: Results of Alluvial Fan Analyses
[Not Applicable to this FIS Project]

SECTION 6.0 – MAPPING METHODS

6.1 Vertical and Horizontal Control

All FIS Reports and FIRMs are referenced to a specific vertical datum. The vertical datum provides a starting point against which flood, ground, and structure elevations can be referenced and compared. Until recently, the standard vertical datum used for newly created or revised FIS Reports and FIRMs was the National Geodetic Vertical Datum of 1929 (NGVD29). With the completion of the NAVD88, many FIS Reports and FIRMs are now prepared using NAVD88 as the referenced vertical datum.

Flood elevations shown in this FIS Report and on the FIRMs are referenced to NAVD88. These flood elevations must be compared to structure and ground elevations referenced to the same vertical datum. For information regarding conversion between NGVD29 and NAVD88 or other datum conversion, visit the National Geodetic Survey website at www.ngs.noaa.gov, or contact the National Geodetic Survey at the following address:

NGS Information Services
NOAA, N/NGS12
National Geodetic Survey
SSMC-3, #9202
1315 East-West Highway
Silver Spring, Maryland 20910-3282
(301) 713-3242

Temporary vertical monuments are often established during the preparation of a flood hazard analysis for the purpose of establishing local vertical control. Although these monuments are not shown on the FIRM, they may be found in the archived project documentation associated with the FIS Report and the FIRMs for this community. Interested individuals may contact FEMA to access these data.

To obtain current elevation, description, and/or location information for benchmarks in the area, please contact information services Branch of the NGS at (301) 713-3242, or visit their website at www.ngs.noaa.gov.

The datum conversion locations and values that were calculated for Mason County are provided in Table 20.

Table 20: Countywide Vertical Datum Conversion

[Not Applicable to this FIS Project]

A countywide conversion factor could not be generated for Mason County because the maximum variance from average exceeds 0.25 feet. Calculations for the vertical offsets on a stream by stream basis are depicted in Table 21.

Table 21: Stream-by-Stream Vertical Datum Conversion

Flooding Source	Average Vertical Datum Conversion Factor (feet)
Coffee Creek	+3.438
Goldsborough Creek	+3.446
Skokomish River	+3.472
Tahuya River	+3.537
Union River	+3.500

6.2 Base Map

The FIRMs and FIS Report for this project have been produced in a digital format. The flood hazard information was converted to a Geographic Information System (GIS) format that meets FEMA's FIRM database specifications and geographic information standards. This information is provided in a digital format so that it can be incorporated into a local GIS and be accessed more easily by the community. The FIRM Database includes most of the tabular information contained in the FIS Report in such a way that the data can be associated with pertinent spatial features. For example, the information contained in the Floodway Data table and Flood Profiles can be linked to the cross sections that are shown on the FIRMs. Additional information about the FIRM Database and its contents can be found in FEMA's *Guidelines and Standards for Mapping Partners*, Appendix L.

Base map information shown on the FIRM was derived from the sources described in Table 22.

Table 22: Base Map Sources

Data Type	Data Provider	Data Date	Data Scale	Data Description
Airport Runway	Washington Department of Transportation	2009	1:24,000	Vector data used to depict Sanderson Field
City of Shelton Boundary	Mason County GIS Department	2012	1:24,000	Vector data used to depict City of Shelton boundary

Table 22: Base Map Sources *(continued)*

Data Type	Data Provider	Data Date	Data Scale	Data Description
County Boundary	Mason County GIS Department	2012	1:24,000	Vector data used to depict Mason County boundary
Datum Conversion	STARR	2013	1:24,000	Table which represents the conversion in datum from NGVD29 to NAVD88
Firm Panels	USGS	1989	1:24,000	Vector data used to depict the boundary of the FIRM panels
Imagery	USDA FSA Aerial Photography Field Office	2009	1:24,000	Orthophotography of Mason County in raster format
Indian Reservations	Washington Department of Transportation	1998	1:24,000	Vector data used to depict Skokomish reservation boundary
Non Public Lands	Washington Department of Natural Resources	2007	1:24,000	Vector data used to depict parks and forests
Public Land Survey	Mason County GIS Department	2012	1:24,000	Vector data used to depict Public Land Survey System
Railroads	Mason County GIS Department	2009	1:24,000	Vector data used to depict railroads
Roads	Mason County GIS Department	2012	1:24,000	Vector data used to depict roads
Structures	Mason County GIS Department	2010	1:24,000	Vector data used to depict, bridges, culverts, and footbridges
Study Information	STARR	2013	1:24,000	Table which informs users of the information about the Mason Countywide study
Water Area	Washington Department of Natural Resources	2006	1:24,000	Vector data used to depicts lakes, ponds, marshes and the Puget Sound
Waterlines	Washington Department of Natural Resources	2006	1:24,000	Vector data used to depict creeks, rivers and streams

6.3 Floodplain and Floodway Delineation

The FIRM shows tints, screens, and symbols to indicate floodplains and floodways as well as the locations of selected cross sections used in the hydraulic analyses and floodway computations.

For riverine flooding sources, the mapped floodplain boundaries shown on the FIRM have been delineated using the flood elevations determined at each cross section; between cross sections, the boundaries were interpolated using the topographic elevation data described in Table 23.. For each coastal flooding source studied as part of this FIS Report, the mapped floodplain boundaries on the FIRM have been delineated using the flood and wave elevations determined at each transect; between transects, boundaries were delineated using land use and land cover data, the topographic elevation data described in Table 23 and knowledge of coastal flood processes. In ponding areas, flood elevations were determined at each junction of the model; between junctions, boundaries were interpolated using the topographic elevation data described in Table 23.

In cases where the 1% and 0.2% annual chance floodplain boundaries are close together, only the 1% annual chance floodplain boundary has been shown. Small areas within the floodplain boundaries may lie above the flood elevations but cannot be shown due to limitations of the map scale and/or lack of detailed topographic data.

The floodway widths presented in this FIS Report and on the FIRM were computed for certain stream segments on the basis of equal conveyance reduction from each side of the floodplain. Floodway widths were computed at cross sections. Between cross sections, the floodway boundaries were interpolated. Table 2 indicates the flooding sources for which floodways have been determined. The results of the floodway computations for those flooding sources have been tabulated for selected cross sections and are shown in Table 24, "Floodway Data."

Table 23: Summary of Topographic Elevation Data used in Mapping

Community	Flooding Source	Source for Topographic Elevation Data			
		Description	Scale	Contour Interval (foot)	Citation
City of Shelton, Mason County (Unincorporated Areas), Skokomish Indian Reservation	Goldsborough Creek, Tahuya River	Puget Sound LiDAR Consortium	1:6,000	4	Puget Sound LiDAR Consortium
Mason County (Unincorporated Areas)	Tahuya River, Union River	Puget Sound LiDAR Consortium	1:6,000	4	Puget Sound LiDAR Consortium

Table 23: Summary of Topographic Elevation Data used in Mapping (Continued)

Community	Flooding Source	Source for Topographic Elevation Data			
		Description	Scale	Contour Interval (foot)	Citation
Mason County (Unincorporated Areas), Skokomish Indian Reservation	Skokomish River	Puget Sound LiDAR Consortium	1:6,000	4	Puget Sound LiDAR Consortium
Mason County (Unincorporated Areas)	Skokomish River	Puget Sound LiDAR Consortium	1:6,000	4	Puget Sound LiDAR Consortium
City of Shelton, Mason County (Unincorporated Areas), Skokomish Indian Reservation	Coffee Creek, Goldsborough Creek, Skokomish River, Tahuya River, Union River	Puget Sound LiDAR Consortium	1:6,000	4	Puget Sound LiDAR Consortium
Mason County (Unincorporated Areas)	Lake Arrowhead, Anderson Lake, Big Timberlake, Campbell Creek, Catfish Lake, Clark Creek, Cloquallum Creek, Cloquallum Creek Tributary 3.0, Cloquallum Creek Tributary 3.1, Coulter Creek, Coulter Creek, Tributary 1, Cranberry Creek, Cranberry Creek, Tributary 1.0, Cranberry Creek, Tributary 2.0, Decker Creek, Deer Creek, Deer Creek, Tributary 1.0, Devereaux Lake, Dewatto River, Dewatto River Tributary 1.0, Fawn Lake, Finch Creek, Goldsborough Creek, Gosnell Creek, Hiawata Creek, Haven Lake	Puget Sound LiDAR Consortium	1:6,000	4	Puget Sound LiDAR Consortium

Table 23: Summary of Topographic Elevation Data used in Mapping (Continued)

Community	Flooding Source	Source for Topographic Elevation Data			
		Description	Scale	Contour Interval (foot)	Citation
Mason County (Unincorporated Areas) *(Continued)*	Isabella Lake, Island Lake, Jarrell Creek, Johns Creek. Lake Limerick, Little Mission Creek, Malaney Creek, Mason Lake, Mill Creek, Miller Creek, Mission Creek, Nahwatzel Lake, North Fork Goldsborough Creek, North Fork Skokomish River, Purdy Creek, Rendsland Creek, Rock Creek, Schumacher Creek, Skookum Creek, South Fork Goldsborough Creek, South Fork Goldsborough Creek Tributary 1.0, South Fork Skokomish River, Spencer Lake, Star Lake, Stimson Creek, Sund Creek, Tahuya River, Tahuya River Tributary 1.0, Tahuya River Tributary 2.0, Tahuya River Tributary 3.0, Tahuya River Tributary 4.0, Tahuya River Tributary 5.0, Tee Lake, Tiger Lake, Trails Ends Lake, Trib to Lake Limerick, Unnamed Stream, Unnamed Stream Tributary 1.0, Winter Creek	Puget Sound LiDAR Consortium	1:6,000	4	Puget Sound LiDAR Consortium

BFEs shown at cross sections on the FIRM represent the 1% annual chance water surface elevations shown on the Flood Profiles and in the Floodway Data tables in the FIS Report. Rounded whole-foot elevations may be shown on the FIRM in coastal areas, areas of ponding, and other areas with static base flood elevations.

Table 24: Floodway Data

LOCATION		FLOODWAY			1% ANNUAL CHANCE FLOOD WATER SURFACE ELEVATION (Feet NAVD88)			
CROSS SECTION	DISTANCE[1]	WIDTH (Feet)	SECTION AREA (Square Feet)	MEAN VELOCITY (FEET / SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
A	300	32	162	3.5	49.7	49.7	50.7	1.0
B	530	26	86	6.5	50.8	50.8	51.2	0.4
C	860	25	80	7.0	55.9	55.9	55.9	0.0
D	1,600	36	96	5.8	63.2	63.2	63.2	0.0
E	1,870	9	63	8.8	69.7	69.7	69.7	0.0
F	2,395	300	2,979	0.2	83.2	83.2	83.2	0.0
G	2,745	360	3,205	0.2	83.2	83.2	83.2	0.0
H	5,125	1,900	15,661	0.0	83.3	83.3	83.3	0.0

[1]Stream distance in feet above confluence with Goldsborough Creek

TABLE 24

FEDERAL EMERGENCY MANAGEMENT AGENCY

MASON COUNTY, WASHINGTON

AND INCORPORATED AREAS

FLOODWAY DATA

FLOODING SOURCE: COFFEE CREEK

LOCATION		FLOODWAY			1% ANNUAL CHANCE FLOOD WATER SURFACE ELEVATION (Feet NAVD88)			
CROSS SECTION	DISTANCE[1]	WIDTH (Feet)	SECTION AREA (Square Feet)	MEAN VELOCITY (FEET / SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
A	950	80	538	5.1	14.2	11.7[2]	11.7[2]	0.0
B	1,753	80	536	5.1	14.2	13.6[2]	13.6[2]	0.0
C	1,969	70	585	4.7	15.8	15.8	15.8	0.0
D	2,460	89	603	4.6	17.5	17.5	17.6	0.1
E	2,682	82	682	4.0	18.2	18.2	18.7	0.5
F	3,073	80	718	3.8	19.0	19.0	19.6	0.6
G	3,981	83	487	5.6	20.2	20.2	20.7	0.5
H	4,990	48	403	6.8	23.4	23.4	23.8	0.4
I	5,380	45	275	9.3	25.2	25.2	25.4	0.2
J	5,412	60	476	5.4	26.3	26.3	26.4	0.1
K	6,246	65	336	7.6	29.3	29.3	29.3	0.0
L	6,896	75	338	7.5	31.7	31.7	31.7	0.0
M	7,772	120	533	4.8	36.3	36.3	36.3	0.0
N	8,347	69	487	6.0	38.6	38.6	39.6	1.0
O	8,997	55	365	7.9	42.4	42.4	42.5	0.1
P	9,897	61	427	6.7	47.2	47.2	47.2	0.0
Q	10,047	60	427	6.6	47.9	47.9	47.9	0.0
R	10,307	41	311	7.2	49.2	49.2	49.2	0.0
S	10,567	60	424	5.3	50.5	50.5	50.5	0.0
T	11,757	62	303	7.2	54.9	54.9	54.9	0.0
U	12,357	65	295	7.2	59.5	59.5	59.5	0.1

[1]Stream distance in feet above the confluence with Oakland Bay
[2]Elevations computed without consideration of backwater from Oakland Bay

TABLE 24

FEDERAL EMERGENCY MANAGEMENT AGENCY

MASON COUNTY, WASHINGTON

AND INCORPORATED AREAS

FLOODWAY DATA

FLOODING SOURCE: GOLDSBOROUGH CREEK

LOCATION		FLOODWAY			1% ANNUAL CHANCE FLOOD WATER SURFACE ELEVATION (Feet NAVD88)			
CROSS SECTION	DISTANCE[1]	WIDTH (Feet)	SECTION AREA (Square Feet)	MEAN VELOCITY (FEET / SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
A	8,098	1,202	9,408	3.8	13.0	13.0	13.9	0.9
B	9,932	2,800	16,834	2.1	14.0	14.0	15.0	1.0
C	11,098	1,249	5,496	6.6	15.0	15.0	15.1	0.1
D	12,233	668	6,390	5.6	17.0	17.0	17.9	0.9
E	13,653	2,430	17,405	2.1	18.8	18.8	19.9	1.1
F	16,181	3,336	26,505	1.4	19.9	19.9	20.8	0.9
G	17,758	3,245	17,316	2.1	20.9	20.9	21.7	0.8
H	19,765	3,766	16,573	2.2	24.0	24.0	24.4	0.4
I	24,736	3,168	25,290	1.4	27.0	27.0	27.2	0.2
J	26,538	2,800	6,590	5.5	29.0	29.0	29.5	0.5
K	27,807	2,901	9,073	4.0	31.0	31.0	32.0	1.0
L	28,729	2,991[2]	16,669	2.2	32.0	32.0	33.0	1.0
M	29,283	3,062[2]	6,006	6.0	33.0	33.0	33.5	0.5
N	30,365	3,534	10,262	3.5	35.0	35.0	35.6	0.6
O	32,133	2,700	8,611	4.2	37.0	37.0	37.8	0.8
P	34,007	1,810	9,271	3.9	40.0	40.0	41.0	1.0
Q	36,041	2,043	9,044	4.0	43.0	43.0	43.9	0.9
R	37,738	2,520[2]	13,741	2.6	47.0	47.0	47.9	0.9
S	39,630	1,589[2]	7,489	4.8	49.0	49.0	49.6	0.6
T	40,383	1,294	8,294	4.3	51.0	51.0	51.4	0.4
U	41,239	1,320	8,405	4.3	53.0	53.0	53.1	0.1

[1]Stream distance in feet above the confluence with Hood Canal
[2]Width takes into account high ground

TABLE 24

FEDERAL EMERGENCY MANAGEMENT AGENCY

MASON COUNTY, WASHINGTON

AND INCORPORATED AREAS

FLOODWAY DATA

FLOODING SOURCE: SKOKOMISH RIVER

LOCATION		FLOODWAY			1% ANNUAL CHANCE FLOOD WATER SURFACE ELEVATION (Feet NAVD88)			
CROSS SECTION	DISTANCE[1]	WIDTH (Feet)	SECTION AREA (Square Feet)	MEAN VELOCITY (FEET / SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
V	42,714	2,109	15,626	2.3	54.0	54.0	54.7	0.7
W	43,845	2,157	12,566	2.9	55.0	55.0	55.6	0.6
X	44,964	1,538	8,111	4.4	57.0	57.0	57.3	0.3
Y	45,690	1,300	5,627	6.4	60.0	60.0	60.0	0.0
Z	46,526	1,147	5,256	6.9	62.0	62.0	62.1	0.1

[1]Stream distance are measured in feet above the confluence with Hood Canal

TABLE 24

FEDERAL EMERGENCY MANAGEMENT AGENCY

MASON COUNTY, WASHINGTON

AND INCORPORATED AREAS

FLOODWAY DATA

FLOODING SOURCE: SKOKOMISH RIVER

LOCATION		FLOODWAY			1% ANNUAL CHANCE FLOOD WATER SURFACE ELEVATION (Feet NAVD88)			
CROSS SECTION	DISTANCE[1]	WIDTH (Feet)	SECTION AREA (Square Feet)	MEAN VELOCITY (FEET / SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
A	310	117	1,399	4.9	12.6	12.6	13.6	1.0
B	620	335	3,347	2.1	13.2	13.2	14.1	0.9
C	1,610	410	3,400	2.0	13.4	13.4	14.3	0.9
D	3,030	490	2,679	2.6	14.2	14.2	15.1	0.9
E	4,710	628	3,800	1.7	15.4	15.4	16.2	0.8
F	6,650	676	2,004	3.3	19.2	19.2	19.8	0.6
G	9,240	1,060	2,267	2.8	26.4	26.4	27.2	0.8
H	11,150	500	1,607	4.0	35.0	35.0	35.0	0.0
I	12,450	710[2]	2,103	3.0	39.6	39.6	40.4	0.8
J	13,650	740	2,563	2.4	44.9	44.9	45.9	1.0
K	15,320	610	1,658	3.7	52.4	52.4	53.1	0.7
L	17,650	720	1,859	3.3	61.6	61.6	62.3	0.7
M	19,060	570	1,508	4.0	69.6	69.6	69.9	0.3
N	20,830	650	2,537	2.4	75.7	75.7	76.6	0.9
O	23,000	440	1,629	3.6	83.6	83.6	83.8	0.2
P	24,700	316	2,035	2.9	89.3	89.3	90.1	0.8
Q	25,670	475	1,249	4.7	93.5	93.5	93.8	0.3
R	26,600	405	1,427	4.0	99.0	99.0	100.0	1.0
S	27,900	455	1,491	3.7	110.2	110.2	110.9	0.7
T	28,450	350	1,395	3.9	113.4	113.4	113.9	0.5
U	30,610	147	853	6.1	123.4	123.4	123.4	0.0

[1]Stream distance in feet above 300 feet downstream of North Shore Road
[2]Width takes into account high ground

TABLE 24

FEDERAL EMERGENCY MANAGEMENT AGENCY

MASON COUNTY, WASHINGTON

AND INCORPORATED AREAS

FLOODWAY DATA

FLOODING SOURCE: TAHUYA RIVER

LOCATION		FLOODWAY			1% ANNUAL CHANCE FLOOD WATER SURFACE ELEVATION (Feet NAVD88)			
CROSS SECTION	DISTANCE[1]	WIDTH (Feet)	SECTION AREA (Square Feet)	MEAN VELOCITY (FEET / SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
V	32,610	250	1,347	3.9	130.3	130.3	130.7	0.4
W	33,310	192	1,183	4.4	132.6	132.6	132.9	0.3
X	34,290	105	808	6.1	136.7	136.7	136.9	0.2
Y	35,070	250	1,227	4.0	139.4	139.4	139.8	0.4
Z	35,980	500	1,520	3.2	142.0	142.0	142.7	0.7
AA	37,200	628	1,320	3.5	146.5	146.5	147.1	0.6
AB	38,330	499	1,498	3.1	150.0	150.0	150.9	0.9
AC	40,290	170	644	6.8	158.2	158.2	158.2	0.0
AD	42,100	100	684	6.4	166.4	166.4	167.2	0.8
AE	42,660	75	580	7.2	169.0	169.0	169.4	0.4
AF	43,800	125	733	5.7	171.8	171.8	172.4	0.6
AG	44,190	140	574	7.3	173.3	173.3	173.8	0.5
AH	44,650	179	938	4.3	175.7	175.7	176.3	0.6
AI	45,100	115	637	6.3	177.2	177.2	177.5	0.3
AJ	45,340	80	525	7.6	178.4	178.4	178.8	0.4
AK	45,640	100	636	6.3	180.4	180.4	180.4	0.0

[1]Stream distance in feet above 300 feet downstream of North Shore Road

TABLE 24

FEDERAL EMERGENCY MANAGEMENT AGENCY

MASON COUNTY, WASHINGTON

AND INCORPORATED AREAS

FLOODWAY DATA

FLOODING SOURCE: TAHUYA RIVER

LOCATION		FLOODWAY			1% ANNUAL CHANCE FLOOD WATER SURFACE ELEVATION (Feet NAVD88)			
CROSS SECTION	DISTANCE[1]	WIDTH (Feet)	SECTION AREA (Square Feet)	MEAN VELOCITY (FEET / SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
A	6,408	297	1,018	2.6	17.4	17.4	17.5	0.1
B	7,843	318	970	2.7	22.0	22.0	22.0	0.0
C	9,168	289	992	2.7	27.2	27.2	27.2	0.0
D	11,818	169	441	6.0	38.1	38.1	38.1	0.0
E	12,298	124	520	5.1	41.0	41.0	41.0	0.0
F	13,523	350	741	3.0	47.5	47.5	47.5	0.0
G	14,398	185	639	3.5	53.6	53.6	53.7	0.1
H	14,838	151	591	3.2	57.3	57.3	57.3	0.0
I	15,018	152	567	3.4	58.8	58.8	58.8	0.0
J	16,868	259	702	2.7	71.4	71.4	71.4	0.0
K	18,008	330	1,106	1.7	75.5	75.5	75.7	0.2
L	19,983	235	555	3.4	85.1	85.1	85.2	0.1
M	21,083	261	830	2.3	89.4	89.4	89.4	0.0
N	25,058	230	470	4.1	106.6	106.6	106.6	0.0
O	26,508	303	905	2.1	115.4	115.4	115.4	0.0
P	27,241	84	249	7.7	118.5	118.5	118.5	0.0
Q	29,091	170	485	3.0	131.1	131.1	131.1	0.0
R[2]	-	-	-	-	-	-	-	-

[1]Stream distance in feet above confluence with Hood Canal
[2]Cross section lies outside of the County boundary

TABLE 24

FEDERAL EMERGENCY MANAGEMENT AGENCY

MASON COUNTY, WASHINGTON

AND INCORPORATED AREAS

FLOODWAY DATA

FLOODING SOURCE: UNION RIVER

Table 25: Flood Hazard and Non-Encroachment Data for Selected Streams

[Not Applicable to this FIS Project]

6.4 Coastal Flood Hazard Mapping

Flood insurance zones and BFEs including the wave effects were identified on each transect based on the results from the onshore wave hazard analyses. Between transects, elevations were interpolated using topographic maps, land-use and land-cover data, and knowledge of coastal flood processes to determine the aerial extent of flooding. Sources for topographic data are shown in Zone VE is subdivided into elevation zones and BFEs are provided on the FIRM.

The limit of Zone VE shown on the FIRM is defined as the farthest inland extent of any of these criteria (determined for the 1% annual chance flood condition):

- The *primary frontal dune zone* is defined in 44 CFR Section 59.1 of the NFIP regulations. The primary frontal dune represents a continuous or nearly continuous mound or ridge of sand with relatively steep seaward and landward slopes that occur immediately landward and adjacent to the beach. The primary frontal dune zone is subject to erosion and overtopping from high tides and waves during major coastal storms. The inland limit of the primary frontal dune zone occurs at the point where there is a distinct change from a relatively steep slope to a relatively mild slope.

- The *wave runup zone* occurs where the (eroded) ground profile is 3.0 feet or more below the 2-percent wave runup elevation.

- The *wave overtopping splash zone* is the area landward of the crest of an overtopped barrier, in cases where the potential 2-percent wave runup exceeds the barrier crest elevation by 3.0 feet or more.

- The *breaking wave height zone* occurs where 3-foot or greater wave heights could occur (this is the area where the wave crest profile is 2.1 feet or more above the total stillwater elevation).

- The *high-velocity flow zone* is landward of the overtopping splash zone (or area on a sloping beach or other shore type), where the product of depth of flow times the flow velocity squared (hv^2) is greater than or equal to 200 ft^3/sec^2. This zone may only be used on the Pacific Coast.

The SFHA boundary indicates the limit of SFHAs shown on the FIRM as either "V" zones or "A" zones.

Table 26 indicates the coastal analyses used for floodplain mapping and the criteria used to determine the inland limit of the open-coast Zone VE and the SFHA boundary at each transect.

Table 26: Summary of Coastal Transect Mapping Considerations

Coastal Transect	Primary Frontal Dune (PFD) Identified	Wave Runup Analysis	Wave Height Analysis	Zone VE Limit	SFHA Boundary
		Zone Designation and BFE (ft NAVD88)	Zone Designation and BFE (ft NAVD88)		
1		VE 18	N/A	Runup	Runup
2		AE 14	N/A	N/A	Runup
3		VE 16	N/A	Runup	Runup
4		VE 21	N/A	Runup	Runup
5		AE 14	N/A	N/A	Runup
6		AE 14	N/A	N/A	Runup
7		AE 13	N/A	N/A	SWEL
8		AE 14	N/A	N/A	Runup
9		AE 14	N/A	N/A	Runup
10		AE 14	N/A	N/A	Runup
11		AE 14	N/A	N/A	Runup
12		AE 15	N/A	N/A	Runup
13		VE 23	N/A	Runup	Runup
14		VE 17	N/A	Runup	Runup
15		AE 14	N/A	N/A	Runup/SWEL
16		VE 20	N/A	Runup	Runup/SWEL
17		VE 17	N/A	Runup	Runup/SWEL
18		AE 15	N/A	N/A	Runup/SWEL
19		VE 20	N/A	Runup	Runup/SWEL
20		AE 13	N/A	N/A	SWEL
21		AE 15	N/A	N/A	Runup
22		AE 14	N/A	N/A	Runup
23		AE 15	N/A	N/A	Runup
24		AE 14	N/A	N/A	Runup
25		AE 14	N/A	N/A	Runup

6.5 FIRM Revisions

This FIS Report and the FIRM are based on the most up-to-date information available to FEMA at the time of its publication; however, flood hazard conditions change over time. Communities or private parties may request flood map revisions at any time. Certain types of requests require submission of supporting data. FEMA may also initiate a revision. Revisions to FIS projects may take several forms, including Letters of Map Amendment (LOMAs), Letters of Map Revision Based on Fill (LOMR-Fs), Letters of Map Revision (LOMRs) (referred to collectively as Letters of Map Change (LOMCs)), Physical Map Revisions (PMRs), and FEMA-contracted restudies. These types of revisions are further described below. Some of these types of revisions do not result in the republishing of the FIS Report. To assure that any user is aware of all revisions, it is advisable to contact the community repository of flood-hazard data (shown in Table 31, "Map Repositories").

6.5.1 Letters of Map Amendment

A LOMA is an official revision by letter to an effective NFIP map. A LOMA results from an administrative process that involves the review of scientific or technical data submitted by the owner or lessee of property who believes the property has incorrectly been included in a designated SFHA. A LOMA amends the currently effective FEMA map and establishes that a specific property is not located in a SFHA. A LOMA cannot be issued for properties located on the PFD (primary frontal dune).

To obtain an application for a LOMA, visit http://www.fema.gov and download the form "MT-1 Application Forms and Instructions for Conditional and Final Letters of Map Amendment and Letters of Map Revision Based on Fill". Visit the "Flood Map-Related Fees" section to determine the cost, if any, of applying for a LOMA.

FEMA offers a tutorial on how to apply for a LOMA. The LOMA Tutorial Series can be accessed at http://www.fema.gov/plan/prevent/fhm/ot_lmreq.shtm.

For more information about how to apply for a LOMA, call the FEMA Map Information eXchange; toll free, at 1-877-FEMA MAP (1-877-336-2627).

6.5.2 Letters of Map Revision Based on Fill

A LOMR-F is an official revision by letter to an effective NFIP map. A LOMR-F states FEMA's determination concerning whether a structure or parcel has been elevated on fill above the base flood elevation and is, therefore, excluded from the SFHA.

Information about obtaining an application for a LOMR-F can be obtained in the same manner as that for a LOMA, by visiting http://www.fema.gov for the "MT-1 Application Forms and Instructions for Conditional and Final Letters of Map Amendment and Letters of Map Revision Based on Fill" or by calling the FEMA Map Information eXchange, toll free, at 1-877-FEMA MAP (1-877-336-2627). Fees for applying for a LOMR-F, if any, are listed in the "Flood Map-Related Fees" section.

A tutorial for LOMR-F is available at http://www.fema.gov/plan/prevent/fhm/ot_lmreq.shtm.

6.5.3 Letters of Map Revision

A LOMR is an official revision to the currently effective FEMA map. It is used to change flood zones, floodplain and floodway delineations, flood elevations and planimetric features. All requests for LOMRs should be made to FEMA through the chief executive officer of the community, since it is the community that must adopt any changes and revisions to the map. If

the request for a LOMR is not submitted through the chief executive officer of the community, evidence must be submitted that the community has been notified of the request.

To obtain an application for a LOMR, visit http://www.fema.gov and download the form "MT-2 Application Forms and Instructions for Conditional Letters of Map Revision and Letters of Map Revision". Visit the "Flood Map-Related Fees" section to determine the cost of applying for a LOMR. For more information about how to apply for a LOMR, call the FEMA Map Information eXchange; toll free, at 1-877-FEMA MAP (1-877-336-2627) to speak to a Map Specialist.

Previously issued mappable LOMCs (including LOMRs) that have been incorporated into the Mason County FIRM are listed in Table 27.

Table 27: Incorporated Letters of Map Change

[Not Applicable to this FIS Project]

6.5.4 Physical Map Revisions

PMRs are an official republication of a community's NFIP map to effect changes to base flood elevations, floodplain boundary delineations, regulatory floodways and planimetric features. These changes typically occur as a result of structural works or improvements, annexations resulting in additional flood hazard areas or correction to base flood elevations or SFHAs.

The community's chief executive officer must submit scientific and technical data to FEMA to support the request for a PMR. The data will be analyzed and the map will be revised if warranted. The community is provided with copies of the revised information and is afforded a review period. When the base flood elevations are changed, a 90-day appeal period is provided. A 6-month adoption period for formal approval of the revised map(s) is also provided.

For more information about the PMR process, please visit http://www.fema.gov and visit the "Flood Map Revision Processes" section.

6.5.5 Contracted Restudies

The NFIP provides for a periodic review and restudy of flood hazards within a given community. FEMA accomplishes this through a national watershed-based mapping needs assessment strategy, known as the Coordinated Needs Management Strategy (CNMS). The CNMS is used by FEMA to assign priorities and allocate funding for new flood hazard analyses used to update the FIS Report and FIRM. The goal of CNMS is to define the validity of the engineering study data within a mapped inventory. The CNMS is used to track the assessment process, document engineering gaps and their resolution, and aid in prioritization for using flood risk as a key factor for areas identified for flood map updates. Visit www.fema.gov to learn more about the CNMS or contact the FEMA Regional Office listed in Section 8 of this FIS Report.

6.5.6 Community Map History

The current FIRM presents flooding information for the entire geographic area of Flood County. Previously, separate FIRMs, Flood Hazard Boundary Maps (FHBMs) and/or Flood Boundary and Floodway Maps (FBFMs) may have been prepared for the incorporated communities and the unincorporated areas in the county that had identified SFHAs. Current and historical data relating to the maps prepared for the project area are presented in Table 28, "Community Map History." A description of each of the column headings and the source of the date is also listed below.

- *Community Name* includes communities falling within the geographic area shown on the FIRM, including those that fall on the boundary line, nonparticipating communities, and communities with maps that have been rescinded. Communities with No Special Flood Hazards are indicated by a footnote. If all maps (FHBM, FBFM, and FIRM) were rescinded for a community, it is not listed in this table unless SFHAs have been identified in this community.

- *Initial Identification Date (First NFIP Map Published)* is the date of the first NFIP map that identified flood hazards in the community. If the FHBM has been converted to a FIRM, the initial FHBM date is shown. If the community has never been mapped, the upcoming effective date or "pending" (for Preliminary FIS Reports) is shown. If the community is listed in Table 28 but not identified on the map, the community is treated as if it were unmapped.

- *Initial FHBM Effective Date* is the effective date of the first Flood Hazard Boundary Map (FHBM). This date may be the same date as the Initial NFIP Map Date.

- *FHBM Revision Date(s)* is the date(s) that the FHBM was revised, if applicable.

- *Initial FIRM Effective Date* is the date of the first effective FIRM for the community. This is the first effective date that is shown on the FIRM panel.

- *FIRM Revision Date(s)* is the date(s) the FIRM was revised, if applicable. This is the revised date that is shown on the FIRM panel, if applicable. As countywide studies are completed or revised, each community listed should have its FIRM dates updated accordingly to reflect the date of the countywide study. Once the FIRMs exist in countywide format, as Physical Map Revisions (PMR) of FIRM panels within the county are completed, the FIRM Revision Dates in the table for each community affected by the PMR are updated with the date of the PMR, even if the PMR did not revise all the panels within that community.

Table 28: Community Map History

Community Name	Initial Identification Date (First NFIP Map Published)	Initial FHBM Effective Date	FHBM Revision Date(s)	Initial FIRM Effective Date	FIRM Revision Date(s)
City of Shelton	6/14/1974	6/14/1974	3/19/1976	12/1/1983	N/A
Mason County	8/9/1977	8/9/1977	5/15/1979	5/17/1988	12/8/1998
Skokomish Indian Reservation	7/2/2002	N/A	N/A	7/2/2002	N/A
Squaxin Island Tribe	N/A	N/A	N/A	N/A	N/A

SECTION 7.0 – CONTRACTED STUDIES AND COMMUNITY COORDINATION

7.1 Contracted Studies

Table 29 provides a summary of the contracted studies, by flooding source, that are included in this FIS Report.

Table 29: Summary of Contracted Studies Included in this FIS Report

Flooding Source	FIS Report Dated	Contractor	Number	Work Completed Date	Affected Communities
Coffee Creek	TBD	STARR	HSFEHQ-09-D-370	6/16/2014	City of Shelton, Mason County (Unincorporated Areas)
Goldsborough Creek	TBD	STARR	HSFEHQ-09-D-370	6/16/2014	City of Shelton, Mason County (Unincorporated Areas)
Skokomish River	TBD	STARR	HSFEHQ-09-D-370	6/16/2014	Skokomish Indian Reservation, Mason County (Unincorporated Areas)
Tahuya River	TBD	STARR	HSFEHQ-09-D-370	6/16/2014	Mason County (Unincorporated Areas)
Union River	TBD	STARR	HSFEHQ-09-D-370	6/16/2014	Mason County (Unincorporated Areas)
Coastal Analysis	TBD	STARR	HSFEHQ009-D-370	6/16/2014	Mason County (Unincorporated Areas)
East Fork Satsop River, Hamma Hamma River, Middle Fork Satsop River, Sherwood Creek, Vance Creek	12/8/98	United Industries Corporation	EMW-C-0281	5/1983	Mason County (Unincorporated Areas)

Table 29: Summary of Contracted Studies Included in this FIS Report *(continued)*

Flooding Source	FIS Report Dated	Contractor	Number	Work Completed Date	Affected Communities
Campbell Creek, Catfish Lake, Clark Creek, Cloquallum Creek, Cloquallum Creek Tributary 3.0, Cloquallum Creek Tributary 3.1, Coulter Creek, Coulter Creek, Tributary 1, Cranberry Creek, Cranberry Creek, Tributary 1.0, Cranberry Creek, Tributary 2.0, Decker Creek, Deer Creek, Deer Creek, Tributary 1.0, Devereaux Lake, Dewatto River, Dewatto River Tributary 1.0, Finch Creek, Goldsborough Creek, Gosnell Creek, Hiawata Creek, Jarrell Creek, Johns Creek, Little Mission Creek, Malaney Creek, Mill Creek, Miller Creek, Mission Creek, Nahwatzel Lake, North Fork Goldsborough Creek, North Fork Skokomish River, Purdy Creek, Rendsland Creek, Rock Creek, Schumacher Creek, Skookum Creek, South Fork Goldsborough Creek, South Fork Goldsborough Creek Tributary 1.0, South Fork Skokomish River, Stimson Creek, Sund Creek, Tahuya River, Tahuya River Tributary 1.0, Tahuya River Tributary 2.0, Tahuya River Tributary 3.0, Tahuya River Tributary 4.0, Tahuya River Tributary 5.0, Unnamed Stream, Unnamed Stream Tributary 1.0, Winter Creek	TBD	STARR	HSFEHQ-09-D-370	6/16/2014	Mason County (Unincorporated Areas)
Lake Arrowhead, Anderson Lake, Big Timberlake, Fawn Lake, Haven Lake, Isabella Lake, Island Lake, Lake Limierick, Mason Lake, Spencer Lake, Star Lake, Tee Lake, Tiger Lake, Trails Ends Lake, Trib to Lake Limerick, North Fork Skokomish River (Confluence with Skokomish River to the dam)	TBD	STARR	HSFE60-15-0005	4/13/2016	Mason County (Unincorporated Areas)

7.2 Community Meetings

The dates of the community meetings held for this FIS project and any previous FIS projects are shown in Table 30. These meetings may have previously been referred to by a variety of names (Community Coordination Officer (CCO), Scoping, Discovery, etc.), but all meetings represent opportunities for FEMA, community officials, study contractors, and other invited guests to discuss the planning for and results of the project.

Table 30: Community Meetings

Community	FIS Report Dated	Date of Meeting	Meeting Type	Attended By
Mason County (Unincorporated Areas)	TBD	03/04/2011	Project Discovery	City of Shelton, Federal Emergency Management Agency, Region 10, Mason County, Skokomish Tribe
		09/03/2014	Flood Risk Review	Mason County, City of Shelton, Skokomish Tribe, FEMA, STARR
		TBD	Public Meeting	

SECTION 8.0 – ADDITIONAL INFORMATION

Information concerning the pertinent data used in the preparation of this FIS Report can be obtained by submitting an order with any required payment to the FEMA Engineering Library. For more information on this process, see http://www.fema.gov.

Table 31 is a list of the locations where FIRMs for Mason County can be viewed. Please note that the maps at these locations are for reference only and are not for distribution. Also, please note that only the maps for the community listed in the table are available at that particular repository. A user may need to visit another repository to view maps from an adjacent community.

Table 31: Map Repositories

Community	Address	City	State	Zip Code
City of Shelton	City Hall 525 West Cota Street	Shelton	WA	98584
Mason County	100 West Public Works Drive	Shelton	WA	98584
Skokomish Indian Reservation	Skokomish Government Center 80 North Tribal Center Road	Skokomish	WA	98584
Squaxin Island Tribe	10 SE Squaxin Lane	Shelton	WA	98584

The National Flood Hazard Layer (NFHL) dataset is a compilation of effective FIRM databases and LOMCs. Together they create a GIS data layer for a State or Territory. The NFHL is updated as studies become effective and extracts are made available to the public monthly. NFHL data can be viewed or ordered from the website shown in Table 32 contains useful contact information regarding the FIS Report, the FIRM, and other relevant flood hazard and GIS data. In addition, information about the state NFIP Coordinator and GIS Coordinator is shown in this table. At the request of FEMA, each Governor has designated an agency of State or territorial government to coordinate that State's or territory's NFIP activities. These agencies often assist communities in developing and adopting necessary floodplain management measures. State GIS Coordinators are knowledgeable about the availability and location of state and local GIS data in their state.

Table 32: Additional Information

FEMA and the NFIP	
FEMA and FEMA Engineering Library website	http://www.fema.gov
NFIP website	http://www.fema.gov/business/nfip
NFHL Dataset	http://msc.fema.gov
FEMA Region X	Federal Regional Center, 130 228th Street SW. Bothell, WA 98021-9796 (425) 487-4657
Other Federal Agencies	
USGS website	http://www.usgs.gov
Hydraulic Engineering Center website	http://www.hec.usace.army.mil
State Agencies and Organizations	
State NFIP Coordinator	State National Floodplain Insurance Program (NFIP) Coordinator Scott McKinney Washington Department of Ecology P.O. Box 47600 Olympia, WA 98504-7600 (360) 407-6131 FAX (360) 407-2305 scott.mckinney@ecy.wa.gov
State GIS Coordinator	State GIS Coordinator Joy Paulus Office of the Chief Information Officer 1110 Jefferson St. SE Olympia, WA 98504-2445 Phone: 360.902.3447 Cell: 360.628.2621 Joy.Paulus@ocio.wa.gov

SECTION 9.0 – BIBLIOGRAPHY AND REFERENCES

Table 33 includes sources used in the preparation of and cited in this FIS Report as well as additional studies that have been conducted in the study area.

Table 33: Bibliography and References

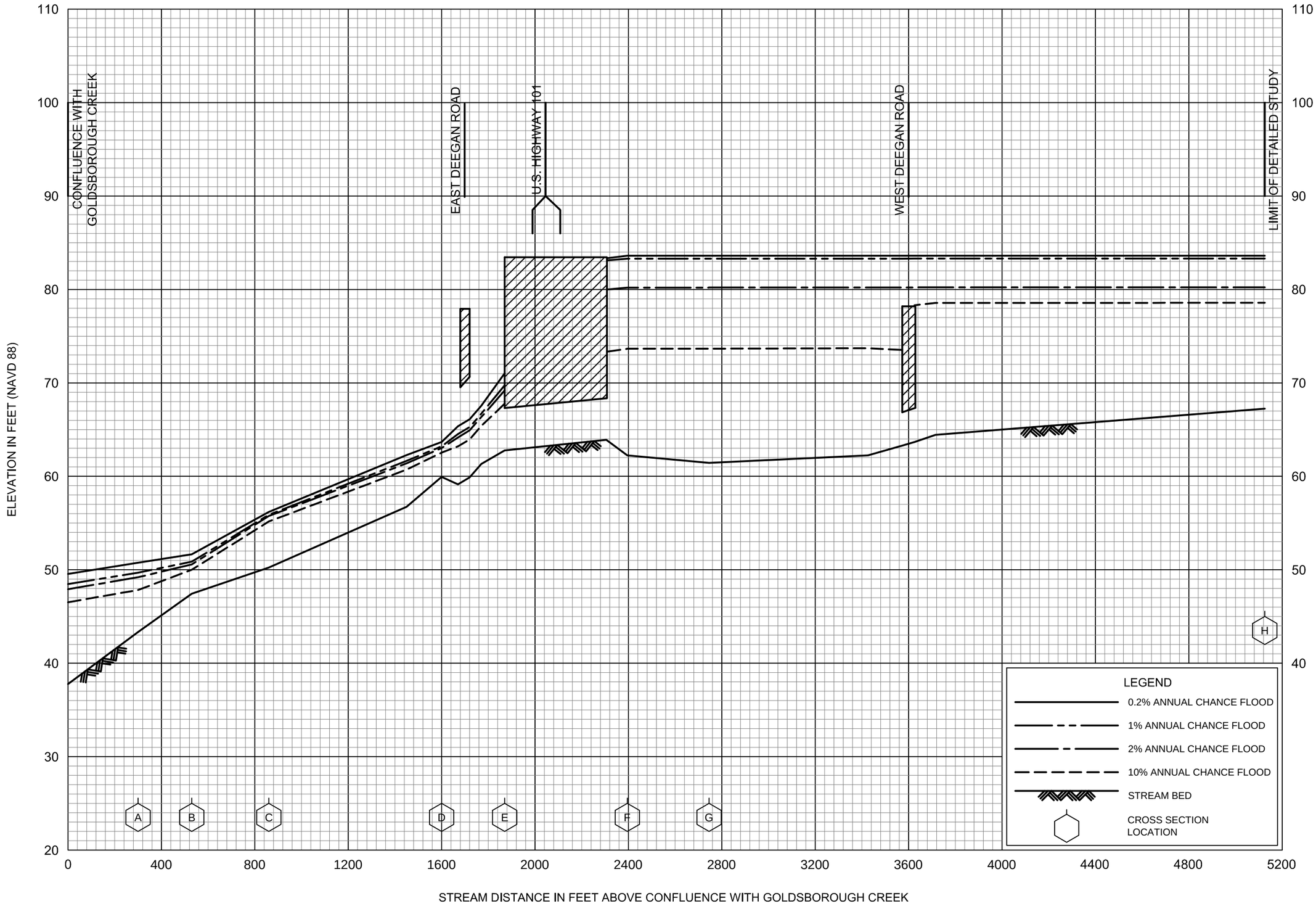
Citation in this FIS	Publisher/ Issuer	*Publication Title,* "Article," Volume, Number, etc.	Author/Editor	Place of Publication	Publication Date/ Date of Issuance	Link
ADCIRC (2003)	U.S. Army Engineer Waterways Experiment Station	*ADCIRC:An Advanced Three-Dimensional Circulation Model for Shelves, Coasts, and Estuaries*	Luettich, R.A.,Jr., Westerink, J.J., and Scheffner, N.W.	Vicksburg, MS	1992	www.adcirc.org
Appendix L	Federal Insurance Administration	*Guidelines and Specifications for Flood Hazard Mapping Partners*	FEMA	Washington, DC	April 2003	
Bulletin 17B (Gage Analysis)	USGS	*Computer Program PEAKFQ, Annual Flood-Frequency Analysis*	USGS		2007	
Fact Sheet FS-016-01	USGS	*The National Flood-Frequency Program – Methods for Estimating Flood Magnitude and Frequency in Washington*	Knowles, S.M. and Sumioka, S.S.		2001	
HEC-1	USACE	*Flood Hydrograph Package 723-X6-L2010*	Hydrologic Engineering Center	Davis, California	January 1973	
Historic Study	FEMA	*Flood Insurance Study: Mason County, Washington-Unincorporated Areas*	FEMA	Washington, DC	December 1998	
Hydrologic Modeling for Approximate streams	STARR	*Zone A models*	STARR	Laurel, MD	June 2014	

Table 33: Bibliography and References *(continued)*

Citation in this FIS	Publisher/ Issuer	*Publication Title,* "Article," Volume, Number, etc.	Author/Editor	Place of Publication	Publication Date/ Date of Issuance	Link
Hydrologic Modeling for Detailed streams	STARR	*Redelineations*	STARR	Laurel, MD	June 2014	
Hydrologic Model for Skokomish River	STARR	*Skokomish River 2D model*	STARR	Laurel, MD	June 2014	
Mitigation Plan	Mason County Division of Emergency Management	*Natural Hazard Mitigation Plan*	STARR	Laurel, MD	July 2010	
Modeling for Coastal Flood Sources	STARR	*Coastal analyses*	STARR	Laurel, MD	June 2014	
Principal Flood Problems	FEMA	*FIRM*	FEMA	Washington, DC	May 1998	
Principal Flood Problems for Goldsborough Creek	FEMA	*FIRM*	FEMA	Washington, DC	June 1983	
PRISM Model	Oregon State University	*PRISM Climate Data*	PRISM Climate Group/ Northwest Alliance for Computational Science and Engineering	Corvallis, OR	February 2004	http://prism.oregonstate.edu
PSLC LiDAR	Puget Sound LiDAR Consortium	*LiDAR*	STARR	Laurel, MD	January 2013	

Table 33: Bibliography and References *(continued)*

Citation in this FIS	Publisher/ Issuer	*Publication Title,* "Article," Volume, Number, etc.	Author/Editor	Place of Publication	Publication Date/ Date of Issuance	Link
Water-Resources Investigation Report 97-4277	USGS	*Magnitude and Frequency of Floods in Washington*	Sumioka, S.S., Kresch, D.L., and Kasnick, K.D.		1998	



FLOOD PROFILES

COFFEE CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

MASON COUNTY, WA

AND INCORPORATED AREAS

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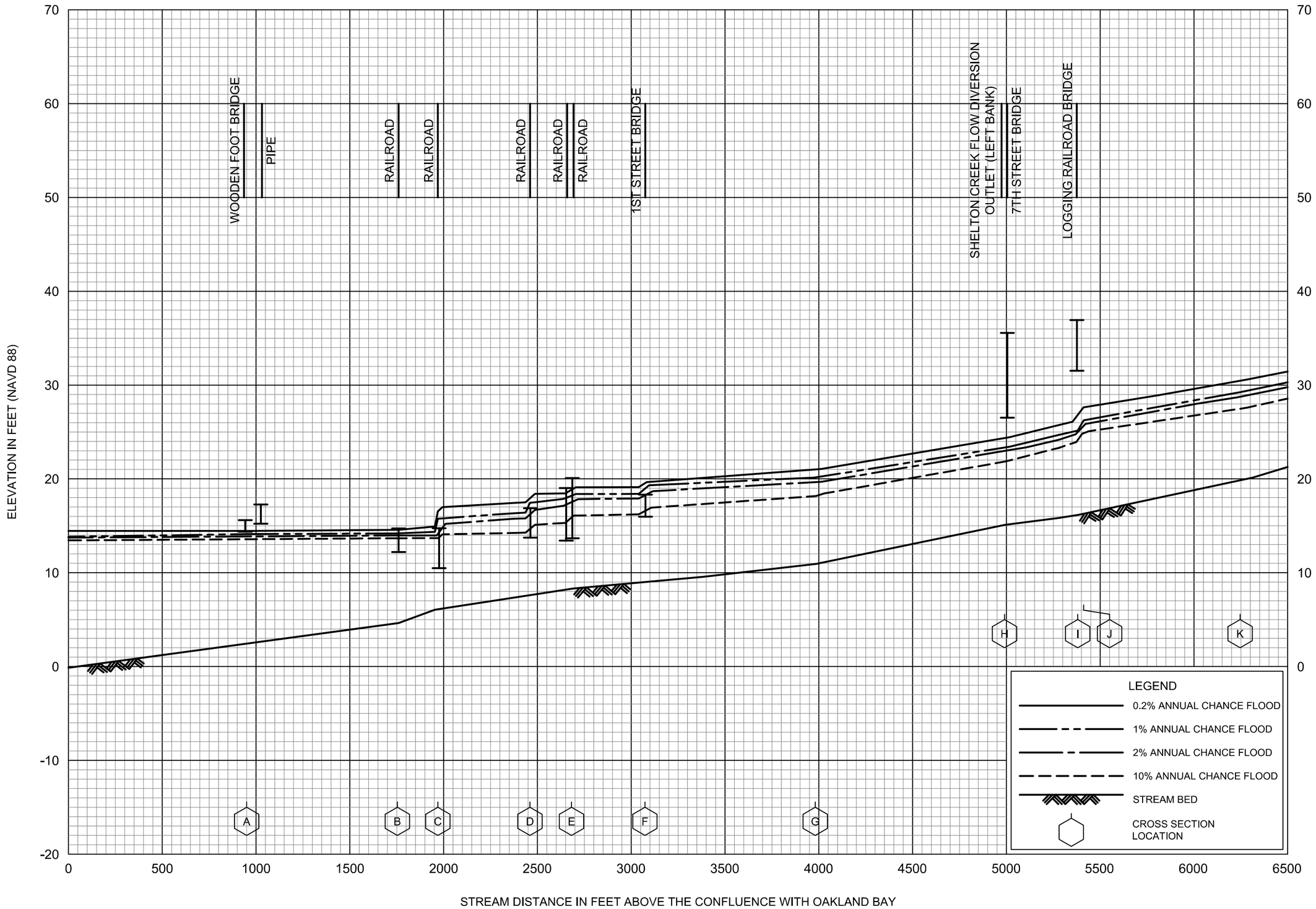

FLOOD PROFILES

GOLDSBOROUGH CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

MASON COUNTY, WA

AND INCORPORATED AREAS

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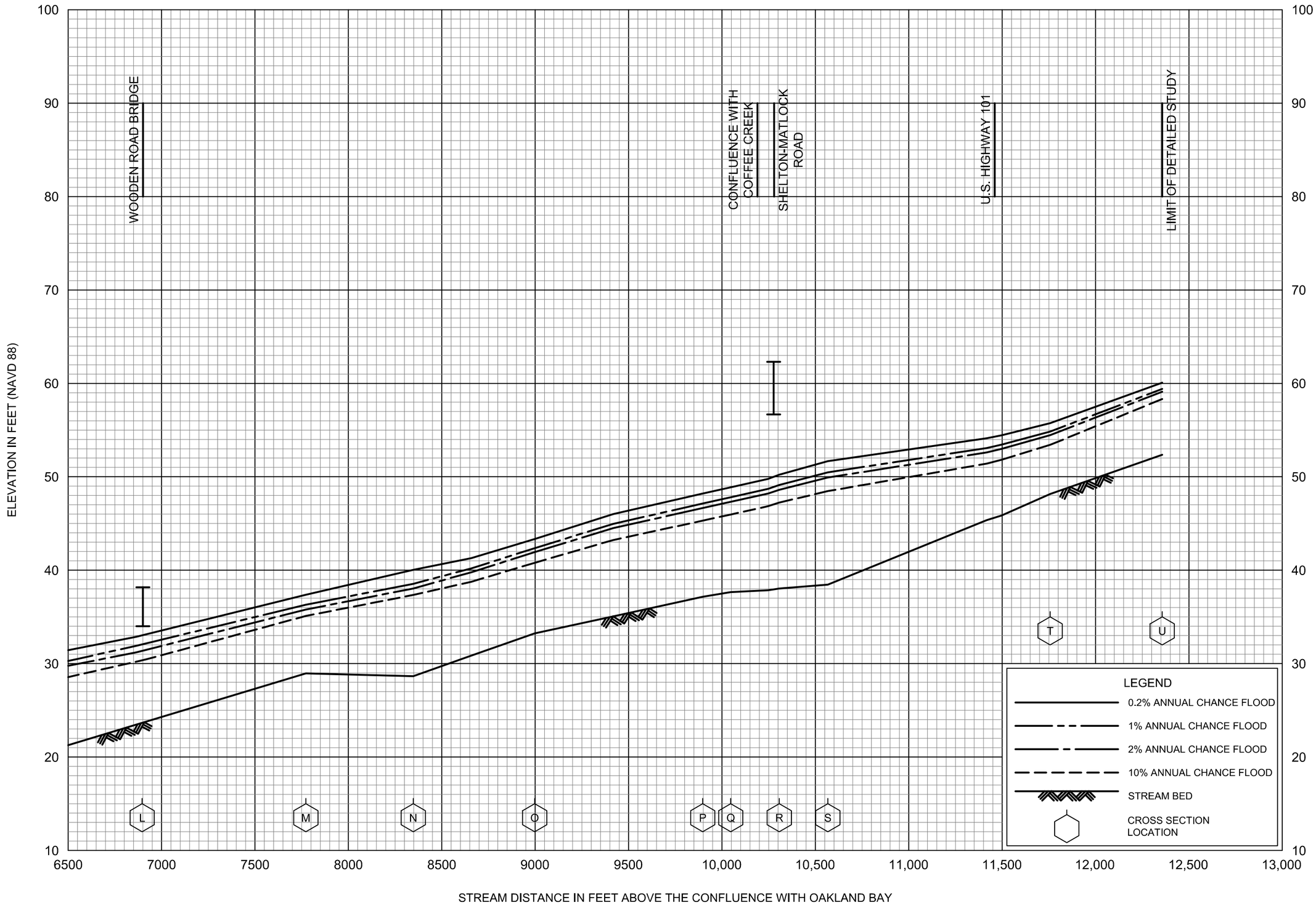

FLOOD PROFILES

GOLDSBOROUGH CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

MASON COUNTY, WA

AND INCORPORATED AREAS

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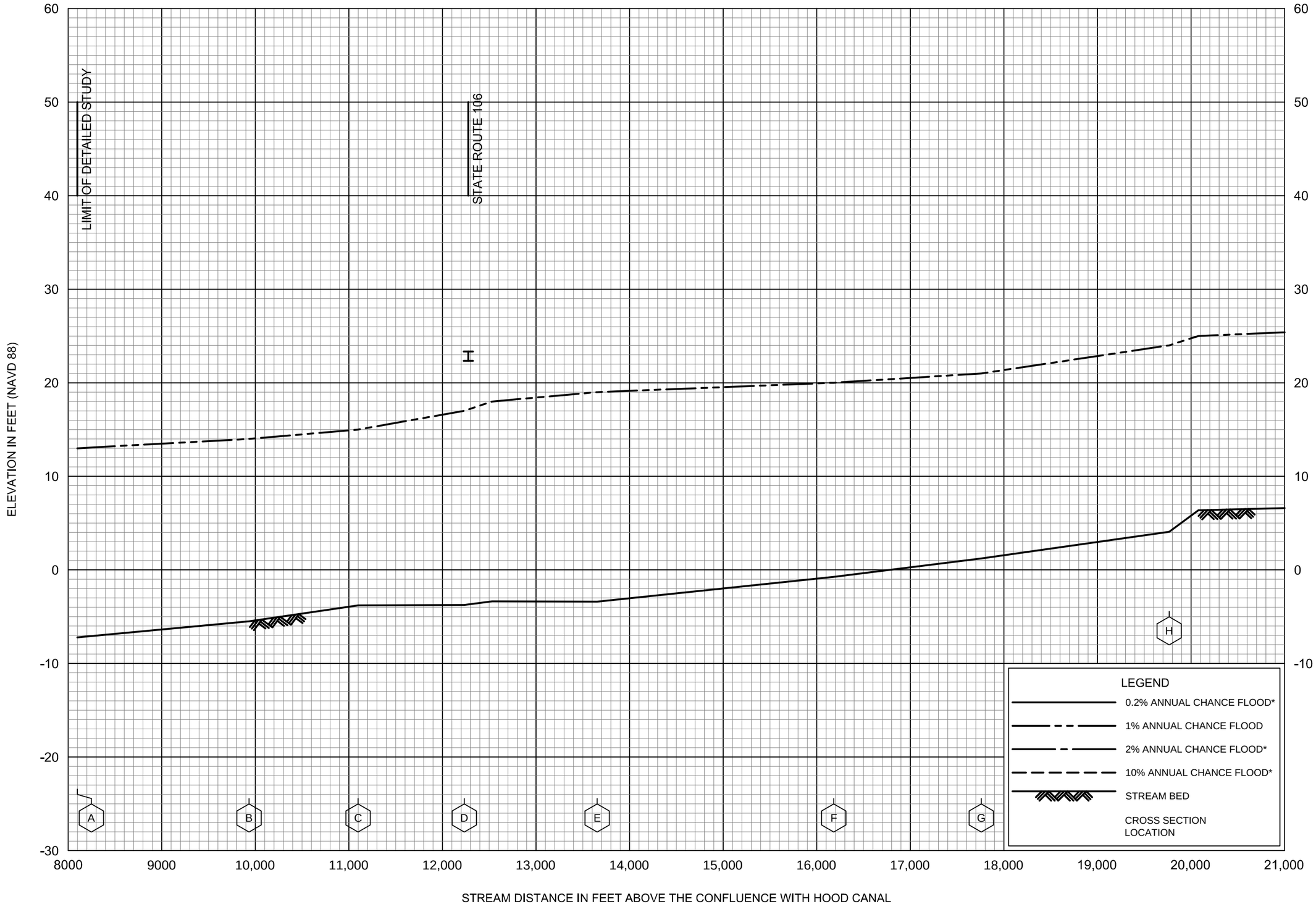

NOTE: 0.2%, 2%, AND 10% ANNUAL CHANCE FLOOD ARE NOT AVALIABLE *

FLOOD PROFILES

SKOKOMISH RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

MASON COUNTY, WA

AND INCORPORATED AREAS

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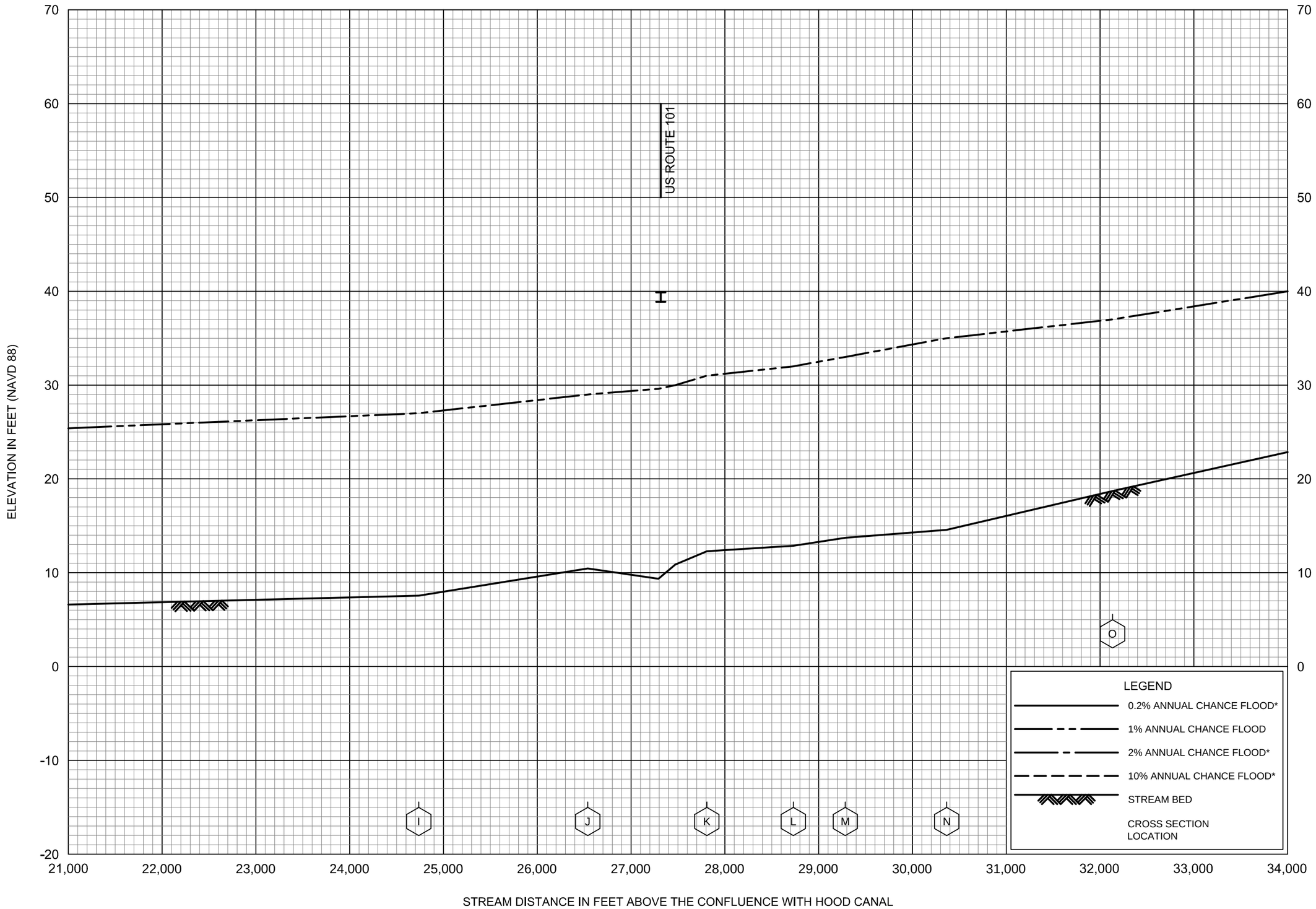

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FLOOD PROFILES

SKOKOMISH RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

MASON COUNTY, WA

AND INCORPORATED AREAS

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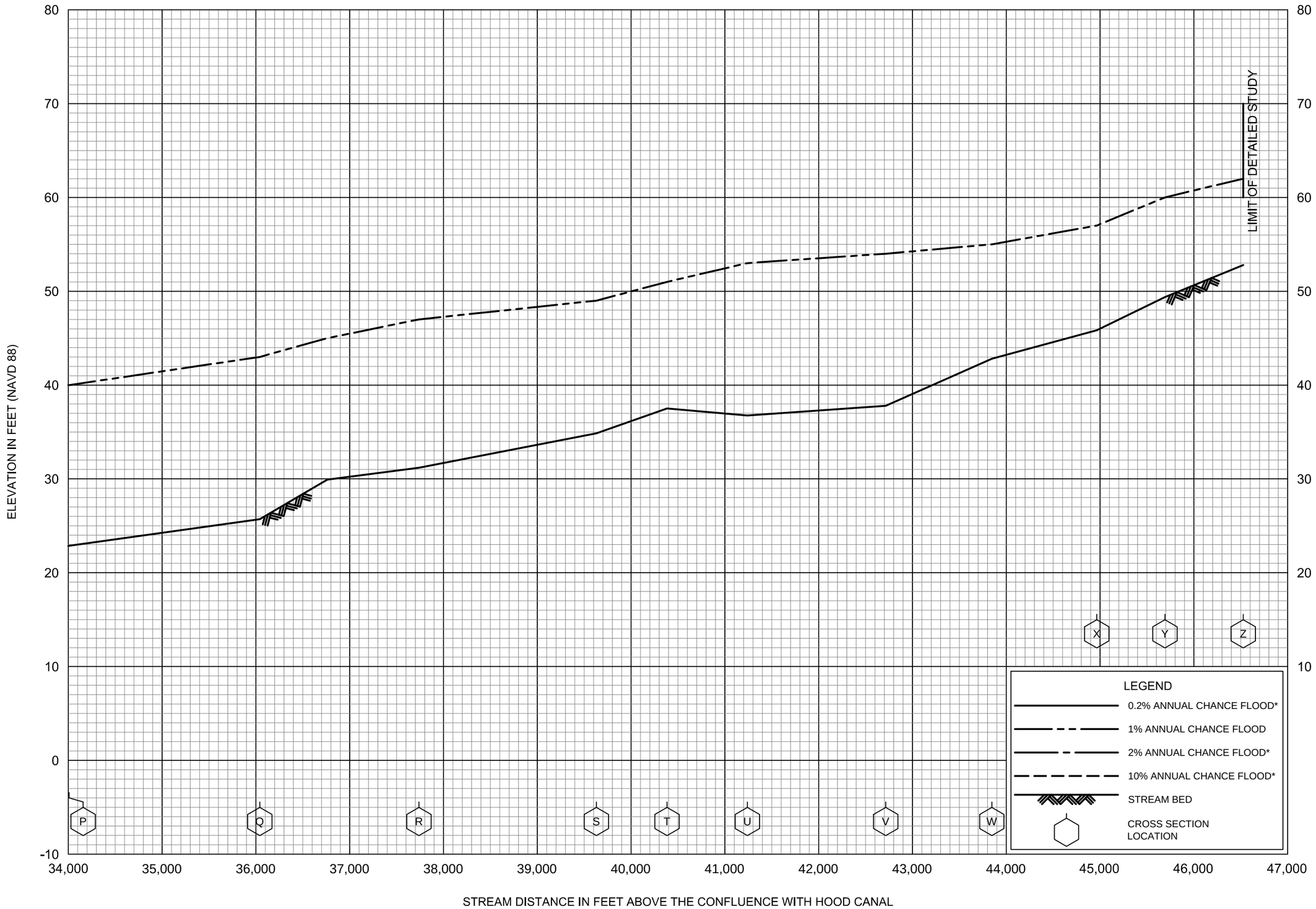

NOTE: 0.2%, 2%, AND 10% ANNUAL CHANCE FLOOD ARE NOT AVALIABLE *

FLOOD PROFILES

SKOKOMISH RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

MASON COUNTY, WA

AND INCORPORATED AREAS

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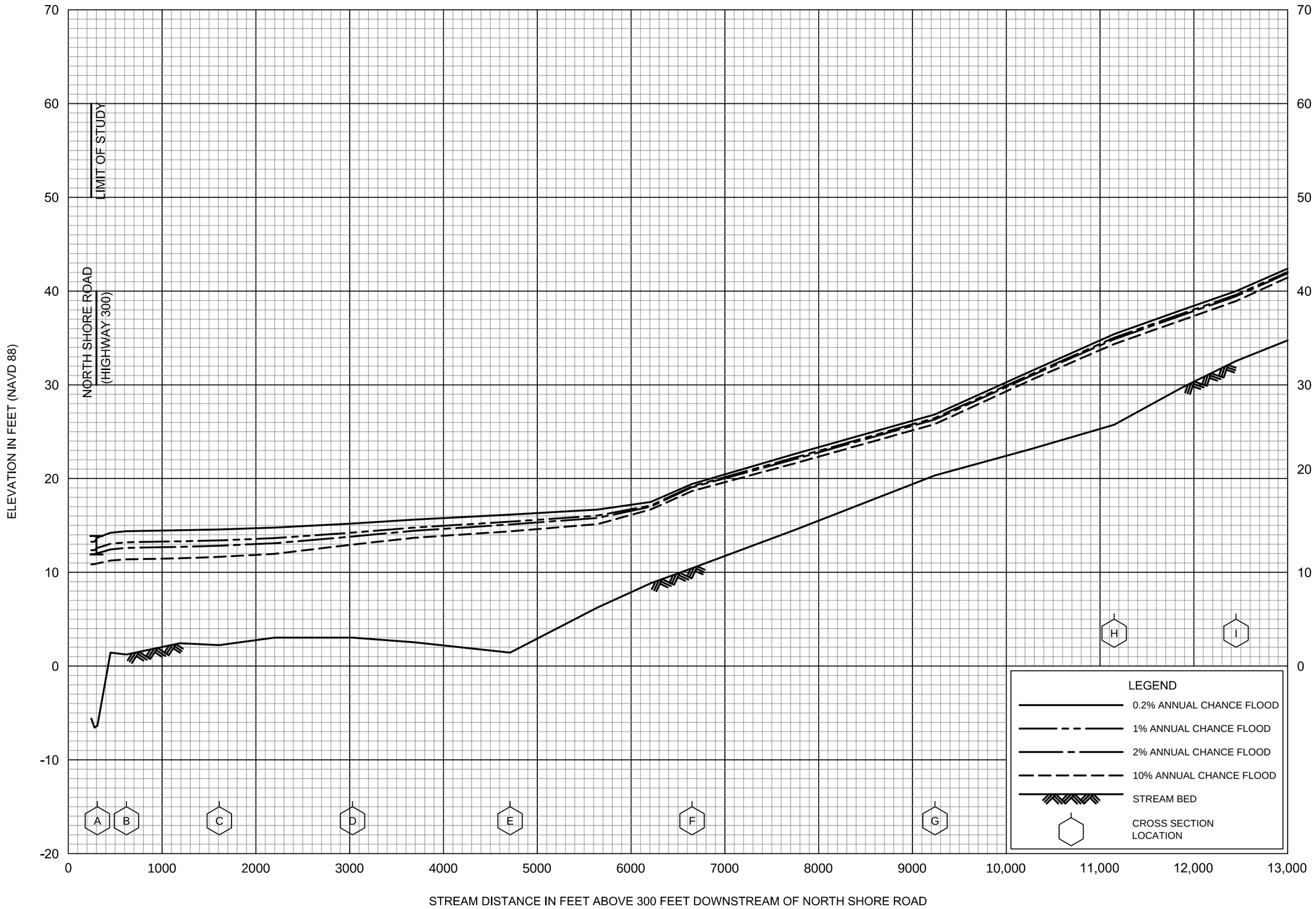


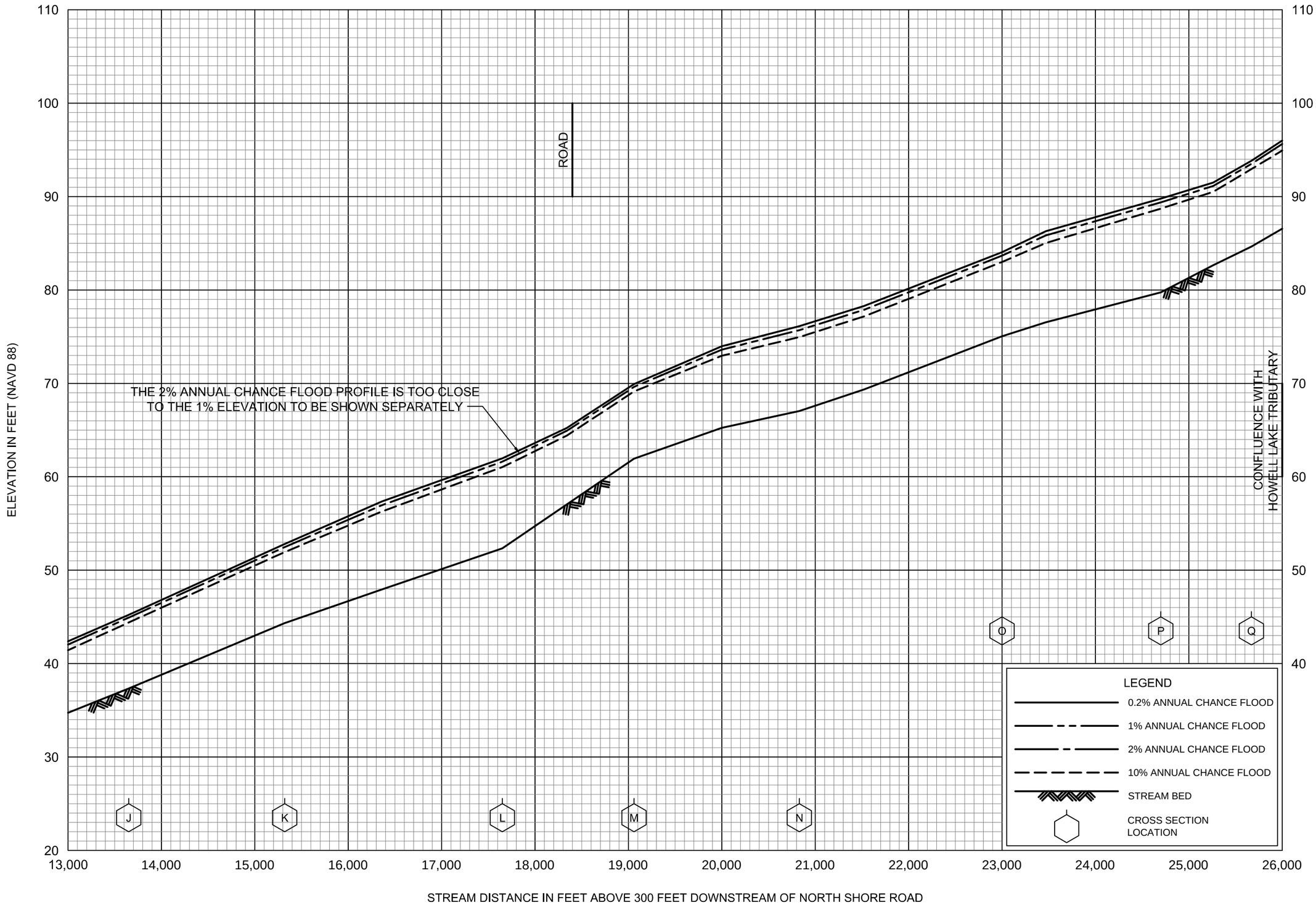
FLOOD PROFILES

TAHUYA RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

MASON COUNTY, WA

AND INCORPORATED AREAS



FLOOD PROFILES

TAHUYA RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

MASON COUNTY, WA

AND INCORPORATED AREAS

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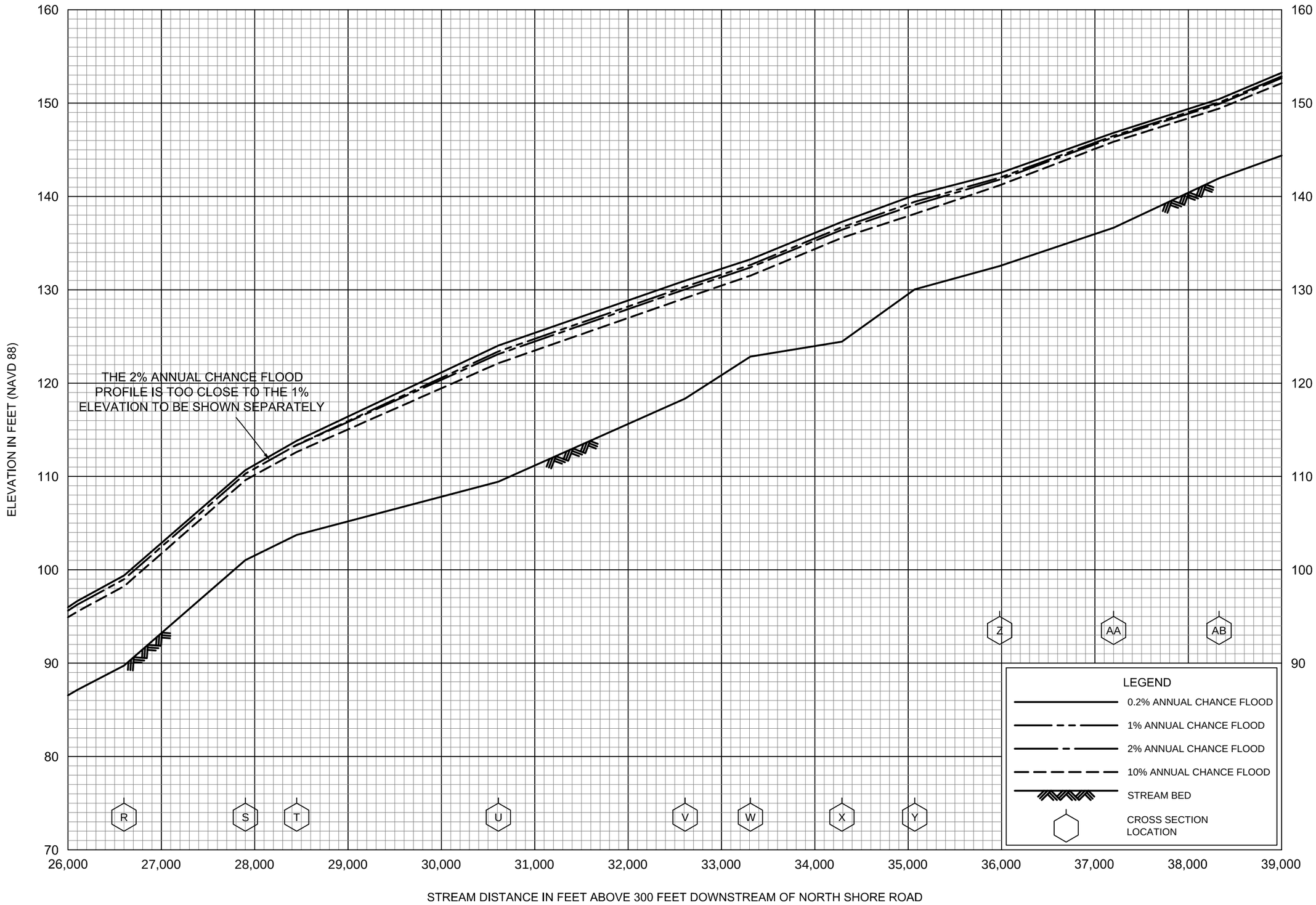

FLOOD PROFILES

TAHUYA RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

MASON COUNTY, WA

AND INCORPORATED AREAS

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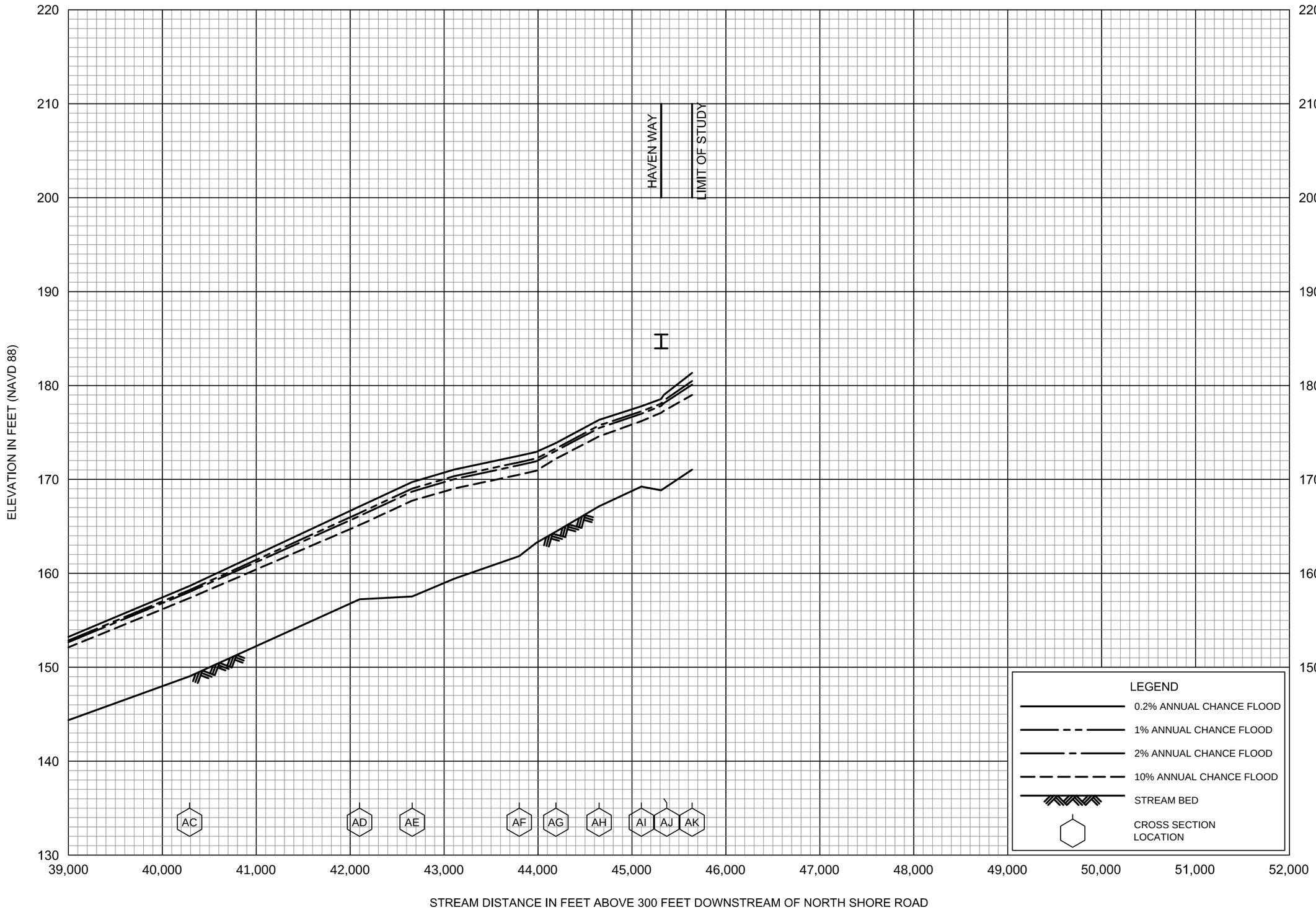


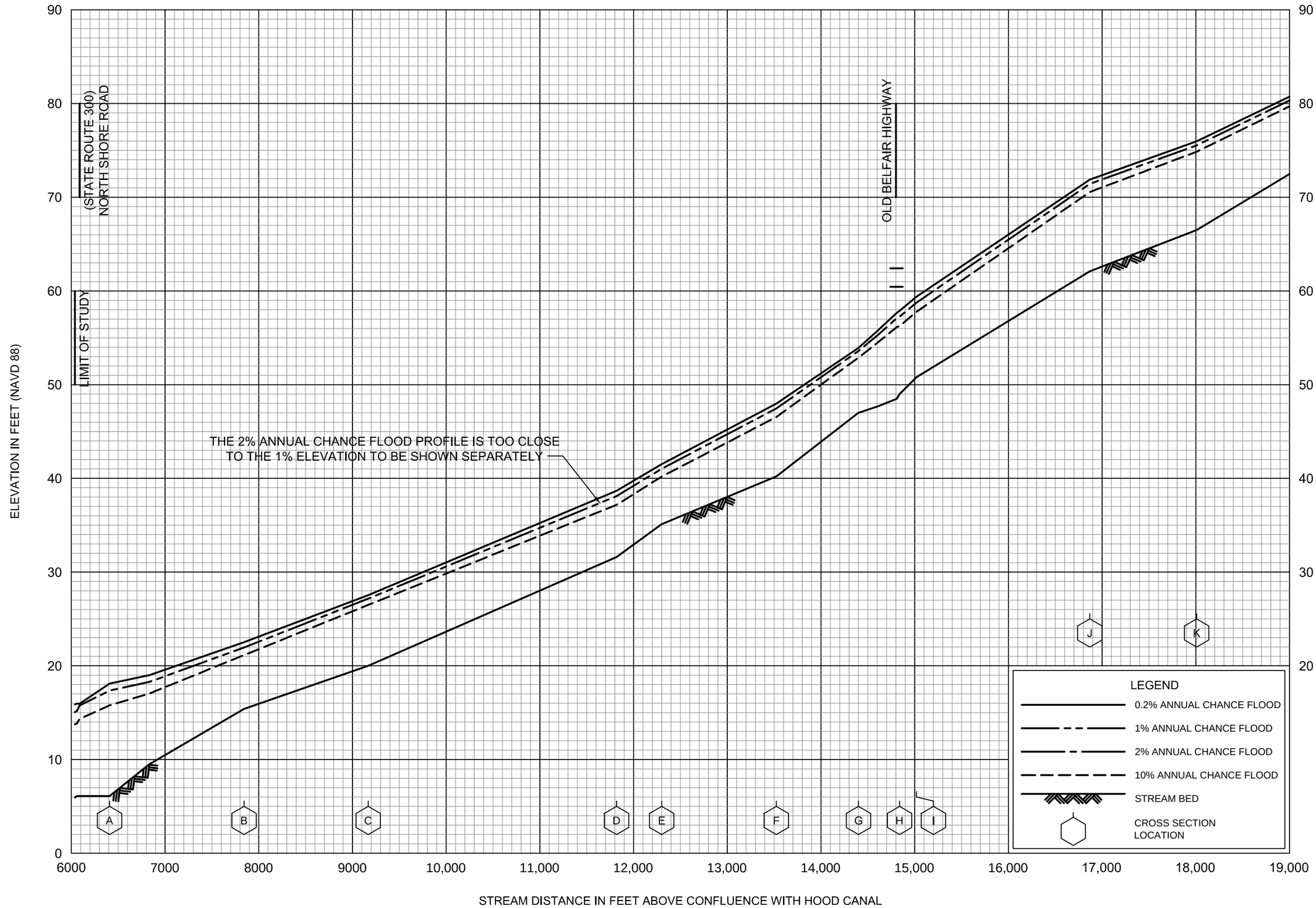
FLOOD PROFILES

TAHUYA RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

MASON COUNTY, WA

AND INCORPORATED AREAS



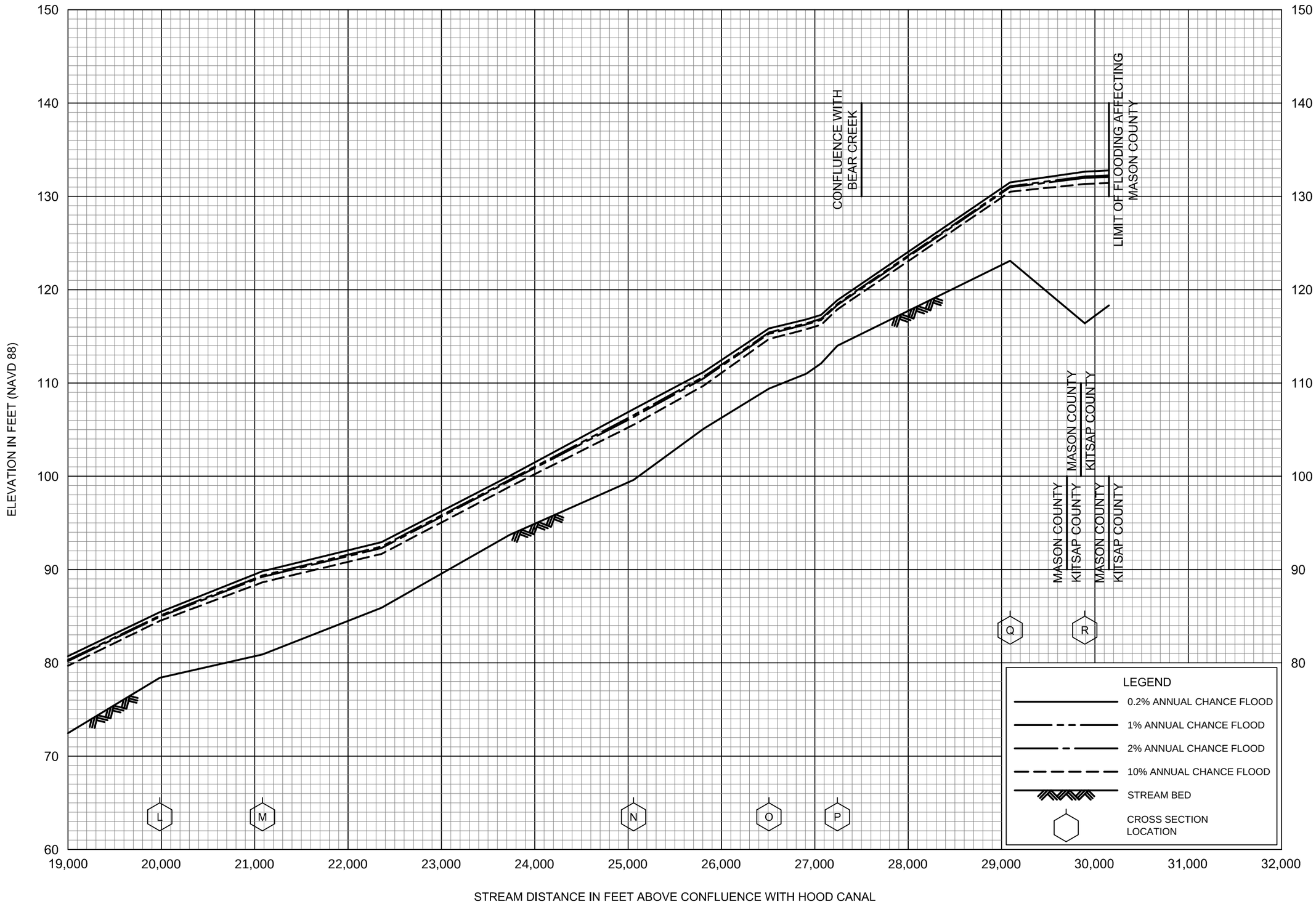
FLOOD PROFILES

UNION RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

MASON COUNTY, WA

AND INCORPORATED AREAS



FLOOD PROFILES

UNION RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

MASON COUNTY, WA

AND INCORPORATED AREAS