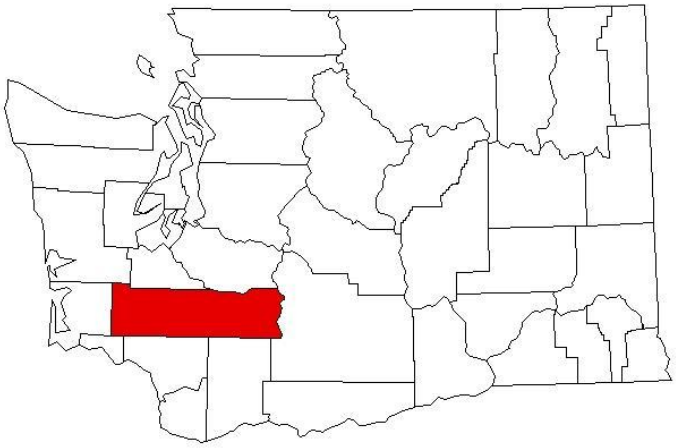
FLOOD INSURANCE STUDY

LEWIS COUNTY, WASHINGTON
AND INCORPORATED AREAS

Community Name	Community Number
LEWIS COUNTY,	
UNINCORPORATED AREAS	530102
CENTRALIA, CITY OF	530103
CHEHALIS, CITY OF	530104
MORTON, CITY OF	530105
MOSSYROCK, CITY OF	530253
NAPAVINE, CITY OF	530254
PE ELL, TOWN OF	530296
TOLEDO, CITY OF	530303
VADER, CITY OF	530266
WINLOCK, CITY OF	530306



PRELIMINARY
NOV 11 2010

Federal Emergency Management Agency

FLOOD INSURANCE STUDY NUMBER
530102V001A

NOTICE TO
FLOOD INSURANCE STUDY USERS

Communities participating in the National Flood Insurance Program have established repositories of flood hazard data for floodplain management and flood insurance purposes. This Flood Insurance Study (FIS) may not contain all data available within the repository. It is advisable to contact the community repository for any additional data.

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

Old Zone	New Zone
A1 through A30	AE
B	X
C	X

The Federal Emergency Management Agency (FEMA) may revise and republish part or all of this FIS report at any time. In addition, FEMA may revise part of this FIS report by the Letter of Map Revision process, which does not involve republication or redistribution of the FIS report. Therefore, users should consult with community officials and check the Community Map Repository to obtain the most current FIS report components.

Initial Countywide FIS Effective Date:

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FLOOD INSURANCE STUDY
LEWIS COUNTY, WASHINGTON AND INCORPORATED AREAS

1.0 INTRODUCTION

1.1 Purpose of Study

This Flood Insurance Study (FIS) revises and updates information on the existence and severity of flood hazards in the geographic area of Lewis County, Washington, including the Cities of Centralia, Chehalis, Morton, Mossyrock, Napavine, Toledo, Winlock and Vader; the Town of Pe Ell Vader; and the unincorporated areas of Lewis County (referred to collectively herein as Lewis County), and aids in the administration of the National Flood Insurance Act of 1968 and the Flood Disaster Protection Act of 1973. This study has developed flood-risk data for various areas of the community that will be used to establish actuarial flood insurance rates and to assist the community in its efforts to promote sound floodplain management. Minimum floodplain management requirements for participation in the National Flood Insurance Program (NFIP) are set forth in the Code of Federal Regulations at 44 CFR, 60.3.

In some states or communities, floodplain management criteria or regulations may exist that are more restrictive or comprehensive than the minimum Federal requirements. In such cases, the more restrictive criteria take precedence and the State (or other jurisdictional agency) will be able to explain them.

1.2 Authority and Acknowledgments

The sources of authority for this FIS report are the National Flood Insurance Act of 1968 and the Flood Disaster Protection Act of 1973.

The hydrologic and hydraulic analyses for this study were performed by multiple contractors. Redelineation and a portion of the approximate Zone A boundaries were completed by Watershed VI Alliance, for the Federal Emergency Management Agency (FEMA), under Contract No. EMA-2002-CO-0048, Task Order HSTO050. This study was completed in September 2010. Floodplain boundaries for approximate studies were delineated based on 10 and 30 meter Digital Elevation Models (DEMs) from the United States Geological Survey (USGS) and LIDAR provided by Lewis County Department of Public Works GIS. Detailed studies of the Chehalis, South Fork Chehalis, Skookumchuck Rivers and Hanaford, Lincoln, Salzer and Stearns Creeks were provided by Northwest Hydraulic Consultants, Inc., for the Federal Emergency Management Agency (FEMA), under IDIQ Contract EMS-2001-CO-0067, Task 19. This study was completed in June 2010. A portion of the approximate Zone A boundaries were completed by Lewis County Department of Public Works GIS, for the Federal Emergency Management Agency (FEMA), under Contract No. EMS-2005-GR-0010. This study was completed in May 2007. Floodplain boundaries for these approximate studies were delineated based on 10 and 30 meter Digital Elevation Models (DEMs) from the United States Geological Survey (USGS) and LIDAR provided by Lewis County Department of Public Works GIS.

This update includes an effort to combine all communities, as well as the unincorporated areas of Lewis County, into a countywide FIS, as compiled from previously published FIS narratives. Table 1 provides a chronological summary of the most recent detailed study analyses of flooding sources within Lewis County, the contract number under which they were performed (if known), and the communities affected by each. Table 2 provides a list of all streams studied using approximate methods.

Table 1. Summary of Flooding Sources Presented in Current Study

Flooding Source	Completion Date	Study Contractor(s)	Contract Or Inter-Agency Agreement No.	Communities Affected
Berwick Creek	September 1979	Tudor Engineering Company	H-4025	Lewis County Uninc.
Big Creek	September 1979	Tudor Engineering Company	H-4025	Lewis County Uninc.
Chehalis River*	June 2010	Northwest Hydraulic Consultants, Inc.	EMS-2001-CO-0067, Task 19	Lewis County Uninc.
Chehalis River (near Pe Ell)	September 1979	Tudor Engineering Company	H-4025	Lewis County Uninc., Pe Ell
China Creek	September 1979	Tudor Engineering Company	H-4025	Lewis County Uninc., Centralia
Cispus River	September 1979	Tudor Engineering Company	H-4025	Lewis County Uninc.
Coal Creek	September 1979	Tudor Engineering Company	H-4025	Lewis County Uninc., Chehalis
Coffee Creek	September 1979	Tudor Engineering Company	H-4025	Lewis County Uninc., Centralia
Cowlitz River	September 1979	Tudor Engineering Company	H-4025	Lewis County Uninc., Toledo
Dillenbaugh Creek	September 1979	Tudor Engineering Company	H-4025	Lewis County Uninc., Chehalis
Elk Creek	September 1979	Tudor Engineering Company	H-4025	Lewis County Uninc.
Hall Creek	September 1979	Tudor Engineering Company	H-4025	Lewis County Uninc.
Hanaford Creek*	June 2010	Northwest Hydraulic Consultants, Inc.	EMS-2001-CO-0067, Task 19	Lewis County Uninc.
Lacamas Creek	September 1979	Tudor Engineering Company	H-4025	Lewis County Uninc.
Lake Creek (Tributary to Tilton River)	September 1979	Tudor Engineering Company	H-4025	Lewis County Uninc., Morton

Table 1. Summary of Flooding Sources Presented in Current Study (cont.)

Flooding Source	Completion Date	Study Contractor(s)	Contract Or Inter-Agency Agreement No.	Communities Affected
Lincoln Creek*	N/A	Northwest Hydraulic Consultants, Inc.	EMS-2001-CO-0067, Task 19	Lewis County Uninc.
McMurphy Creek	September 1979	Tudor Engineering Company	H-4025	Lewis County Uninc., Vader
Middle Fork Newaukum River	September 1979	Tudor Engineering Company	H-4025	Lewis County Uninc.
Mineral Creek	September 1979	Tudor Engineering Company	H-4025	Lewis County Uninc.
Newaukum River	September 1979	Tudor Engineering Company	H-4025	Lewis County Uninc., Napavine
Newaukum River Overflow	October 1999	U.S. Army Corps of Engineers, Seattle District	EMW-97-IA-0140, PO No. 1	Napavine
No Name Creek (Tributary to Siler Creek)	September 1979	Tudor Engineering Company	H-4025	Lewis County Uninc.
North Fork Newaukum River	September 1979	Tudor Engineering Company	H-4025	Lewis County Uninc.
Olequa Creek	September 1979	Tudor Engineering Company	H-4025	Lewis County Uninc., Vader
Roundtop Creek	September 1979	Tudor Engineering Company	H-4025	Lewis County Uninc.
Salzer Creek*	June 2010	Northwest Hydraulic Consultants, Inc.	EMS-2001-CO-0067, Task 19	Lewis County Uninc.
Salzer Creek Middle Fork	September 1979	Tudor Engineering Company	H-4025	Lewis County Uninc.
Salzer Creek North Fork	September 1979	Tudor Engineering Company	H-4025	Lewis County Uninc.
Salzer Creek South Fork	September 1979	Tudor Engineering Company	H-4025	Lewis County Uninc.

Table 1. Summary of Flooding Sources Presented in Current Study (cont.)

Flooding Source	Completion Date	Study Contractor(s)	Contract Or Inter-Agency Agreement No.	Communities Affected
Scheuber Bypass	June 2010	Northwest Hydraulic Consultants, Inc.	EMS-2001-CO-0067, Task 19	Lewis County Uninc.
Siler Creek	September 1979	Tudor Engineering Company	H-4025	Lewis County Uninc.
Silver Creek	September 1979	Tudor Engineering Company	H-4025	Lewis County Uninc.
Skookumchuck River*	June 2010	Northwest Hydraulic Consultants, Inc.	EMS-2001-CO-0067, Task 19	Lewis County Uninc.
South Fork Chehalis River*	June 2010	Northwest Hydraulic Consultants, Inc.	EMS-2001-CO-0067, Task 19	Lewis County Uninc.
South Fork Newaukum River	September 1979	Tudor Engineering Company	H-4025	Lewis County Uninc.
South Fork Tilton River	September 1979	Tudor Engineering Company	H-4025	Lewis County Uninc.
Stearns Creek*	June 2010	Northwest Hydraulic Consultants, Inc.	EMS-2001-CO-0067, Task 19	Lewis County Uninc.
Stowe Creek	September 1979	Tudor Engineering Company	H-4025	Pe Ell
Surrey Creek	September 1979	Tudor Engineering Company	H-4025	Lewis County Uninc.
Tilton River	September 1979	Tudor Engineering Company	H-4025	Lewis County Uninc., Morton

* Flooding source with new or revised analyses incorporated as part of the current study update

Table 2. Streams Studied by Approximate Methods

Flooding Source		
Ames Creek	Dillenbaugh Creek	Kearney Creek
Berry Creek	Eagle Creek	King Creek
Berwick Creek	East Creek	Kiona Creek
Big Creek	Eight Creek	Kiona Creek Tributary
Black Creek	Elk Creek	Klickitat Creek
Blue Lake Creek	Elk Creek (Tributary to Chambers Creek)	Lacamas Creek
Bunker Creek	Elk Creek (Tributary to Green River)	Lake Creek (Tributary to Cowlitz River)
Butter Creek	Elk Creek Tributary 1	Lake Creek (Tributary to South Fork Chehalis River)
Camp Creek	Elk Creek Tributary 2	Lake Creek (Tributary to Tilton River)
Catt Creek	Foster Creek	Lincoln Creek
Cedar Creek	Fronia Creek	Little Nisqually River
Cedar Creek (Tributary to S Fork Chehalis River)	Frost Creek	Lost Creek
Chambers Creek	Green River	Lucas Creek
Chehalis River	Greenhorn Creek	Lucas Creek Tributary 1
China Creek	Halfway Creek	McCormick Creek
Cispus River	Hall Creek	McMurphy Creek
Clear Fork Cowlitz River	Hanaford Creek	Middle Fork Newaukum River
Coal Creek	Hanaford Creek Tributary 3	Middle Fork Newaukum River Tributary 1
Coffee Creek	Hanaford Creek Tributary 3.1	Middle Fork Newaukum River Tributary 2
Cowlitz River	Highland Creek	Mill Creek
Crystal Creek	Independence Creek	Mill Creek Tributary 1
Curtis Creek	Independence Creek Tributary 2/2.1	Mill Creek Tributary 2
Deep Creek (Tributary to Bunker Creek)	Independence Creek Tributary 5	Miller Creek
Deer Creek	Iron Creek	Mineral Creek
Deschutes River	Johnson Creek	Kearney Creek
Devils Creek	Jones Creek	King Creek
Devils Creek Tributary 1	Katula Creek	Kiona Creek

Table 2. Streams Studied by Approximate Methods (cont.)

Flooding Source		
Klickitat Creek	Nineteen Creek	Salzer Creek South Fork
Lacamas Creek	Nisqually River	Sand Creek
Lake Creek (Tributary to Cowlitz River)	No Name Creek	Scammon Creek
Lake Creek (Tributary to South Fork Chehalis River)	No Name Creek (Tributary to Siler Creek)	Scammon Creek Tributary 1
Lake Creek (Tributary to Tilton River)	North Fork Cispus River	Shaw Creek
Lincoln Creek	North Fork Lincoln Creek	Scheuber Bypass
Little Nisqually River	North Fork Lincoln Creek Tributary 1	Siler Creek
Lost Creek	North Fork Newaukum River	Silver Creek
Lucas Creek	North Fork Tilton River	Silver Creek (Tributary to Cowlitz River)
Lucas Creek Tributary 1	Ohanapecosh River	Simmons Creek
McCormick Creek	Ohanapecosh River Tributary 10	Skate Creek
McMurphy Creek	Ohanapecosh River Tributary 10.1	Skook Creek
Middle Fork Newaukum River	Olequa Creek	Skook Creek Tributary 1
Middle Fork Newaukum River Tributary 1	Oliver Creek	Skook Creek Tributary 2
Middle Fork Newaukum River Tributary 2	Packwood Creek	Smith Creek
Mill Creek	Packwood Creek Tributary 1	Snyder Creek
Mill Creek Tributary 1	Packwood Creek Tributary 2	South Fork Chehalis River
Mill Creek Tributary 2	Peters Creek	South Fork Garrard Creek
Miller Creek	Prairie Creek	South Fork Lincoln Creek
Mineral Creek	Quartz Creek	South Fork Newaukum River
Mineral Lake	Rainey Creek	South Fork Tilton River
Mineral Lake (above Kiona Creek)	Reese Creek	South Hanaford Creek
Minnie Creek	Rock Creek	Salzer Creek South Fork
Mitchell Creek	Roundtop Creek	Sand Creek
Muddy Fork Cowlitz River	Salmon Creek	Scammon Creek
Newaukum River	Salzer Creek Middle Fork	Scammon Creek Tributary 1
Newaukum River Overflow	Salzer Creek North Fork	Shaw Creek

Table 2. Streams Studied by Approximate Methods (cont.)

Flooding Source	
Scheuber Bypass	Sulphur Creek
Siler Creek	Sulphur Creek Tributary 1
Silver Creek	Surrey Creek
Silver Creek (Tributary to Cowlitz River)	Thompson Creek
Simmons Creek	Tilton River
Skate Creek	Unnamed Stream
Skook Creek	Upper Lake Creek
Skook Creek Tributary 1	Walupt Creek
Skook Creek Tributary 2	West Fork Stearns Creek
Smith Creek	West Fork Tilton River
Snyder Creek	Willame Creek
South Fork Chehalis River	Winston Creek
South Fork Garrard Creek	Woods Creek
South Fork Lincoln Creek	Yellowjacket Creek
South Fork Newaukum River	
South Fork Tilton River	
South Hanaford Creek	
South Hanaford Creek Tributary 1	
Sponenbergh Creek	
Sponenbergh Creek Tributary 2	
Stearns Creek	
Steffen Creek	
Stillman Creek	
Stillwater Creek	
Stiltner Creek	
Stowe Creek	
Stowell Creek	

Base map information shown on this Flood Insurance Rate Map (FIRM) was provided in digital format by Lewis County. This information was photogrammetrically compiled at a scale of 1:3000 from aerial photography dated 2006.

The digital FIRMs were produced in State Plane coordinates referenced to the North American Datum of 1988 and the GRS 1980 spheroid. Differences in the datum and spheroid used in the production of the FIRMs for adjacent counties may result in slight positional differences in map features at the county boundaries. These differences do not affect the accuracy of information shown on the FIRM.

Information on the authority and acknowledgments for each of the previously printed FIS reports FIRMs for communities within the county is listed below.

Lewis County Unincorporated Areas

The hydrologic and hydraulic analyses for the FIS, effective in October 1981 and revised July 17, 2006, were prepared by Tudor Engineering Company for FEMA, under Contract No. H-4025. That work was completed in September 1979 (Reference 1).

The 1981 FIS for the unincorporated areas of Lewis County was revised in July 2006. The revision was made by the United States Army Corps of Engineers (USACE), Seattle District, under Interagency Agreement EMW-97-IA-0140, Project Order No. 1. The work was completed in October 1999. A portion of the restudied reach prepared by the USACE was revised by Bluhm and Associates based on a more recent and accurate map submitted by the City of Napavine (Reference 2). This topographic map outdated the based map dated 1998 used by the USACE for the revision from River Mile (RM) 6.75 to Rush Road (Reference 3).

City of Centralia

The hydrologic and hydraulic analyses for the FIS dated December 1, 1981 were prepared by Tudor Engineering Company for FEMA, under Contract No. H-4025. That work was completed in September 1979 (Reference 4).

City of Chehalis

The hydrologic and hydraulic analyses for the FIS revised July 17, 2006 were prepared by Tudor Engineering Company for FEMA, under Contract No. H-4025. That work was completed in September 1978 (Reference 5).

City of Morton

The hydrologic and hydraulic analyses for the FIS revised March 2, 1982 were prepared by Tudor Engineering Company for FEMA, under Contract No. H-4025. That work was completed in June 1978 (Reference 6).

City of Napavine

The hydrologic and hydraulic analyses for the FIS revised July 17, 2006 were prepared by the USACE, Seattle District, for FEMA, under Interagency Agreement No. EMW-97-IA-0140, Project Order No. 1. That work was completed in October 1999.

A portion of the restudied reach prepared by the USACE was revised based on a more recent and accurate map by Bluhm and Associates, submitted by the City of Napavine, which was used in the Interstate 5 freeway fill that impacted the area located west of Exit 72 in Napavine. That topographic map outdated the base map dated 1998, used by the USACE in the map

delineation from RM 6.75 to Rush Road (Reference 7).

Town of Pe Ell
The hydrologic and hydraulic analyses for the FIS dated September 1979 were prepared by Tudor Engineering Company for FEMA, under Contract No. H-4025. That work was completed in May 1978 (Reference 8).

City of Toledo
The hydrologic and hydraulic analyses for the FIS dated May 1980 were prepared by Tudor Engineering Company for FEMA, under Contract No. H-4025. That work was completed in June 1979 (Reference 9).

City of Vader
The hydrologic and hydraulic analyses for the FIS dated March 1979 were prepared by Tudor Engineering Company for FEMA, under Contract No. H-4025. That work was completed in April 1978 (Reference 10).

City of Winlock
The hydrologic and hydraulic analyses for the FIS dated March 1979 were prepared by Tudor Engineering Company for FEMA, under Contract No. H-4025. That work was completed in April 1978 (Reference 11).

1.3 Coordination

The initial Consultation Coordination Officer (CCO) meeting for this first time countywide study was held on April 12, 2006, and attended by a representative of the Lewis County Unincorporated Areas.

The results of the study were reviewed at the final CCO meeting held on [to be determined], and attended by representatives of [to be determined]. All problems raised at that meeting have been addressed in this study.

The history of the FIS coordination activities for the individual communities prior to this countywide study are presented below.

Lewis County Unincorporated Areas
The identification of streams selected for detailed analysis for the study dated October 15, 1981 was accomplished in a meeting on April 14, 1976; attended by representatives of the community, a study contractor originally identified to perform the study but not brought under contract, and FEMA. A meeting on July 6, 1976 was attended by representatives of the county, the selected study contractor, and FEMA.

During the course of the work, several informal contacts were made by the study contractor with the community for the purpose of obtaining data and base map material. On July 25, 1979, the results of the study were reviewed at an interim technical meeting attended by representatives of the study contractor, FEMA, and Lewis County.

The final coordination meeting was held on December 18, 1980, and was attended by representatives of FEMA, the study contractor, and the county. No problems were raised at

the meeting.

For the revision in July 2006, a final coordination meeting was held on July 16, 2003, and was attended by representatives of the City of Chehalis, City of Napavine, the USACE, Seattle District, Lewis County and Washington Department of Ecology. All problems raised at that meeting were addressed in the revision (Reference 1).

City of Centralia

The identification of streams selected for detailed analysis for the study dated December 1, 1981 was accomplished in a meeting on April 14, 1976; attended by representatives of the community, a study contractor originally identified to perform the study but not brought under contract, and FEMA. A meeting on July 6, 1976 was attended by representatives of the county, the selected study contractor, and FEMA.

During the course of the work, several informal contacts were made by the study contractor with the community for the purpose of obtaining data and base map material. On July 25, 1979, the results of the study were reviewed at an interim technical meeting attended by representatives of the study contractor, FEMA, and the City of Centralia.

The final coordination meeting was held on February 17, 1981, and was attended by representatives of FEMA, the study contractor, and the city. No problems were raised at the meeting (Reference 4).

City of Chehalis

For the City of Chehalis FIS revised July 17, 2006, streams selected for detailed analysis were identified in a meeting on April 14, 1976; attended by representatives of the community, a study contractor originally identified to perform the study but not brought under contract, and the FEMA. A meeting on July 6, 1976 was attended by representatives of the county, the selected study contractor, and FEMA.

During the course of the work, several informal contacts were made by the study contractor with the community for the purpose of obtaining data and base map material. On August 7, 1978, the results of the study were reviewed at an interim technical meeting attended by representatives of the study contractor, FEMA, and the City of Chehalis.

The final coordination meeting was held on January 21, 1979, and was attended by representatives of FEMA, the study contractor, and the city council. No problems were raised at the meeting which would affect the technical results of this study (Reference 5).

City of Morton

For the City of Morton FIS revised March 2, 1982, streams selected for detailed analysis were identified in a meeting on April 14, 1976; attended by representatives of the community, a study contractor originally identified to perform the study but not brought under contract, and FEMA. A meeting on July 6, 1976 was attended by representatives of the county, the selected study contractor, and FEMA.

During the course of the work, several informal contacts were made by the study contractor with the community for the purpose of obtaining data and base map material. On May 26, 1978, the results of the study were reviewed at an interim technical meeting attended by representatives of the study contractor, FEMA, and the City of Morton.

The final coordination meeting was held on September 20, 1978, and was attended by representatives of FEMA, the study contractor, and the city. No problems were raised at the meeting (Reference 6).

City of Napavine

For the City of Napavine study dated July 17, 2006, results of the study were reviewed at the final coordination meeting held on July 16, 2003; attended by representatives of the Cities of Chehalis and Napavine; the USACE, Seattle District; Lewis County; and Washington Department of Ecology. All problems raised at that meeting were addressed in the study (Reference 7).

Town of Pe Ell

For the Town of Pe Ell study dated September 1979, streams selected for detailed analysis were identified in a meeting on April 14, 1976; attended by representatives of the community, a study contractor originally identified to perform the study but not brought under contract, and FEMA. A meeting on July 6, 1976 was attended by representatives of the county, Tudor Engineering (the study contractor), and FEMA.

During the course of the study, several informal contacts were made by the study contractor with the community for the purpose of obtaining data and base map material. On April 10, 1978, the results of the study were reviewed at an interim technical meeting attended by representatives of the study contractor, FEMA, and the Town of Pe Ell.

The final coordination meeting was held on September 19, 1978, and was attended by representatives of FEMA, the study contractor, and the town. All problems brought up at this meeting were resolved in the study (Reference 8).

City of Toledo

For the City of Toledo study dated May 1980, streams selected for detailed analysis were identified in a meeting on April 13, 1976; attended by representatives of the community and FEMA. A meeting on July 6, 1976 was attended by representatives of the county, the study contractor, and FEMA.

On May 17, 1979, the results of the study were reviewed at an interim technical meeting attended by representatives of the study contractor, FEMA, and the City of Toledo.

The final coordination meeting was held on November 27, 1979, and was attended by representatives of FEMA, the study contractor, and the city. All problems raised at that meeting were addressed in the study (Reference 9).

City of Vader

For the City of Vader study dated March 1979, streams selected for detailed analysis were identified in a meeting on April 14, 1976; attended by representatives of the community, a

study contractor originally identified to perform the study but not brought under contract, and FEMA. A meeting on July 6, 1976 was attended by representatives of the county, the study contractor, and FEMA.

During the course of the study, several informal contacts were made by the study contractor with the community for the purpose of obtaining data and base map material.

The final coordination meeting was held on September 5, 1978, and was attended by representatives of FEMA, the study contractor, and the city. All problems brought up at this meeting were resolved in the study (Reference 10).

City of Winlock

For the City of Winlock study dated March 1979, streams selected for detailed analysis were identified in a meeting on April 14, 1976; attended by representatives of the community, a study contractor originally identified to perform the study but not brought under contract, and FEMA. A meeting on July 6, 1976 was attended by representatives of the county, Tudor Engineering (the study contractor), and FEMA.

During the course of the study, several informal contacts were made by the study contractor with the community for the purpose of obtaining data and base map material. On April 10, 1975, the results of the study were reviewed at an interim technical meeting attended by representatives of the study contractor, FEMA, and the City of Winlock.

The final coordination meeting was held on September 11, 1978, and was attended by representatives of FEMA, the study contractor, and the city. No problems were raised at the meeting (Reference 11).

The dates of the historical initial and final CCO meetings held for the communities within the boundaries of Lewis County are shown in Table 3"Historical CCO Meeting Dates."

Table 3. Historical CCO Meeting Dates

Community Name	Initial CCO Date	Final CCO Date
Lewis County (Unincorporated Areas), revised July 17, 2006	*	July 16, 2003
Lewis County (Unincorporated Areas)	April 14, 1976	December 18, 1980
Centralia, City of	April 14, 1976	February 17, 1981
Chehalis, City of	April 14, 1976	January 21, 1979
Morton, City of	April 14, 1976	September 20, 1978
Mossyrock, City of	*	*
Napavine, City of	*	July 16, 2003
Pe Ell, Town of	April 14, 1976	September 19, 1978
Toledo, City of	April 13, 1976	November 27, 1979
Vader, City of	April 14, 1976	September 5, 1978
Winlock, City of	April 14, 1976	September 11, 1978

*Date not available

2.0 AREA STUDIED

2.1 Scope of Study

This FIS covers the geographic area of Lewis County, Washington, including the incorporated communities listed in Section 1.1. The areas studied by detailed methods were selected with priority given to all known flood hazards and areas of projected development or proposed construction.

The areas studied by detailed methods were selected with priority given to all known flood hazards and areas of projected development or proposed construction.

Streams studied by detailed methods are provided in Table 4, "Streams Studied by Detailed Methods." The stream study types are identified as being either Detailed or Redelineation. Detailed streams are those streams that were restudied within the County. Redelineation streams are those streams previously studied and had elevations and flood boundaries adjusted to conform to the new maps' datum and topographic data. Studied streams whose names were duplicated within the county on previous FIRMs have been changed. Stream name changes since the previous FIS are shown in Table 5, "Stream Name Changes."

Numerous streams as well as Mineral Lake were studied by approximate methods. Approximate analyses were used to study those areas having a low development potential or minimal flood hazards. The scope and methods of study were proposed to, and agreed upon, by FEMA and the study contractors.

Table 4. Streams Studied by Detailed Methods

Stream	Study Type	Reach Length (Miles)	Study Area
Berwick Creek	Redelineation	2.98	From confluence with Dillenbaugh Creek to River Mile 2.98.
Big Creek	Redelineation	6.2	From confluence with Nisqually River to River Mile 6.2.
Chehalis River	Redelineation	1.9	From approximately 1.2 miles downstream of Route 6 to approximately 0.7 mile upstream of Route 6.
Chehalis River	Detailed	41.88	From Lewis County corporate limits to approximately 0.6 mile upstream of Elk Creek Road.
China Creek	Redelineation	4.55	From confluence with Chehalis River to River Mile 4.55.
Cispus River	Redelineation	4.47	From River Mile 12.2 to River Mile 16.67.
Coal Creek	Redelineation	2.60	From confluence with Salzer Creek to River Mile 2.60.
Coffee Creek	Redelineation	2.60	From confluence with Skookumchuck River to River Mile 2.60.
Cowlitz River	Redelineation	7.77	From River Mile 29.07 to River Mile 36.84.
Cowlitz River	Redelineation	40.52	From River Mile 91.12 to River Mile 131.64.
Dillenbaugh Creek	Redelineation	5.25	From confluence with Chehalis River to River Mile 5.25.
Elk Creek	Redelineation	2.84	From confluence with Chehalis River to River Mile 2.84.
Hall Creek	Redelineation	3.22	From confluence with Cowlitz River to River Mile 3.22.
Hanaford Creek	Detailed	6.73	From confluence of Skookumchuck River to approximately 0.6 mile downstream of Hanaford Valley Road.
Lacamas Creek	Redelineation	14.75	From River Mile 3.75 to River Mile 18.50.
Lake Creek (Tributary to Tilton River)	Redelineation	2.0	From confluence with Tilton River to River Mile 2.0.
Lincoln Creek	Detailed	5.8	From confluence with Chehalis River to approximately 100 feet downstream of Teague Road.

Table 4. Streams Studied by Detailed Methods (cont.)

Stream	Study Type	Reach Length (Miles)	Study Area
McMurphy Creek	Redelineation	0.7	From confluence with Olequa Creek to approximately 0.3 mile upstream of East Culvert No. 2.
Middle Fork Newaukum River	Redelineation	1.25	From confluence with North Fork Newaukum River to River Mile 1.25.
Mineral Creek	Redelineation	2.68	From River Mile 1.45 to River Mile 4.13.
Newaukum River	Redelineation	11.42	From confluence with Chehalis River to River Mile 11.42.
No Name Creek (Tributary to Siler Creek)	Redelineation	0.39	From confluence with Siler Creek to River Mile 0.39.
North Fork Newaukum River	Redelineation	1.25	From confluence with Newaukum River to River Mile 1.25.
Olequa Creek	Redelineation	3.12	From River Mile 2.0 to River Mile 5.12.
Roundtop Creek	Redelineation	1.0	From confluence with Mineral Creek to River Mile 1.0.
Salzer Creek	Detailed	5.3	From confluence with Chehalis River to approximately 160 feet downstream of Proffitt Road.
Salzer Creek Middle Fork	Redelineation	0.45	From confluence with Salzer Creek to River Mile 0.45.
Salzer Creek North Fork	Redelineation	0.74	From confluence with Salzer Creek Middle Fork to River Mile 4.14.
Salzer Creek South Fork	Redelineation	0.75	From confluence with Salzer Creek to River Mile 0.75.
Siler Creek	Redelineation	3.40	From mouth to river mile 3.40
Silver Creek	Redelineation	1.1	From river mile 0.15 to river mile 1.25
Skookumchuck River	Detailed	5.64	From confluence with Chehalis River to approximately 1.0 mile upstream of Downing Road.

Table 4. Streams Studied by Detailed Methods (cont.)

Stream	Study Type	Reach Length (Miles)	Study Area
South Fork Chehalis River	Detailed	7.0	From confluence with Chehalis River to approximately 80 feet downstream of Boistfort Road.
South Fork Newaukum River	Redelineation	12.44	From River Mile 11.42 to River Mile 23.86
South Fork Tilton River	Redelineation	1.05	From mouth to river mile 1.05
Stearns Creek	Detailed	4.5	From confluence with Chehalis River to approximately 50 feet upstream of Brown Road West.
Stowe Creek	Redelineation	0.71	From confluence with Chehalis River to approximately 0.22 mile upstream of Kelso Street.
Surrey Creek	Redelineation	1.87	From mouth to river mile 1.87
Tilton River	Redelineation	12.90	From river mile 9.0 to river mile 21.90

Table 5. Stream Name Changes

Community	Old Name	New Name
Lewis County	Cedar Creek	Cedar Creek (Tributary to South Fork Chehalis River)
Lewis County	Coal Creek	Coal Creek (Tributary to Coffee Creek)
Lewis County	Deep Creek	Deep Creek (Tributary to Bunker Creek)
Lewis County	Elk Creek	Elk Creek (Tributary to Chambers Creek)
Lewis County	Elk Creek	Elk Creek (Tributary to Green River)
Lewis County	Lake Creek	Lake Creek (Tributary to Catt Creek)
Lewis County	Lake Creek	Lake Creek (Tributary to Cowlitz River)

Table 5. Stream Name Changes (cont.)

Community	Old Name	New Name
Lewis County	Lake Creek	Lake Creek (Tributary to Silver Creek)
Lewis County	Lake Creek	Lake Creek (Tributary to South Fork Chehalis River)
Lewis County, City of Morton	Lake Creek	Lake Creek (Tributary to Tilton River)
Lewis County	Lake Creek	Lake Creek (Tributary to West Fork Little Nisqually River)
Lewis County	Silver Creek	Silver Creek (Tributary to Cowlitz River)

2.2 Community Description

Lewis County is located in southwestern Washington, covering a land area of approximately 2,427 square miles. It is bordered to the north by Thurston, Pierce, and Grays Harbor Counties, to the south by Cowlitz, Skamania, and Wahkiakum Counties, to the west by Pacific County, and to the east by Yakima County. The major roads serving Lewis County include Interstate Highway 5, State Highway 6, State Highway 508, and US Highway 12. The City of Chehalis, the county seat, is situated in the northwestern part of the county, approximately 85 miles south of the City of Seattle on Interstate Highway 5.

Lewis County was founded in 1845 and was named after the explorer Meriwether Lewis. A farmer named John Jackson was one of the first settlers in the county in 1845 when he began farming in the area known as Jackson Prairie. Cowlitz Landing was the first community in Lewis County, established in 1843 just south of the present City of Toledo. A railroad came through the territory from Columbus River to Puget Sound in 1872, providing an alternate method of transportation, which, up to this time, was primarily by boat within the network of rivers and streams. Rail service is currently provided by the Burlington Northern; Union Pacific; Chicago, Milwaukee, St. Paul and Pacific; and Curtis, Millburn, and Eastern Railroads (Reference 1).

Since its formation, Lewis County has grown to a population of 74,741, based on a 2009 estimate by the US Census Bureau (Reference 12). The population grew rapidly from approximately 12,500 in 1890 to over 32,000 in 1910. The population reached approximately 41,900 by 1960 and grew to approximately 48,400 by 1969, then dropped to approximately 47,100 by 1975. Since then, the population has grown rather steadily to current levels. In the early days of settlement, coal mining, lumbering, and agriculture were the main economic activities within the county (Reference 1). Today, manufacturing is the main industry in Lewis County, accounting for nearly 19 percent of all private wage and salary workers. Other industries, including agriculture, construction, and retail trade are also vital to Lewis County. Approximately 72 percent of workers in Lewis County are private wage or salary workers (Reference 13).

The climate in Lewis County is widely variable and is influenced by the mountain ranges running through the county; the Coast Range in the western part of the county and the Cascade Range in the eastern portion of the county. Average annual precipitation varies from 90 inches in the higher elevations to less than 50 inches in the lowlands. Most of the precipitation generally occurs between October and March. Annual snowfall averages vary from 10 inches to 50 inches. Temperature variations throughout the county are also influenced by elevation. During the winter months, temperatures range from 25°F to 45°F, with temperatures dropping below freezing on 50 to 80 nights in the lower elevations and on 125 to 160 nights in the mountains. The coldest weather is usually the result of cold air from Canada or the arrival of a high-pressure area that developed over the Pacific Northwest or east of the Cascade Range. During the summer months, afternoon temperatures in the lower elevations range from 70°F to 80°F, reaching 90°F or higher on 5 to 15 days, and 100°F or higher on one out of four summers. Minimum temperatures during the summer range from 45°F to 55°F. Temperatures in the mountains decrease approximately 2°F to 3°F with each 1,000 feet increase in elevation. Relative humidity ranges from 45 percent in the afternoon to near 90 percent at sunrise (Reference 1).

With the exception of Big Creek, Mineral Creek, Roundtop Creek, and watersheds which drain approximately 112 square miles of the Nisqually River basin in northeastern Lewis County, the entire study is concerned with rivers and streams within the Chehalis and Cowlitz River basins. The principal river systems in Lewis County are described as follows:

Chehalis River Basin

The Chehalis River, along with its major tributaries, Skookumchuck and Newaukum Rivers, represents the principal drainage sources through the Chehalis River basin. Four main soil types can be used to describe soil characteristics throughout the basin. Olympic and Cispus soils are most prevalent in the mountainous areas of the Coast and Cascade Ranges. These soils are brown to reddish and have developed from weathered basalt rock. The soils are well drained and may extend from a few inches to over 20 feet above bedrock. Melbourne-Meskill silty clay loams are predominant throughout the rolling foothills. These soils are granular, friable, and poorly to moderately well drained. They are gray to brown heavy surface soils over dense, slightly to well compacted subsoil. Salkum and Scamman silty clay loams are predominant in the lower Newaukum River valley to the south and east of Chehalis. These are light brown to dark brown granular soils which grade into a clay and gravel matrix extending to over 100 feet deep in some areas. These soils range from well to poorly drained. Finally, a well-drained, brown to dark, deep alluvial soil classified as Chehalis loam are predominant in the alluvial flood plains of all the major rivers in the basin.

Chehalis River originates in the steep, densely forested area north of Skamokawa Pass in the southwestern corner of the county. The river has a total drainage area of approximately 2,114 square miles, and flows northerly through the Town of Pe Ell to Doty, then easterly to the City of Chehalis, and then it flows generally north by east to its mouth in Grays Harbor County. Over 38 percent of the basin is within Lewis County. Elevations within the basin range from over 2,500 feet at the headwaters to approximately 150 feet at the northern county limits. Streambed slopes vary from approximately 13 feet per mile at Pe Ell to approximately 3 feet per mile at Chehalis, with slopes averaging approximately 5 feet per mile throughout the county. South Fork Chehalis River is a significant tributary to Chehalis River, draining approximately 123

square miles in the southwestern portion of the county. The river runs through generally rugged and steep terrain, with elevations up to 2,500 feet in the headwaters. In the lower elevations, the river flows through a broad, relatively flat valley before discharging into Chehalis River at RM 88. The average streambed slope through the study reach is approximately 6 feet per mile.

Skookumchuck River originates in northeastern Lewis County and flows generally north by west for most of its course through Thurston County before turning southwest into Lewis County once again and discharging into Chehalis River at the City of Centralia. The river drains an area of approximately 181 square miles, with Hanaford Creek being its largest tributary. The headwaters of Skookumchuck River are located in the densely forested Snoqualmie National Forest at elevations of over 3,000 feet. In the lower elevations, the river flows throw Centralia with an average streambed slope of approximately 9 feet per mile.

Newaukum River flows into Chehalis River at RM 75.2 and is divided into three forks; North Fork, Middle Fork and South Fork Newaukum River; between RM 11.5 and 13.5. South Fork Newaukum is sometimes identified as Newaukum River proper. All three forks flow generally west by south to Newaukum Prairie where they join and flow northwesterly to the confluence with Chehalis River south of the City of Chehalis. Newaukum River has a drainage area of approximately 155 square miles at its mouth, with the basin being roughly 24 miles long by 9 miles at its widest point. Headwaters of South Fork Newaukum River originate in Newaukum Lake in Snoqualmie National Forest at an elevation of 3,100 feet. The streambed gradient averages approximately 15 feet per mile through the study area.

Stowe Creek, and its tributaries upstream of the Town of Pe Ell drain an area of approximately 7 square miles. The headwaters of Stowe Creek originate in the steep, rugged slopes of Joy Mountain. The creek flows generally in a northwesterly direction from its source to its mouth where it empties into Chehalis River within the Town of Pe Ell. Altitudes range from approximately 360 feet at its confluence with Chehalis River to over 1800 feet at the headwaters. The slope of the creek through Pe Ell is very steep, averaging over 55 feet per mile.

China Creek, Salzer Creek, and Dillenbaugh Creek are minor tributaries to Chehalis River and are included in the study because of their history of flooding within the Cities of Centralia and Chehalis.

Cowlitz River Basin

Cowlitz River, together with its major tributaries Tilton River and Cispus River, drains approximately 1,622 square miles upstream of the Lewis County/Cowlitz County line. Soil types throughout the basin generally concur with those described for the Chehalis River basin. One marked difference is the predominance of Cispus and Siler silt loam in the Cowlitz River valley upstream of Mossyrock dam. Siler loam is an alluvial deposit which occurs from 10 to 20 feet above the normal stage of the river. It consists of a grayish-brown surface soil from 6 to 18 inches thick, resting on a thick layer of loose, porous, yellowish-white pumice. The subsoil is underlain by layers of stratified find sand and silt. The Cispus soils occupy terrace positions above the valley floor. They are composed of pumice fragments varying in size from 0.25 to 2 inches in diameter. The soils are very loose, coarse, and porous, and range from 2 to 5 feet deep. The pumice was erupted from Mount St. Helens and blown into the area between Kosmos and Randle by southwest winds.

Cowlitz River has its headwaters in the high Cascade Range, draining a total area of approximately 2,480 square miles through mainly rugged forest land. Of the total drainage area, approximately 75 percent is mountainous terrain, with the remainder being rolling, terraced foothills. Mount Rainier is the highest point in the basin with an elevation over 14,400 feet. Near Packwood headwaters fall steeply from approximately 5,000 feet at RM 145 to 1,000 feet at RM 124, an average slope of 190 feet per mile. In the next 72 miles, the river falls 760 feet to a point downstream of the Mayfield Dam at an average slope of nearly 11 feet per mile. Below that point, through the Toledo area, the average slope is approximately 6 feet per mile.
Tilton River, together with its major tributaries, East Fork, West Fork, and North Fork Tilton River, drains approximately 166 square miles before discharging into Cowlitz River at the upstream end of Mayfield Lake. Topography of the watershed is generally rugged, with steep, timber-covered mountainous terrain. The highest point in the basin is in the Gifford Pinchot National Forest on East Fork Tilton River, with an elevation of approximately 4,500 feet. East Fork Tilton River and South Fork River merge into Tilton River immediately north of Coal Canyon, at the upstream end of the study. From there, the river flows southwesterly to the City of Morton, and then generally west by north to its confluence with Bear Canyon Creek, before flowing southwesterly to its confluence with Cowlitz River. Average streambed slope through the study reach is approximately 29 feet per mile.

Cispus River drains approximately 445 square miles, of which approximately 44 percent is located in southeastern Lewis County. Topography of the basin is generally rugged, with steep, timber-covered ridges. The highest point in the watershed is in the headwaters at Mount Adams, which rises to over 12,300 feet. The river generally flows west by north from its origin and discharges into Cowlitz River approximately 6 miles upstream from Riffe Lake, upstream of Mossyrock Dam. Average streambed slope through the study reach is approximately 23 feet per mile.

Olequa Creek and Lacamas Creek are also significant tributaries to Cowlitz River. Olequa Creek drains an area of 106 square miles and joins Cowlitz River at RM 24.8. Approximately 75 percent of the Olequa Creek basin is in Lewis County, north and west of Vader in the vicinity of Winlock. The topography is rugged and timber-covered to the west of the creek, rising to elevations of over 1,200 feet. The topography is generally rolling farmland in the areas of Napavine Prairie and Grand Prairie, with elevations ranging from 400 to 500 feet. Average streambed slope through the Olequa Creek study reach varies from 18 feet per mile through Vader to over 40 feet per mile upstream of Winlock. Lacamas Creek drains an area of approximately 46 square miles and discharges into Cowlitz River approximately 1 mile east of Vader, at RM 28.5. The creek drains Lacamas Prairie to the east and Drews Prairie further downstream to the west. Elevations range from less than 100 feet at the mouth to over 600 feet at the headwaters south of Onalaska. Average streambed slope varies from 10 feet per mile to 36 feet per mile (Reference 1).

Incorporated areas in Lewis County are described as follows:

City of Centralia

The City of Centralia is located in northwestern Lewis County, near the confluence of Chehalis River and Skookumchuck River. The largest city in Lewis County, Centralia is 80 miles south of Seattle on Interstate Highway 5, and 90 miles north of Portland. Approximately 4 miles south on the east bank of Chehalis River is the City of Chehalis, the county seat. Settlers first came to

the area in 1845, and a community was first established in 1852. A Virginia-born man named George Washington was one of the first to arrive in the area, staking a claim at the mouth of Skookumchuck River, a site then known as Cochrans Landing. Washington platted a town called Centerville in 1875, following the completion of the Northern Pacific Railroad through the area. The community grew rapidly and led to incorporation of the community as Centralia in 1886. The population stabilized at approximately 2,000 until after the turn of the century, when the population surged to 7,311 by 1910 (Reference 4). Since then, Centralia has grown slowly and steadily to an estimate of 15,700 in July 2009. The total land area of Centralia is approximately 7.41 square miles (Reference 14).

The city began as a center and railhead for the surrounding lumber industry, with more recent trends broadening the economic base with diversified manufacturing and commercial activity. Manufacturing industries in Centralia include bank checks, clothing, doors, gloves, concrete and food products, and veneer. Within a few miles of the city are extensive coal deposits, which are used to fuel the 1400-megawatt steam-electric Centralia Generating Plant.

Centralia is on a 2-mile-wide plain over which Chehalis River flows, at an elevation of 185 feet. Most of the residences and large part of the business district of Centralia are located outside the portion of the floodplain subject to inundation by Chehalis River. However, a considerable area of Centralia is subject to flooding by Skookumchuck River. Most of the floodplain is devoted to agriculture and similar uses including the Southwest Washington Fairgrounds and a Washington State game farm (Reference 4).

City of Chehalis

The City of Chehalis is located in northwestern Lewis County, just south of the City of Centralia, about 85 miles south of Seattle on Interstate Highway 5 and 85 miles north of Portland. Chehalis lies on the east bank of Chehalis River, near the mouth of Newaukum River. The city is the county seat (Reference 15). Settlers first came to the area in 1851, establishing a community there in 1858. The community was called Saundersville after the area's first settler, Schuyler S. Saunders, until it was renamed Chehalis in 1870. Chehalis is a Native American word meaning "shifting and shining sands." Rapid growth led to incorporation of the community in 1883. Population remained less than 2,000 until after the turn of the century, and then surged to 4,507 by 1910 (Reference 5). Since then, the population of Chehalis has grown to an estimate of 7,396 in July 2009. The total land area is approximately 5.61 square miles (Reference 14).

In the early years, Chehalis was the center for a predominantly farming community. Completion of the Northern Pacific Railroad led to more industrial and commercial activities in the city, including fruit canning; logging; dairy products and poultry processing; and manufacturing of lumber and wood products, metal castings, prefabricated modular buildings, and tire rubber.
The City of Chehalis is located in a 2-mile wide plain through which the Chehalis River flows, at an elevation of 204 feet. Chehalis River flows north, forming the western corporate limits for most of the city's length. Newaukum River flows northwesterly through the southern portion of the city before discharging into Chehalis River just below the southwestern corner of the city. Dillenbaugh and Salzer Creeks discharge into Chehalis River, Salzer Creek to the north of the city and Dillenbaugh Creek in the middle of the city. Coal Creek discharges into Salzer Creek after flowing north through Chehalis. Most of the residences and a large part of the business district of Chehalis are located outside the portion of the floodplain subject to inundation by

Chehalis River; however, a considerable area of the city is subject to flooding. This area of the floodplain, located west of Interstate Highway 5, is mainly devoted to agriculture and includes the sewage treatment plant and the Chehalis-Centralia Airport (Reference 5).

City of Morton

The City of Morton is located in the center of Lewis County at the foot of Cutler Mountain on the edge of the Tilton River, approximately 38 miles east of the City of Chehalis. Morton lies east of Interstate Highway 5 on US Highway 12, and on State Highway 508, which runs roughly parallel to and north of US Highway 12 from Interstate Highway 5 to Morton where it joins State Highway 7, serving the city from the north. Morton was first settled in 1891 and incorporated in 1913. Morton experienced rapid population growth from 475 in 1930 to over 1,100 in 1950 (Reference 6). Since then, the population increased to a 1977 estimate of 1,400 (Reference 6), and has since decreased to an estimate of 1,083 in 2009. The economy of Morton depends on the wood products, health care, and educational and other services industries; agriculture is also carried on. The total land area of Morton is approximately 1.04 square miles (Reference 14).

City of Mossyrock

The City of Mossyrock is located in the center of Lewis County on Highway 12, with Riffe Lake to the east and Mayfield Lake to the west. Mossyrock was officially incorporated in 1948 after beginning as a trading post called Mossy Rock in 1852 (Reference 16). The population of Mossyrock was estimated to be 521 in July 2007. The total land area of Mossyrock is approximately 0.44 square miles (Reference 14).

City of Napavine

The City of Napavine is located in eastern Lewis County, with the Newaukum River running through the northern portion of the city. The City of Napavine was originally incorporated in 1913, but had to discontinue its incorporation because of financial difficulties until it was reincorporated in 1921 (Reference 17). The population of Napavine was estimated to be 1,910 in July 2009. The total land area is approximately 1.19 square miles (Reference 14).

Town of Pe Ell

The Town of Pe Ell is located in western Lewis County, approximately 3 miles east of the Pacific County limits and 18 miles southwest of the City of Chehalis. It lies on State Highway 6, west of Interstate Highway 5. The town was originally intended to be named Pierre after one of the area's first white settlers; however, the name evolved into Pe Ell which was more in line with the Native American mispronunciation of the name Pierre. Pe Ell was platted in the 1880s by Omar Maurman, and incorporated in 1906. The town experienced a decline in population from 838 in 1910 to 540 in 1971. The population in 1975 was 660 (Reference 8), and has not changed much since then, slightly increasing to an estimate of 675 in July 2009. The total land area of the Town of Pe Ell is 0.6 square miles (Reference 14). The main industries in Pe Ell are agriculture, forestry, fishing, and hunting, and educational services.

City of Toledo

The City of Toledo is located in the southwest corner of Lewis County, with the Cowlitz River running along the eastern side of the city. The city is located approximately 2 miles east of Interstate Highway 5, approximately 84 miles southwest of the City of Seattle, and approximately 20 miles southeast of the City of Chehalis. Toledo was an important

transportation center during the early settlement of the State of Washington, and was incorporated in 1892. Toledo has had an unsteady population growth pattern, from a population of 285 in 1900, the city grew to 530 in 1930, and then dropped to 499 by 1960. The estimated population in 1978 was 673 (Reference 9), and has not changed much since then, with an estimation of 688 in July 2009. The total land area of Toledo is approximately 0.34 square miles (Reference 14).

The economy of Toledo is mainly based on logging and milling activities in the surrounding areas, as well as farming. Most of the land within the corporate limits of the city, including the floodplain, is used for residential or commercial purposes; however, some areas of the floodplain are used for croplands and pasture.

City of Vader

The City of Vader is located in southern Lewis County, approximately 18 miles south of Chehalis and 1 mile north of the Cowlitz County line. It is on State Road 603, approximately 3.5 miles west of Interstate 5. Vader was incorporated as Little Falls in 1906, and the name was changed to Vader in 1913. Vader is the smallest of the nine incorporated municipalities in Lewis County. The population of Vader decreased from 631 in 1910 to 387 in 1970 (Reference 10) but has shown slow, steady population growth to an estimate of 615 in July 2009. The total land area of the City of Vader is 0.9 square miles (Reference 14).

City of Winlock

The City of Winlock is located in southwestern Lewis County. Wildwood lies approximately 10 miles to the southwest of Winlock, Chehalis lies approximately 13 miles to the south, and Napavine lies approximately 5 miles to the north.

Winlock was incorporated in 1890, the third municipality to be incorporated in Lewis County. The city's population reached 1,140 in 1910; by 1968, it had declined to 850. In 1975, the estimated population of Winlock was 974. Winlock is currently the fourth largest city in Lewis County (Reference 11). Population has grown to an estimate of 1,235 in July 2009. The total land area of the City of Winlock is 1.1 square miles. The main industries of Winlock are on construction, accommodation and food services, food and beverage, educational services, agriculture, forestry, fishing, and hunting, truck transportation, and public administration (Reference 14).

2.3 Principal Flood Problems

Major flooding within the Chehalis River basin occurs during the winter season, generally from November through February, and is the result of heavy rainfall, occasionally augmented by snowmelt. Flooding and resultant damage are a significant problem in the basin, especially in those areas surrounding the Cities of Centralia and Chehalis. The worst flooding occurs when Chehalis River and its tributaries reach flood stage at approximately the same time. Flooding is intensified over a large area by backwater from Chehalis River because of the low-lying, relatively flat topography of the valley lands extending from Fords Prairie, north of Centralia to Adna, west of Chehalis, and the lower Newaukum River valley, southeast of Chehalis. During periods of flooding on Chehalis River, water flows upstream into its numerous small tributaries, and generally creates extensive areas of shallow ponding. Normal flows on the tributary streams add to ponding problems since they cannot escape through

regular drainage routes. It is estimated that the 1-percent-annual-chance flood would inundate approximately 16 square miles in the immediate Chehalis-Centralia area, of which approximately 6 square miles have been developed for commercial, industrial, or residential use.

Major floods also occurred in the Chehalis River Basin in 1972, 1975, 1986, 1990, 1996, and most recently in 2007 and 2009. Damage from the 1996 flood was estimated at $151 million. A combined total of $107.6 million has been expended by federal and state assistance programs and federal business loans towards disaster recovery from the December 2007 flood. This total does not take into account individual losses covered by private insurance, but the total damage has been estimated at approximately $500 million (Reference 13). The damage for the 2009 flood is yet to be determined, but it was one of the most damaging floods in the history of Lewis County.

January 1972

Crest stage on Chehalis, Newaukum, and Skookumchuck Rivers is usually reached within one day of the heaviest rainfall, and the peak flow normally subsides within a few hours. In the immediate vicinity of the confluence of Skookumchuck and Newaukum Rivers with Chehalis River, backwater effects may prolong high river stages for several hours on either river. The January 1972 flood was one of the largest recorded floods in the upper Chehalis River basin. The flood was extremely severe near the two confluences because of high discharges on all three rivers, peaking almost simultaneously at those locations. The flood resulted from heavy rains and rapid warming which accompanied an intense maritime Pacific Ocean storm system. Flood damage in the areas affected by these three rivers was estimated at over $5 million, the major portion occurring in the Centralia-Chehalis urban areas (Reference 1).

December 2007

The December 2007 flood was a result of heavy rainfall upstream at the vicinity of the William Hills area, with total rainfall amount greater than 11 inches on December 3, 2007 (Reference 18). During the flood on December 3, the Doty gauge reported a peak flow of 51,100 cubic feet per second (cfs) before floodwaters swamped the instruments and destroyed the equipment at the site, far in excess of the 28,900 cfs peak flow during the February 1996 flood. The USGS determined that the peak stream flow was 63,100 cfs. Down river at Grand Mound, the peak instantaneous flow was slightly higher than in the 1996 flood with the peak of 79,100 cfs.

A twenty-mile stretch of Interstate 5 was closed between exits 68 and 88 because of flooding from the Chehalis River. It was reported that the roadway was under about 10 feet of water. The recommended detour added about four hours and stretched 280 miles. WADOT crews had to breach the dike to help drain flood waters on Dec. 5, 2007 (Reference 19).

January 2009

The extreme flooding that occurred in Washington in early January had two main contributors: heavy precipitation that fell on Jan 6th and 7th and warm temperatures that melted snow still on the ground in some places. The gage at Grand Mound has 81 years of record and the flood peak on January 6 was the sixth largest peak recorded at 48,800 cfs.

During the storms, a stretch of Interstate 5 again was closed because of flooding from the Chehalis River. Since the main east/west mountain passes were also closed during this event, the flooding from the Chehalis River essentially cut off traffic to the Puget Sound area and no detour was available.

The 2006 revision of the Lewis County unincorporated areas FIS took into account significant floods in the Chehalis River Basin in 1990, 1991, and 1996. Table 6 summarizes the peak flows for these events.

Table 6. Summary of Recent Flood Events

	Flood Event Peak Flow (cubic feet per second)				
Location	**January 1990**	**November 1990**	**February 1996**	**December 2007**	**January 2009**
Newaukum River near Chehalis	10,400	10,300	13,300	12,900	13,000
Skookumchuck River near Bucoda	8,540	8,400	11,300	3,600	10,500
Chehalis River near Grand Mound	68,700	48,000	74,800	_79,100	48,800

Flooding from sources within the Cowlitz River basin also generally occurs during the winter months. Major floods usually result from a combination of intensive rainfall and snowmelt after the watershed has been saturated from prior rainfall. Before the construction of the Mossyrock and Mayfield Dams, known major floods remained above bank-full for periods of 3 to 5 days (Reference 20). Water level changes have been significantly affected by the two reservoirs behind the dams, Riffe Lake and Mayfield Reservoirs. The largest flood on Cowlitz River occurred in December 1933. In earlier times, floods are reported as having occurred on this river in 1855, 1867, and 1894, but no indication of their magnitude has been recorded. In 1867, the former community of Cowlitz Landing was almost entirely washed away. This event prompted the relocation of the community to higher ground in the area of Toledo. Flooding in the Cowlitz River basin results mainly in damage to farm buildings, livestock, highways, and associated utilities such as electric and telephone services. Small areas in the vicinity of Packwood and Randle have suffered damage to residential and commercial buildings.

At the time of the original Lewis County Unincorporated Areas FIS, effective in 1981, the gage on Cowlitz River at Packwood had 46 years of record, while the gage at Randle had 29 years of record. In 1968, the Cowlitz River gage near Randle was moved 1.4 miles upstream of its former location. In 1977, the flow at the gage below Randle was in excess of the 1-percent-annual-chance discharge, while at Packwood it was considerably less than the expected 1-percent-annual-chance discharge for that gage. During the floods of 1959 and 1962, conditions were such that relatively high return discharges were experienced at Packwood, while flows at Randle represented low expected return events. These observations give some indication of the temporal and spatial diversity of rainstorm events in the upper Cowlitz River valley, and the effect, together with snowmelt runoff in the headwaters, on localized flooding throughout that area. Tables 7 and 8 list the six highest peak discharges

recorded on Cowlitz River in 46 and 29 years of record at the Packwood and Randle gages, respectively (Reference 1).

Table 7. Historic Peak Discharges, Cowlitz River at Packwood

Date	Peak Discharges (Cubic Feet per Second)	Gage Height (Feet)	Approximate Recurrence Interval (Years)
December 2, 1977	36,200	13.7	33
December 21, 1933	36,000	13.0	33
November 23, 1959	34,300	--[1]	25
November 20, 1962	32,100	--[1]	20
December 4, 1975	30,600	12.8	16
December 18, 1917	28,800	--[1]	13

[1]Data Not Available

Table 8. Historic Peak Discharges, Cowlitz River near Randle

Date	Peak Discharges (Cubic Feet per Second)	Gage Height (Feet)	Approximate Recurrence Interval (Years)
December 2, 1977	89,300	26.5	115
December 4, 1975	73,300	24.5	42
January 1, 1974	65,800	23.5	25
November 24, 1959	47,500	--[1]	7
January 3, 1965	45,000	--[1]	5
November 20, 1962	41,000	--[1]	4

[1]Data Not Available

Cispus and Tilton Rivers both discharge into Cowlitz River upstream of the gage near Randle, but downstream of the gage in Packwood. The gage on Cispus River is located near Randle, and at the time of the original Lewis County Unincorporated Areas FIS, covered a record of 47 years. Two gages had operated on Tilton River at the time of the original FIS. The one near Cinebar operated from 1941 to 1958, and the gage upstream of the confluence of Bear Creek operated from 1956 to the time of the original study. Tables 9 and 10 list the six highest discharges recorded on Cispus and Tilton Rivers at the time of the original FIS (Reference 1).

Table 9. Historic Peak Discharges, Cispus River

Date	Peak Discharges (Cubic Feet per Second)	Gage Height (Feet)	Approximate Recurrence Interval (Years)
January 15, 1974	21,700	12.5	33
December 2, 1977	21,200	12.2	30
December 22, 1933	20,000	--[1]	25
December 4, 1975	17,300	11.3	13
November 20, 1962	14,100	10.3	7
December 21, 1972	14,000	10.3	7

[1]Data Not Available

Table 10. Historic Peak Discharges, Tilton River

Date	Peak Discharges (Cubic Feet per Second)	Gage Height (Feet)	Approximate Recurrence Interval (Years)
December 11, 1955	23,200[1]	--[2]	39[3]
December 9, 1953	22,500[1]	--[2]	33[3]
December 2, 1977	22,500	17.5	50
December 1, 1975	17,600	14.8	13
January 20, 1972	17,600	14.8	13
November 20, 1962	16,300	--[2]	9

[1]Recorded at Gage Site near Cinebar, Drainage Area Increase of 17 Square Miles
[2]Data Not Available
[3]Based on Estimated Frequency Curve at the Gage Near Cinebar

2.4 Flood Protection Measures

After historical flooding in December 2007, the Chehalis River Basin Flood Authority was created by inter-local agreement. The Chehalis River Basin Flood Authority set goals to initiate a basin-wide study of flood response needs and options, create a three county flood control district, and to inform federal and state governments of local needs and options. This inter-local agreement established Lewis County as the lead agency (Reference 21). The Water Resources Development Act of 2007 gave the USACE authorization for a project known as the Twin Cities Flood Damage Reduction Project, which focuses on flood protection measures in the Cities of Chehalis and Centralia. In September 2008, the USACE, and the State of Washington, in coordination with representatives of local jurisdictions, kicked off a two part pre-construction phase. Part one involves an evaluation and update of

the project with consideration of the impact of the 2007 flood. The second part includes design work needed for the construction phase. Many levees in the Chehalis River Basin were damaged during the 2007 flood. The USACE is authorized by Congress to help repair damaged levees that meet certain criteria. Repairs to levees at Airport Road and Fulmer Road were completed in October 2008, and repairs on levees for Salzer Creek and Skookumchuck River are set to be completed in the summer of 2009 (Reference 13).

There are also several flood protection measures that lessen the impact of flooding on Cowlitz River. Storage on Riffe Lake at RM 65.5 began in 1968 and provides significant flood storage capacity. Mayfield Reservoir at RM 52.0 has provided storage since 1962. Both projects are owned and operated by the City of Tacoma in Pierce County under a Federal Power Commission license. They regulate flood peaks at Castle Rock in coordination with the USACE, Portland District. Numerous levee projects have been constructed along Cowlitz River, which have minimal effect on the 1-percent-annual-chance and 0.2-percent-annual-chance floods (Reference 1). The Pacific Power and Light Company and the Washington Water power Company have built a dam on Skookumchuck River approximately 11 miles northeast of Centralia (River Mile 21.9) to provide a reliable water supply for the coal-fired steam electric generating plant. This dam does not provide the upstream storage capacity necessary to significantly impact the design floods considered in this study (Reference 4). There is an unaccredited levee along Newaukum River between Rush Road and Interstate 5/U.S. Highway 12 (Reference 1).

There is a dam on the Skookumchuck River approximately 11 miles northeast of Centralia (River Mile 21.9) to provide a reliable water supply for a coal-fired stream electric generating plant; however, this dam does not provide storage capacity necessary to significantly impact the design floods downstream (Reference 4).

There are no existing flood protection measures in Morton, Napavine, Pe Ell, Vader and Winlock.

3.0 ENGINEERING METHODS

For the flooding sources studied by detailed methods 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 once on the average during any l0-, 50-, l00-, 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 l0-, 50-, 100-, and 500-year floods, have a l0-, 2-, 1-, and 0.2-percent-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 1-percent-annual-chance flood in any 50-year period is approximately 40 percent (4 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.

3.1 Hydrologic Analyses

Hydrologic analyses were carried out to establish the peak discharge-frequency relationships for each flooding source studied by detail methods affecting the county.

Cowlitz River Basin

For the Cowlitz River and its tributaries, the 10-, 2-, 1-, and 0.2-percent-annual-chance flood discharges were determined using a few different methods. The Standard log-Pearson Type III frequency analysis, as outlined by the U.S. Water Resources Council (Reference 22) was performed on all available gage records. A frequency-probability curve was computed for each station, and the peak flood discharges were obtained from the results. In some instances short records were correlated with longer records to provide additional data for the analyses. Table 12 lists all gages, maintained and operated by the USGS, from which a sufficient record length was available at the time of the original county and community studies.

For the reaches studied in detail, regional frequency analysis was carried out based on the results of the log-Pearson Type III analyses described above. A regression equation was derived for each return period by correlating the drainage area, stream length, average slope, precipitation, and surface storage with the computed peak discharge at each station. A regional residual coefficient map of the basin was plotted, and peak discharges obtained from the equations were modified by the appropriate coefficients.

Results from the above two analyses were used to calibrate an in-house runoff-routing computer model incorporating design recurrence for the 24-hour storm precipitation and the United States Soil Conservation Service unit hydrograph criteria (Reference 23). Storm precipitation volumes for the l0-, 2-, and 1-percent-annual-chance events were obtained from the National Oceanic and Atmospheric Administration Atlas 2 (Reference 24). Precipitation volume for the 0.2-percent-annual-chance storm was obtained by extending the Atlas 2 frequency curve on normal distribution probability paper. The intensity distributions of the precipitation volumes were based on worst case 24-hour distribution recorded at the Centralia rainfall gage. Loss factors were estimated from soil type and land use, as recommended by the U.S. Soil Conservation Service methodology (Reference 23).

The USACE, Seattle District, and the United States Soil Conservation Service (SCS) conducted hydrologic studies for selected reaches on Newaukum River (Reference 25), Coal Creeks (Reference 26), China Creek (Reference 27), and Coffee Creek (Reference 28). Frequency probability curves and other runoff data were provided by the USACE and SCS.

Discharge frequencies for Cowlitz River below Mayfield Dam were based on Mayfield Dam operational criteria and a cumulative frequency curve developed by the USACE, Portland District, dated February 1972. Adjustments to compensate for contributing areas downstream from the dam were made using the runoff-routing computer model previously described in this section. The rainfall intensity distribution pattern was based on precipitation records at Cinebar and Castle Rock.

Chehalis River Basin

Chehalis, South Fork Chehalis, Newaukum and Skookumchuck Rivers and Stearns, Salzer, Hanaford and Lincoln Creeks

Hydrologic analyses were carried out to establish the 10, 2, 1 and 0.2-percent annual chance peak flows and synthetic hydrographs for these streams. Hydrographs were created from the instantaneous peak, and 1-, 3- and 7-day flow volumes computed from USGS gage data by frequency analyses or two-station comparisons (Reference 29). These hydrographs were used as inflows to the HEC-RAS models created for the hydraulic analysis.

The USGS station data within the study area was divided into two groups: fully gaged record sites are stations having more than 50 years of record; all other sites are defined as "partial gaged record sites". Flood frequency curves were developed using HEC-SSP (Reference 30) for the fully gaged sites, and two-station comparisons were applied to estimate the flow and the return quantiles for the partial gaged sites. Table 12 lists the gages, maintained and operated by the USGS, used in all the analyses for Lewis County flood sources while Table 11 lists the method used for determining the 10, 2, 1 and 0.2-percent annual chance flows for various locations in the Chehalis River basin.

A balanced synthetic hydrograph was then created for the 10, 2, 1 and 0.2-percent annual chance floods based on the instantaneous peak and 1-, 3- and 7-day flow volume of these events. The final result is a single hydrograph that represents the instantaneous peak flow, and the 1-, 3-, and 7-day volume for a particular event at each of the locations.

Inflow hydrographs for ungaged tributaries and local flows were scaled from these hydrographs. The scaling ratios are from the hydrologic study by the USACE, Seattle District, of the Chehalis River (Reference 31). Scaling factors for the ungaged detailed streams and the specific hydrograph scaled are listed in Table 11, "Scaling Factors Used to Relate Flood Frequency Events."

Table 11: Scaling Factors used to Relate Flood Frequency Events

Stream	Drainage Area (Sq. Mi.)	Reference Gage Used for Scaling Hydrograph	Drainage Area for Reference Gage (Sq. Mi.)	USACE Relation Factor Between Basin and Reference Gage	Hydrograph Ratio Specified In HEC-RAS
Stearns Creek	23.23	South Fork	52.42	0.5	0.22
Salzer Creek	12.21	Newaukum River	138.35	0.7	0.06
Hanaford Creek	21.10	Bucoda Local	46.1	1	0.46
Lincoln Creek	31.84	Bucoda Local	46.1	1	0.69

Table 12. Stream Gages Used in Lewis County Analyses

Stream Name and Gage Number	Location	Period of Record
Chehalis River (No. 12027500)	Near Grand Mound	1928 – 2009
Chehalis River (No. 12020000)	Near Doty	1939 – 2009
South Fork Chehalis River (No. 12020800)	Near Wildwood, WA	1999 – 2009
South Fork Chehalis River (No. 12020900)	Near Boistfort	1961 – 1980
South Fork Chehalis River (No. 12021000)	At Boistfort	1944 – 1950
Newaukum River (No. 12025000)	Near Chehalis	1942 – 2009 (Record Not Continuous)
South Fork Newaukum River (No. 12024000)	Near Onalaska	1945 – 1979 (Record Not Continuous)
North Fork Newaukum River (No. 12024500)	Near Forest	1957 – 1966
Skookumchuck River (No. 12026000)	Near Centralia Below Bloody Run Creek	1939 – 2007
Skookumchuck River (No. 12026400)	Near Bucoda	1967 – 1979
Skookumchuck River (No. 12025700)	Near Vail	1967 – 1979
Skookumchuck River (No. 120261500)	Near Centralia	1939 – 1979
Elk Creek (No. 12020500)	Near Doty	1944 – 1979 (Record Not Continuous)
Water Mill Creek (No. 12019600)	Near Pe Ell	1950 - 1970
Cowlitz River (No. 14226500)	At Packwood	1929 – 1979
Cowlitz River (No. 14233400)	Near Randle	1947 – 1979
Cowlitz River (No. 14238000)	Near Mayfield Dam	1934 – 1979 (Regulated Since 1962)

Table 12. Stream Gages Used in Lewis County Analyses (cont.)

Stream Name and Gage Number	Location	Period of Record
Cowlitz River (No. 14243000)	At Castle Rock	1926 – 1979 (Regulated Since 1962)
Cispus River (No. 14232500)	Near Randle	1929 – 1979
Tilton River (No. 14236500)	Near Cinebar	1941 – 1958
Tilton River (No. 14236200)	Above Bear Creek	1956 – 1979
West Fork Tilton River (No. 14235500)	Upstream of Morton	1950 – 1979
Lake Creek (No. 14226000)	Near Packwood	1962 – 1979
Mineral Creek (No. 12083000)	Near Mineral (Nisqually River Basin)	1942 - 1979

Berwick, Coal, Dillenbaugh, Elk, Lake, Middle Fork Salzer, North Fork Salzer, South Fork Salzer, and Stowe Creeks and North and Middle Forks Newaukum River and Chehalis River near Pe Ell

The hydrologic analyses for these streams were not updated for this countywide study. The analysis used for these streams is the same as described above for the Cowlitz basin.

For this countywide study, discharges for the 1-percent-annual-chance recurrence interval were calculated for stream reaches studied by approximate methods (Ames Creek, Berry Creek, Butter Creek, Camp Creek, Cedar Creek, Cispus River, Clear Fork Cowlitz River, Cowlitz River, Crystal Creek, Frost Creek, Greenhorn Creek, Highland Creek, Iron Creek, Johnson Creek, Kearney Creek, Kiona Creek, Klikitat Creek, Lake Creek (Tributary to Tilton River), Mill Creek, Mineral Lake, Minnie Creek, Nineteen Creek, Nisqually River, North Fork Cispus River, North Fork Tilton River, Ohanapecosh River, Ohanapecosh River Tributary 10, Ohanapecosh River Tributary 10.1, Oliver Creek, Quartz Creek, Rainey Creek, Roundtop Creek, Salmon Creek, Skate Creek, Skook Creek, Skook Creek Tributary 1, Skook Creek Tributary 2, South Fork Newaukum River, Steffen Creek, Stiltner Creek, Stowell Creek, Tilton River, West Fork Tilton River, Willame Creek, Winston Creek, Woods, Creek, and Yellowjacket Creek) using regression equations for rural areas in Washington found in USGS Fact Sheet 008-01.

Peak-discharge-drainage area relationships for the streams studied in detail are shown in Table 13, "Summary of Discharges."

3.2 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. Users should be aware that flood elevations shown on the FIRMs represent rounded whole-foot elevations and may not exactly reflect the elevations shown on the Flood Profiles or in the Floodway Data Tables in the FIS report. 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 in conjunction with the data shown on the FIRM. The hydraulic methods used for the current and previous flood insurance studies in Lewis County are described as follows:

Cowlitz River and Tributaries

For the Cowlitz River and its backwater analyses carried out by the study contractor were performed using the HEC-2 step-backwater computer program (Reference 32). Streambed cross sections were taken in the field by depth soundings across the area of flow, and overbank cross sections were obtained photogrammetrically. All bridges and culverts were field surveyed to obtain elevation data and structural geometry. Channel and overbank roughness coefficients (Manning's "n") were based on field inspection, or derived from calibrating known discharges to associated high-water elevations. Channel roughness coefficients ranged from 0.025 for large rivers to over 0.050 for smaller streams, and overbank coefficients ranged from 0.080 to 0.150, see Table 12. Starting water-surface elevations generally were derived using the slope-area method.

Cowlitz River and Tributaries (continued)

Flood profiles were drawn showing computed water surface elevations (WSELs) for the selected recurrence intervals. Backwater effects of large rivers on smaller tributaries are shown by extending the higher WSELs at the confluences until they intersect the natural profiles of the smaller streams. Shallow flooding analysis in Packwood was completed by comparing elevations of a ridge between Cowlitz River and Packwood with elevations of 1-percent-annual-chance flooding from Cowlitz River. From this, a discharge was determined over the ridge and a normal-depth analysis was used to calculate the depth of flooding in the Packwood area (Reference 1).

Streams selected for approximate analysis were investigated using discharges for detailed analysis, but for the 1-percent-annual-chance recurrence interval only. Flood depths were estimated in the field by use of the hand-held programmable calculator using the normal-depth method. Flooded areas corresponding to the estimated depth of flooding were then mapped, in the field, using a hand level and approximate distances. All mapping used for approximate studies was obtained from USGS topographic maps (References 33 and 34).

Table 13. Summary of Discharges (cont.)

Flooding Source And Location	Drainage Area (Square Miles)	Peak Discharges (Cubic Feet Per Second) 10-Percent-Annual-Chance	2- Percent-Annual-Chance	1- Percent-Annual-Chance	0.2- Percent-Annual-Chance
BERWICK CREEK					
At confluence with Dillenbaugh Creek	5.0	130	180	220	280
BIG CREEK					
At confluence with Nisqually River	38.8	5,400	7,300	8,000	10,300
CHEHALIS RIVER					
At confluence with Rock Creek (River Mile 106.71)	88.0	14,150	18,760	21,800	26,500
At Pe Ell (River Mile 106.4)	95.0	15,200	20,000	23,000	28,000
Near Doty	113.0	19,857	32,562	39,353	59,165
Downstream confluence with South Fork Chehalis River (River Mile 87.9)*	332.0	38,074	59,682	70,502	102,515
Downstream confluence with Newaukum River (River Mile 72.2)*	593.0	40,379	46,288	47,398	50,433
At Grand Mound Gaging Station	895.0	45,084	65,410	75,084	100,333
CHINA CREEK					
At confluence with Chehalis River	5.9	120	220	290	--[2]
CISPUS RIVER					
Downstream Study Reach (River Mile 12.2)	321.0	15,300	22,000	25,100	32,900
COAL CREEK					
At confluence with Salzer Creek	9.2	230	420	530	790

Table 13. Summary of Discharges (cont.)

Flooding Source And Location	Drainage Area (Square Miles)	Peak Discharges (Cubic Feet Per Second) 10-Percent-Annual-Chance	2- Percent-Annual-Chance	1- Percent-Annual-Chance	0.2- Percent-Annual-Chance
COFFEE CREEK					
At confluence with Skookumchuck River	7.3	150	275	345	510
COWLITZ RIVER					
At Packwood	287.0	27,300	39,800	45,600	60,800
Downstream of confluence with Cispus River	1,030.0	53,000	75,000	85,100	111,000
At Toledo	1,461.0	49,000	60,000	69,600	94,700
At Toledo (Downstream of Salmon Creek confluence)	1,540.0	51,000[1]	63,000[1]	73,600[1]	98,900[1]
DILLENBAUGH CREEK					
At confluence with Chehalis River	12.1	440	560	630	800
ELK CREEK					
At confluence with Chehalis River	61.0	4,200	5,100	5,600	7,300
HALL CREEK					
At confluence with Cowlitz River	12.7	1,660	2,200	2,400	3,000
HANAFORD CREEK					
At confluence with Skookumchuck River	21.1	2,483	3,593	4,102	5,180
LACAMAS CREEK					
Upstream Study Limit	3.9	200	350	410	550
Downstream Study Limit	34.4	1,150	1,900	2,400	3,250

[1] Discharges reduced due to retarding effects on flood peaks by Riffe Lake and Mayfield Reservoir
[2] Data Not Available

Table 13. Summary of Discharges (cont.)

Flooding Source And Location	Drainage Area (Square Miles)	Peak Discharges (Cubic Feet Per Second) 10-Percent-Annual-Chance	2- Percent-Annual-Chance	1- Percent-Annual-Chance	0.2- Percent-Annual-Chance
LAKE CREEK (TRIBUTARY TO SOUTH FORK CHEHALIS RIVER)					
At confluence with South Fork Chehalis River	28.0	900	1,350	1,600	2,100
LAKE CREEK (TRIBUTARY TO TILTON RIVER)					
At confluence with Tilton River	11.7	1,090	1,340	1,530	1,720
LINCOLN CREEK					
At confluence with Chehalis River	31.8	2,268	3,333	4,124	6,298
MCMURPHY CREEK					
At confluence with Olequa Creek	1.1	85	130	160	220
MIDDLE FORK NEWAUKUM RIVER					
At confluence with North Fork Newaukum River	19.0	660	1,000	1,250	1,700
MINERAL CREEK					
At Downstream Study Limit	62.1	8,200	11,100	12,400	16,100
NEWAUKUM RIVER (INCLUDING SOUTH FORK NEWAUKUM RIVER)					
At gage at Napavine	155.0	9,260	12,000	13,200	15,800
At confluence with Chehalis River	155.0	7,860	10,750	11,500	13,640
NO NAME CREEK (TRIBUTARY TO SILER CREEK)					
At confluence with Siler Creek	2.1	180	290	350	480

[1] Discharges reduced due to retarding effects on flood peaks by Riffe Lake and Mayfield Reservoir
[2] Data Not Available

Table 13. Summary of Discharges (cont.)

Flooding Source And Location	Drainage Area (Square Miles)	Peak Discharges (Cubic Feet Per Second) 10-Percent-Annual-Chance	2- Percent-Annual-Chance	1- Percent-Annual-Chance	0.2- Percent-Annual-Chance
NORTH FORK NEWAUKUM RIVER					
At confluence with Newaukum River	69.0	4,400	6,350	7,400	9,400
OLEQUA CREEK					
At confluence with North Fork Olequa Creek	22.2	680	1,300	1,470	2,300
At Winlock (Downstream of King Creek Confluence)	38.5	1,370	2,450	2,900	4,350
At downstream Limit of Study for Winlock FIS	42.4	1,510	2,740	3,220	4,790
At confluence with McMurphy Creek	60.2	2,345	4,070	4,740	6,920
At Vader (Downstream of Stillwater Creek Confluence)	102.2	5,130	8,550	10,000	14,180
At downstream limit of study	106.9	5,220	8,700	10,190	14,400
ROUNDTOP CREEK					
At confluence with Mineral Creek	11.2	1,250	1,700	1,900	2,390
SALZER CREEK					
At confluence with Chehalis River	12.2	612	798	872	1,038
SALZER CREEK MIDDLE FORK					
At confluence with Salzer Creek	2.0	190	340	440	--[2]
SALZER CREEK – NORTH FORK					
At confluence with Salzer Creek – Middle Fork	3.0	180	320	410	--[2]

[1] Discharges reduced due to retarding effects on flood peaks by Riffe Lake and Mayfield Reservoir
[2] Data Not Available

Table 13. Summary of Discharges (cont.)

Flooding Source And Location	Drainage Area (Square Miles)	Peak Discharges (Cubic Feet Per Second) 10-Percent-Annual-Chance	2- Percent-Annual-Chance	1- Percent-Annual-Chance	0.2- Percent-Annual-Chance
SALZER CREEK – SOUTH FORK					
At confluence with Salzer Creek	8.0	250	450	580	--[2]
SILER CREEK					
At confluence with Cowlitz River	12.4	930	1,550	1,800	2,500
SILVER CREEK					
At confluence with Cowlitz River	51.7	7,100	10,550	12,750	16,300
SKOOKUMCHUCK RIVER					
At confluence with Chehalis River	181.0	8,750	11,000	13,000	17,900
At mouth (regulated)	181.0	8,900	11,900	13,300	16,500
SOUTH FORK CHEHALIS RIVER					
At confluence with Chehalis River	123.0	9,300	12,860	14,800	18,600
SOUTH FORK TILTON RIVER					
At confluence with Tilton River	28.0	4,150	5,350	6,250	8,000
STEARNS CREEK					
At confluence with Chehalis River	23.2	4,763	6,229	6,855	7,778
STOWE CREEK					
At confluence with Chehalis River	7.2	1,025	1,130	1,200	1,450
SURREY CREEK					
At confluence with Cowlitz River	4.4	590	890	1,120	1,460

[1] Discharges reduced due to retarding effects on flood peaks by Riffe Lake and Mayfield Reservoir
[2] Data Not Available

Table 13. Summary of Discharges (cont.)

Flooding Source And Location	Drainage Area (Square Miles)	Peak Discharges (Cubic Feet Per Second) 10-Percent-Annual-Chance	2- Percent-Annual-Chance	1- Percent-Annual-Chance	0.2- Percent-Annual-Chance
TILTON RIVER					
At confluence with Connelly Creek	71.5	10,190	13,550	15,560	19,320
At confluence with Lake Creek	85.9	11,100	14,720	17,100	21,000
Downstream Study Limit at River Mile 9.0	138.7	16,100	21,700	24,500	30,650

*flood peaks attenuated on the Chehalis River between RM 75 and 88 due to broad floodplains

[1] Discharges reduced due to retarding effects on flood peaks by Riffe Lake and Mayfield Reservoir
[2] Data Not Available

Chehalis River and Tributaries

Berwick, Dillenbaugh, Elk, Lake Creeks

The hydraulic analyses for these streams were not updated for this countywide study. The analysis used for these streams is the same as described above for the Cowlitz basin.

China, Coal, Coffee, Middle Fork Salzer, North Fork Salzer, South Fork Salzer Creeks

Hydraulic studies to determine the flooding characteristics of these streams were carried out by the SCS (References 26, 27, and 28). Elevations and floodway widths for these streams were taken directly from the published reports. No 0.2-percent annual chance flood elevations were provided by the SCS for Salzer Creek and its tributaries or China Creek, therefore, no 0.2-percent-annual chance profiles are shown.

Chehalis River near Pe Ell and Stowe Creek

The water surface elevations for the Chehalis River near Pe Ell and Stowe Creek were computed using HEC-2. The cross section data for the overbank areas were developed photogrammatically; data for wet portions of cross sections were obtained by field survey. All bridges and culverts were surveyed to obtain elevation data and structural geometry. Starting water surface elevations were computed by the slope-area method. Shallow flooding occurs where water from Stowe Creek overtops the Burlington Northern Railroad tracks. The tracks create a weir effect and flooding is estimated to be 1 foot in depth using normal depth calculations, a range finder and engineering judgment.

Channel and overbank roughness factors (Manning's n) were based on field inspection and photographs at each cross section location. Roughness coefficient values for the Chehalis River ranged from 0.035 to 0.040 in the channel and from 0.075 to 0.080 in the overbank. Values for Stowe Creek were 0.040 in the channel and ranged from 0.080 to 0.150 in the overbank areas.

Approximate water-surface elevations were determined in the field with a hand-held programmable calculator and a normal depth calculation program. These elevations were not tied into the National Geodetic Vertical Datum (NGVD29), but represent the maximum channel flow depth based on an assumed thalweg elevation of zero.

Newaukum River

Hydraulic studies on Chehalis, Newaukum, and Skookumchuck Rivers were updated in 2006 by the USACE, Seattle District. A UNET unsteady flow model of Chehalis River developed by the USACE in 1996 was used to establish flood levels on Chehalis River at the mouth of Newaukum River. The Chehalis River UNET model has tributary inflows for Newaukum and Skookumchuck Rivers, with local inflows between Adna and Grand Mound. Flow hydrographs were used at each of the boundary points to initiate the Chehalis River UNET model. The UNET model was calibrated to 1996 high water marks (HWMs) gathered by the USACE (Reference 35).

The USACE steady flow computer program HEC-RAS (Reference 36) was used to model the Newaukum River. Starting water-surface elevations for the Newaukum River HEC-RAS modeling were based on the corresponding Chehalis River levels obtained from the USACE's UNET model.

Most cross sections used in the model were obtained from a UNET model of the Newaukum River developed by Pacific International Engineering (PIE) as part of a Chehalis River watershed study. The source of the cross sections in the UNET model was 2-foot contour topographic mapping develop by the USACE for that study.
The cross sections for the main channel portion of the Newaukum River HEC-RAS model were compiled from various sources.

- Duane Hartman and Associates surveyed the main channel to supplement the UNET model cross sections on the studied reach from RM 1.49 to the mouth.
- From RM 1.66 to RM 1.87, main channel cross sections were converted from the previously surveyed cross sections used in the USACE backwater model.
- From RM 7.02 to RM 7.48, cross sections in the vicinity of Rush Road and Interstate Highway 5 were supplemented with survey information previously obtained by Northwest Hydraulic Consultants, Inc. (NHC). The surveyed cross sections on this reach were obtained in 1997 for a study to determine the impact of a proposed development adjacent to the river.
- From RM 7.54 to RM 10.63, Main channel cross sections were converted from cross sections used in an earlier HEC-2 model completed by Tudor Engineering for a previous FIS, along with other sections surveyed by the USACE in 1998 (Reference 37).

Additional cross sections were added, and the alignment and location of certain existing cross sections were adjusted, as required to accurately model the river. The additional cross sections were generated from the 1999 USACE 2-foot topographic mapping, with the low flow channel being interpolated from the adjacent cross sections in the HEC-RAS model. Split flow occurs upstream of the LaBree Road bridge where overflows cross the north bank of the Newaukum River, flowing north into Berwick Creek and Dillenbaugh Creek. The amount of flow leaving the Newaukum River and entering Dillenbaugh Creek was determined using the weir equation and balancing the water levels in the Newaukum River across the flow split. Starting WSELs for the Dillenbaugh Creek-Newaukum River Overflow were taken from the Newaukum River upstream of the Birmingham Northern Relief Road Bridge (RM 1.49).

Data for all bridges in the 2006 revision were obtained from historic files maintained by the USACE. All bridges were field checked in 1998 by the USACE and again in 2000 by NHC to check whether changes to the bridge configurations occurred. The hydraulic analysis for the 2006 revision was based on unobstructed flow with no debris at all bridges and culverts. Roughness factors (Manning's "n") used in the backwater analysis were based on the previous Newaukum River model runs, aerial photography, and field observations made by the USACE and NHC. The roughness coefficients of the Newaukum River channel and overbank areas were in compliance with guidelines established by the USGS. The channel roughness factor for Newaukum River was 0.055, and the overbank roughness factors

ranged from 0.07 to 0.14. The roughness factor for the Dillenbaugh Creek-Newaukum River Overflow was 0.075 in the channel and 0.10 in the overbanks (Reference 38).
The Newaukum River HEC-RAS model was calibrated to the February 1996 HWMs gathered by the USACE (Reference 35), and from anecdotal data collected by the USACE from several property owners on the north side of the river between RM 2.27 and RM 4.68. HWMs were provided on the Newaukum River at Shorey Road (RM 0.08), the Birmingham Northern Relief Road (RM 1.49), LaBree Road (RM 4.10), Rush Road (RM 7.10), and Jackson Highway (RM 9.72).

Chehalis, South Fork Chehalis, and Skookumchuck Rivers and Stearns, Salzer, Hanaford and Lincoln Creeks

For this revision the above described 2006 UNET unsteady flow model for the Chehalis River (Reference 31) and the listed tributaries was converted to a unsteady HEC-RAS 4.1 model (Reference 36). The HEC-RAS model parameters and geometric data were then refined to simulate the February 1996 and December 2007 storm events. Ground elevation points and 2 foot contours (Reference 39) were used for modifying the geometric data. Manning's n roughness values were selected based on comparing channel characteristics observed at the site to photographs of channels with computed "n" values and professional engineering judgment. The Manning's n values were further adjusted in order to simulate water surface elevations that matched surveyed February 1996 and December 2007 high water marks. Manning's n values for the updated 41 miles of the Chehalis River ranged from 0.04 to 0.05 in the main channel and from 0.06 to 0.13 in the overbanks.
The boundary conditions for the model were determined assuming that the coincident peak flood event for the Chehalis River and its tributaries is the 10-percent-annual chance flood event. So the HEC-RAS model was run twice, once for the Chehalis River main stream and once for the tributaries. The runs are described below.

- Chehalis River main stem run - In this situation it was assumed that the tributaries had already peaked so the tributary inflows into the model for the Chehalis River main stem were set to the 10-percent-annual chance inflow hydrograph.
- Tributary run - In this situation it was assumed that the Chehalis River main stream elevations were at the 10-percent-annual chance flood elevation and those elevations were used as the downstream boundary conditions for the tributary model.

Additionally, there are numerous unaccredited levees that impact the flooding along the Chehalis River. In order to determine their full impact on the flooding, with and without levees runs were conducted. The Chehalis River model was run assuming the levees did not fail and then assuming failure of the left bank levee only and then assuming failure of the right bank levee only. The same runs were completed for the tributaries with levees.

Channel roughness factors (Manning's 'n') used in the hydraulic computations were selected based on field observations of the streams and floodplain areas. Channel values ranged from 0.040 to 0.060 and floodplain values ranged from 0.034 to 0.150. Manning's 'n' values used for this study are shown in **Error! Reference source not found.**, "Manning's 'n' Values."

Locations of selected cross sections used in the hydraulic analyses are shown on the Flood Profiles (Exhibit 1). For stream segments for which a floodway was computed (Section 4.2), selected cross-section locations are also shown on the FIRM (Exhibit 2).

Approximate Studies

The approximate study methodology used the computer program WISE as a preprocessor to HEC-RAS. Tools within WISE allowed the engineer to verify that the cross-section data was acceptable. The WISE program was used to generate the input data file for HEC-RAS. Then HEC-RAS was used to determine the flood elevation at each cross section of the modeled stream. No floodway was calculated for streams studied by approximate methods. To estimate the Manning's roughness coefficients, engineering judgment was used based on available survey pictures, aerial photography and land use data.

Table 14. Manning's "n" Values

Flooding Source	Manning's 'n'	
	Channel	Overbank
Berwick Creek	0.040–0.060	0.034–0.150
Big Creek	0.025–0.050	0.080–0.150
Cedar Creek	0.040–0.060	0.034–0.150
Chehalis River	0.040–0.500	0.045-0.130
China Creek	0.030–0.050	0.150–0.250
Cispus River	0.025–0.050	0.080–0.150
Coal Creek	0.040–0.060	0.034–0.150
Coffee Creek	0.040–0.060	0.034–0.150
Cowlitz River	0.035–0.040	0.090–0.120
Dillenbaugh Creek	0.040–0.060	0.034–0.150
Elk Creek	0.025–0.050	0.080–0.150
Hall Creek	0.025–0.050	0.080–0.150
Hanaford Creek	0.070–0.080	0.080–0.120
Lacamas Creek	0.025–0.050	0.080–0.150
Lake Creek (Tributary to Tilton River)	0.040–0.055	0.200
Lincoln Creek	0.070	0.150
McMurphy Creek	0.045–0.055	0.200
Middle Fork Newaukum Creek	0.040–0.060	0.034–0.150
Mineral Creek	0.025–0.050	0.080–0.150
Newaukum River	0.050	0.040–0.120

Table 14. Manning's "n" Values (cont.)

Flooding Source	Manning's 'n' Channel	Manning's 'n' Overbank
Dillenbaugh Creek – Newaukum River Overflow	0.075	0.10
No Name Creek (Tributary to Siler Creek)	0.025–0.050	0.080–0.150
North Fork Newaukum River	0.025–0.050	0.080–0.150
Olequa Creek	0.045–0.055	0.200
Roundtop Creek	0.025–0.050	0.080–0.150
Salzer Creek	0.035–0.045	0.150
Salzer Creek Middle Fork	0.025–0.050	0.080–0.150
Salzer Creek Middle Fork	0.040–0.060	0.034–0.150
Salzer Creek North Fork	0.080–0.088	0.04–0.180
Salzer Creek South Fork	0.040–0.060	0.034–0.150
Siler Creek	0.025–0.050	0.080–0.150
Silver Creek	0.025–0.050	0.080–0.150
Skookumchuck River	00.055	0.060–0.160
South Fork Chehalis River	0.00	0.050-0.070
South Fork Newaukum River	0.040–0.060	0.034–0.150
South Fork Tilton River	0.025–0.050	0.080–0.150
Stearns Creek	0.040–0.060	0.034–0.150
Stowe Creek	0.040	0.080–0.150
Surrey Creek	0.025–0.050	0.080–0.150
Tilton River	0.040–0.055	0.200

The hydraulic analyses for this study 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.

3.3 Vertical Datum

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

(NGVD). With the completion of the North American Vertical Datum of 1988 (NAVD), many FIS reports and FIRMs are now prepared using NAVD as the referenced vertical datum.

Flood elevations shown in this FIS report and on the FIRM are referenced to the NAVD. These flood elevations must be compared to structure and ground elevations referenced to the same vertical datum. Some of the data used in this revision were taken from the prior effective FIS reports and FIRMs and adjusted to NAVD88. The datum conversion factor from NGVD29 to NAVD88 in Lewis County has been calculated on a stream-by-stream basis.

Table 15. Stream by Stream Datum Conversion Factors

Flooding Source	Conversion Factor
Berwick Creek	3.4
Big Creek	3.7
Chehalis River	3.4
China Creek	3.4
Coal Creek	3.4
Cispus River	3.6
Coffee Creek	3.4
Cowlitz River (Downstream Portion)	3.4
Cowlitz River (Upstream Portion)	3.6
Davis Creek	3.6
Dillenbaugh Creek	3.4
Elk Creek	3.4
Hall Creek	3.6
Hanaford Creek	3.4
Lacamas Creek	3.5
Lake Creek	3.5
Lincoln Creek	3.4
McMurphy Creek	3.3
Middle Fork Newaukum River	3.4
Mineral Creek	3.5
Newaukum River	3.4
Newaukum River Overflow	3.4
No Name Creek	3.5
North Fork Newaukum River	3.5
Olequa Creek	3.4
Roundtop Creek	3.5
Salzer Creek	3.4
Salzer Creek Middle Fork	3.5
Salzer Creek North Fork	3.5
Salzer Creek South Fork	3.5
Sethe Creek	3.6
Siler Creek	3.5

Flooding Source	Conversion Factor
Silver Creek	3.5
Skookumchuck River	3.4
Smith Creek	3.6

Table 15. Stream by Stream Datum Conversion Factors (cont.)

Flooding Source	Conversion Factor
South Fork Chehalis River	3.4
South Fork Newaukum River	3.5
South Fork Tilton River	3.5
South Hanaford Creek	3.5
Stearns Creek	3.4

For additional information regarding conversion between the NGVD and NAVD, 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, MD 20910-3282
(301) 713-3191

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 Technical Support Data Notebook associated with FIS report and FIRM for this community. Interested individuals may contact FEMA to access these data.

To obtain current elevation, description, and/or location information for benchmarks shown on this map, please contact the Information Services Branch of the NGS at (301) 713-3242, or visit their website at www.ngs.noaa.gov.

4.0 FLOODPLAIN MANAGEMENT APPLICATIONS

The NFIP encourages State and local governments to adopt sound floodplain management programs. To assist in this endeavor, each FIS report provides 1-percent-annual-chance floodplain data, which may include a combination of the following: 10-, 2-, 1-, and 0.2-percent-annual-chance flood elevations; delineations of 1- and 0.2-percent-annual-chance floodplains; and a 1-percent-annual-chance floodway. This information is presented on the FIRM and in many components of the FIS report, including Flood Profiles, Floodway Data tables, and Summary of Stillwater Elevation tables. Users should reference the data presented in the FIS report as well as additional information that may be available at the local community map repository before making flood elevation and/or floodplain boundary determinations.

4.1 Floodplain Boundaries

To provide a national standard without regional discrimination, the 1-percent-annual-chance flood has been adopted by FEMA as the base flood for floodplain management purposes. The 0.2-percent-annual-chance flood is employed to indicate additional areas of flood risk in the community. For each stream studied by detailed methods, the 1- and 0.2-percent-annual-chance floodplain boundaries have been delineated using the flood elevations determined at each cross section. Between each cross section, the boundaries were interpolated using topographic at varying scales and contour intervals. These are described below.

Cowlitz River and Tributaries

For the Cowlitz River and its tributaries the boundaries between cross sections were interpolated using topographic maps at a scale of 1:4,800, with a contour interval of 4 feet (Reference 40). Additional flood boundary and topographic adjustments were made along Lake Creek using a USGS 7.5 minute series orthophoto quad, scale 1:24,000, Morton, S.E., Washington 1979 (Reference 41)

Chehalis River and Tributaries

Berwick, China, Coal, Coffee, Dillenbaugh, Elk, Lake, Middle Fork Salzer, North Fork Salzer, South Fork Salzer and Stowe Creeks and Chehalis River near Pe Ell

For these streams the boundaries between cross sections were interpolated using topographic maps at a scale of 1:4,800, with a contour interval of 4 feet (Reference 40); at a scale of 1:2,400, with a contour interval of 5 feet (References 42 and 43); at a scale of 1:2,400 with a contour interval of 2 feet (Reference 44); at a scale of 1:1,200, with a contour interval of 2 feet (Reference 45)

Chehalis, South Fork Chehalis, and Skookumchuck Rivers and Stearns, Salzer, Hanaford and Lincoln Creeks

For these streams the boundaries between cross sections were interpolated using topographic maps at a contour interval of 2 feet (Reference 39).

Newaukum River

For the Newaukum River the boundaries between cross sections were interpolated using topographic maps at a scale of 1:4,800, with a contour interval of 4 feet (Reference 40) and the flood boundaries west of Exit 72 in the City of Napavine were delineated based on the topographic maps submitted by Bluhm and Associates at a scale of 1:100, with a contour interval of 1 foot (Reference 46).

An uncertified levee currently exists approximately 200 feet away from the north bank of the Newaukum River between Rush Road and I-5 to provide flood protection for a development. Because the levee is uncertified the 1 and 0.2-percent floodplains for this reach shown on the FIRMS ignore the levee. A gutter line along the levee separates the base flood elevations (BFEs) shown on the FIRMS through this reach. North of the levee in the natural floodplain, the BFEs are based on the unprotected 1-percent annual chance floodplain, while south of the levee the BFEs are based on the assumption that the levee holds.

Some boundaries were developed photogrammetrically, using aerial photographs at a scale

of 1:12,000 (Reference 47).The 1- and 0.2-percent-annual-chance floodplain boundaries are shown on the FIRM (Exhibit 2). On this map, the 1-percent-annual-chance floodplain boundary corresponds to the boundary of the areas of special flood hazards (Zones A, AE, and AH) and 0.2-percent-annual-chance floodplain boundary corresponds to the boundary of areas of moderate flood hazards (Zone X). In cases where the 1- and 0.2-percent-annual-chance floodplain boundaries are close together, only the 1-percent-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.

For the streams studied by approximate methods, only the 1-percent-annual-chance floodplain boundaries are shown on the FIRM. For this revision, the floodplain boundaries were delineated based on topographic maps at a scale of 1:24,000, with a contour interval of 20 feet (Reference 41).

4.2 Floodways

Encroachment on floodplains, such as structures and fill, reduces the flood carrying capacity, increases the 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 this aspect of floodplain management. Under this concept, the area of the 1-percent-annual-chance floodplain is divided into a floodway and a floodway fringe. The floodway is the channel of a stream plus any adjacent floodplain areas that must be kept free of encroachment so that the 1-percent-annual-chance flood can be carried without substantial increases in flood heights. Minimum Federal standards limit such increases to 1 foot, provided that hazardous velocities are not produced. The floodways in this study are presented to local agencies as minimum standards that can be adopted directly or that can be used as a basis for additional floodway studies.

The floodways presented in this study 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. The results of the floodway computations are tabulated for selected cross sections in **Error! Reference source not found.**, "Floodway Data." No section area or velocity data was supplied by the U.S. Soil Conservation Service for China Creek, Coffee Creek, Salzer Creek North Fork and Salzer Creek South Fork and Coal Creek (Reference 1); therefore, no data is shown in **Error! Reference source not found.**. At China Creek, the majority of the conveyance from the three computed floods (10, 2 and 1-percent annual chance) will break out of the channel at Lundberg Road, flow across a field, and rejoin the channel at Little Hanaford Road. The floodway, therefore, is shown outside of the channel in this area.

Newaukum River

In agreement with FEMA guidelines, the existing Newaukum River floodway at the time of the 2006 revision was generally retained wherever possible. Where the floodway could not be retained, it was computed based on equal conveyance reduction from each side of the floodplain to provide an optimized 1-foot rise in the 1-percent-annual-chance WSEL.

In cases where the floodway and 1-percent-annual-chance floodplain boundaries are either close together or collinear, only the floodway boundary is shown. The area between the floodway and the 1-percent-annual-chance floodplain boundaries is termed the floodway fringe. The floodway fringe encompasses the portion of the floodplain that could be completely obstructed without increasing the WSEL of the 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 1, "Floodway Schematic."

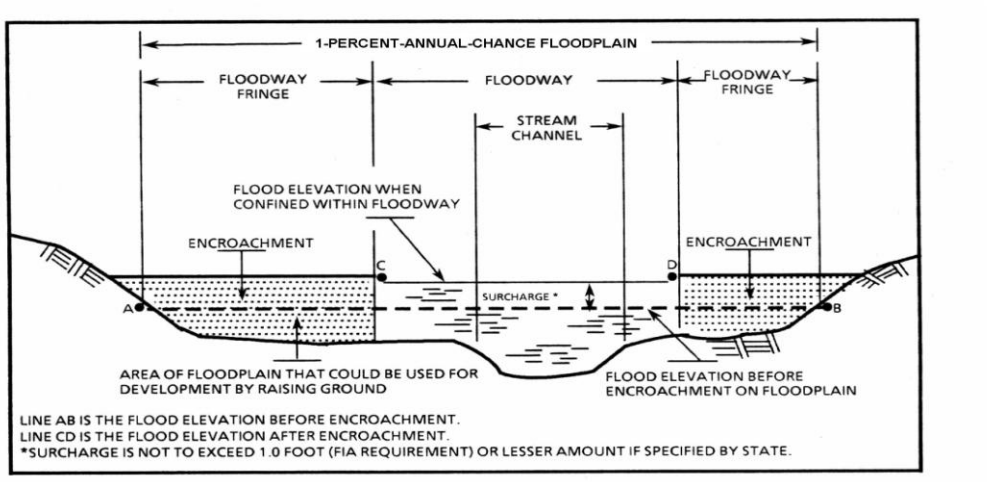

Figure 1. Floodway Schematic

No floodways were computed for streams studied by approximate methods. Along streams where floodways have not been computed, the community must ensure that the cumulative effect of development in the floodplains will not cause more than a 1-foot increase in the base flood elevations at any point within the county.

FLOODING SOURCE		FLOODWAY			1-PERCENT-ANNUAL-CHANCE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY (FEET NAVD)	WITHOUT FLOODWAY (FEET NAVD)	WITH FLOODWAY (FEET NAVD)	INCREASE (FEET)
BERWICK CREEK								
A	1.098	14	62	3.5	213.6	213.6	214.1	0.5
B	1.250	28	76	2.8	216.1	216.1	216.4	0.3
C	1.268	10	49	4.4	216.5	216.5	216.7	0.2
D	1.360	24	64	3.4	218.7	218.7	218.7	0.0
E	1.549	21	53	4.1	229.7	229.7	229.8	0.1
F	1.608	21	41	5.2	232.7	232.7	232.8	0.1
G	1.629	37	135	1.6	234.1	234.1	234.3	0.2
H	1.922	12	60	3.6	243.2	243.2	243.2	0.0
I	1.934	80	258	0.8	243.4	243.4	243.4	0.0
J	2.106	45	94	2.3	245.6	245.6	246.4	0.8
K	2.375	125	111	1.9	252.9	252.9	253.8	0.9
L	2.761	100	109	1.3	262.3	262.3	263.3	1.0
M	2.966	8	47	4.6	271.4	271.4	272.3	0.9

[1] Stream distance in miles above mouth

TABLE 16

FEDERAL EMERGENCY MANAGEMENT AGENCY

LEWIS COUNTY, WA

AND INCORPORATED AREAS

FLOODWAY DATA

BERWICK CREEK

FLOODING SOURCE		FLOODWAY			1-PERCENT-ANNUAL-CHANCE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY (FEET NAVD)	WITHOUT FLOODWAY (FEET NAVD)	WITH FLOODWAY (FEET NAVD)	INCREASE (FEET)
BIG CREEK								
A	0.05	209	1,248	6.4	1,578.1	1,578.1	1,579.1	1.0
B	0.54	89	735	10.6	1,608.7	1,608.7	1,609.4	0.7
C	0.59	50	602	13.0	1,613.6	1,613.6	1,614.4	0.8
D	0.62	201	1,643	4.8	1,617.8	1,617.8	1,618.0	0.2
E	1.09	86	537	14.3	1,638.5	1,638.5	1,638.5	0.0
F	1.53	350	2,610	2.9	1,662.9	1,662.9	1,663.8	0.9
G	1.60	50	437	7.2	1,665.1	1,665.1	1,665.3	0.2
H	1.63	120	917	3.4	1,666.3	1,666.3	1,666.4	0.1
I	1.98	70	306	10.3	1,679.7	1,679.7	1,680.5	0.8
J	2.46	250	719	4.4	1,716.4	1,716.4	1,717.4	1.0
K	2.84	101	377	8.3	1,740.8	1,740.8	1,740.8	0.0
L	3.11	180	577	5.5	1,757.9	1,757.9	1,758.5	0.6
M	3.15	63	465	6.8	1,763.2	1,763.2	1,763.5	0.3
N	3.18	120	773	4.1	1,764.5	1,764.5	1,764.6	0.1
O	3.40	72	279	11.3	1,776.4	1,776.4	1,776.4	0.0
P	3.43	48	352	8.9	1,781.1	1,781.1	1,781.3	0.2
Q	3.45	133	796	4.0	1,782.9	1,782.9	1,782.9	0.0
R	3.68	137	579	5.4	1,793.7	1,793.7	1,793.7	0.0
S	3.91	70	308	10.2	1,805.9	1,805.9	1,806.2	0.3
T	3.96	55	343	7.3	1,809.9	1,809.9	1,810.2	0.3
U	3.98	125	825	3.0	1,811.2	1,811.2	1,811.4	0.2
V	4.26	66	285	8.8	1,824.2	1,824.2	1,824.5	0.3
W	4.62	37	264	9.5	1,847.8	1,847.8	1,848.1	0.3

[1] Stream distance in miles above mouth

TABLE 16

FEDERAL EMERGENCY MANAGEMENT AGENCY

LEWIS COUNTY, WA

AND INCORPORATED AREAS

FLOODWAY DATA

BIG CREEK

FLOODING SOURCE		FLOODWAY			1-PERCENT-ANNUAL-CHANCE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY (FEET NAVD)	WITHOUT FLOODWAY (FEET NAVD)	WITH FLOODWAY (FEET NAVD)	INCREASE (FEET)
BIG CREEK (continued)								
X	4.64	34	291	7.1	1,850.0	1,850.0	1,850.0	0.0
Y	5.02	43	253	8.2	1,877.0	1,877.0	1,877.0	0.0
Z	5.21	42	221	9.4	1,889.8	1,889.8	1,890.2	0.4
AA	5.69	36	226	9.2	1,927.6	1,927.6	1,928.4	0.8
AB	5.95	76	287	7.3	1,947.4	1,947.4	1,947.5	0.1
AC	6.20	47	214	9.7	1,967.9	1,967.9	1,967.9	0.0

[1] Stream distance in miles above mouth

FLOODING SOURCE		FLOODWAY			1-PERCENT-ANNUAL-CHANCE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY (FEET NAVD)	WITHOUT FLOODWAY (FEET NAVD)	WITH FLOODWAY (FEET NAVD)	INCREASE (FEET)
CHEHALIS RIVER								
A	2,600	3,999	38,399	2.5	152.6	152.6	153.3	0.7
B	5,570	4,411	25,341	3.5	154.1	154.0	154.8	0.8
C	8,599	3,663	25,768	1.3	155.8	155.8	156.8	1.0
D	12,062	844	5,821	5.4	157.7	157.7	158.3	0.6
E	17,049	2,210	24,149	3.7	163.0	163.0	163.6	0.6
F	17,864	2,423	22,731	4.6	163.5	163.5	164.1	0.6
G	19,859	1,478	19,595	4.4	166.4	166.4	167.2	0.8
H	22,534	1,640	22,354	3.9	168.2	168.2	168.9	0.7
I	24,558	2,214	36,130	2.4	169.5	169.5	170.4	0.9
J	27,280	2,858	31,705	2.7	170.9	170.9	171.7	0.8
K	28,888	3,227	28,225	3.1	172.1	172.1	172.8	0.7
L	30,409	2,687	18,708	4.6	173.6	173.6	174.2	0.6
M	31,796	3,040	22,490	3.9	174.4	175.4	175.9	0.5
N	33,130	3,162	33,406	3.2	176.4	176.3	176.9	0.6
O	34,511	1,716	15,088	5.0	177.0	177.0	177.6	0.6
P	35,838	1,168	14,225	5.3	178.3	178.3	178.9	0.6
Q	36,603	1,176	15,339	4.9	179.8	179.8	180.5	0.7
R	37,595	3,012	36,958	3.0	180.0	180.0	180.7	0.7
S	38,450	3,102[2]	40,211	2.1	180.2	180.2	180.9	0.7
T	40,590	3,862[2]	58,907	1.3	180.5	180.5	181.2	0.7
U	43,004	4,592[2]	69,919	1.1	180.6	180.6	181.3	0.7
V	44,663	6,075[2]	83,255	0.9	180.6	180.6	181.3	0.7
W	47,585	6,860[2]	99,208	0.8	180.7	180.6	181.4	0.8

[1]Stream distance in feet above Lewis County boundary

FLOODING SOURCE		FLOODWAY			1-PERCENT-ANNUAL-CHANCE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY (FEET NAVD)	WITHOUT FLOODWAY (FEET NAVD)	WITH FLOODWAY (FEET NAVD)	INCREASE (FEET)
CHEHALIS RIVER (continued)								
X	49,610	5,963[2]	83,807	0.9	180.7	180.7	181.4	0.7
Y	51,951	5,133[2]	71,234	0.9	180.8	180.8	181.5	0.7
Z	54,325	3,833[2]	45,689	1.0	180.8	180.8	181.5	0.7
AA	55,175	3,369	34,520	1.2	180.9	180.9	181.6	0.7
AB	57,366	2,727	33,847	1.2	181.2	181.0	181.7	0.7
AC	58,504	2,823	37,045	0.6	181.3	181.0	181.7	0.7
AD	59,850	2,449	28,188	0.9	181.4	181.0	181.7	0.7
AE	61,444	2,109	22,312	1.5	181.6	181.1	181.8	0.7
AF	63,257	2,283	19,347	2.3	181.9	181.4	182.0	0.6
AG	65,157	2,382	31,522	1.7	182.2	181.7	182.3	0.6
AH	66,334	2,081	22,063	2.1	182.4	181.9	182.5	0.6
AI	67,865	3,939	43,021	1.2	182.6	182.2	182.7	0.5
AJ	71,701	3,135	32,536	1.7	182.9	182.4	183.0	0.6
AK	73,360	2,760	26,361	1.9	183.0	182.6	183.1	0.5
AL	74,584	4,140	34,546	1.9	183.2	182.8	183.3	0.5
AM	76,234	4,480	35,415	2.9	183.4	183.0	183.5	0.5
AN	77,809	3,843	39,265	2.8	184.6	184.4	184.8	0.4
AO	80,441	1,329	14,895	3.0	185.8	185.6	185.9	0.3
AP	82,020	1,881	18,388	2.0	186.2	186.0	186.4	0.4
AQ	83,997	3,128	34,831	1.3	186.4	186.2	186.6	0.4
AR	85,401	3,422	23,202	2.2	186.5	186.6	186.9	0.3
AS	87,270	3,922	38,380	1.5	186.9	186.6	186.9	0.3
AT	89,713	3,564	24,119	2.3	187.4	187.2	187.4	0.2

[1]Stream distance in feet above Lewis County boundary

FLOODING SOURCE		FLOODWAY			1-PERCENT-ANNUAL-CHANCE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY (FEET NAVD)	WITHOUT FLOODWAY (FEET NAVD)	WITH FLOODWAY (FEET NAVD)	INCREASE (FEET)
CHEHALIS RIVER (continued)								
AU	91,184	3,505	29,681	2.0	187.9	187.6	187.9	0.3
AV	92,161	3,414	22,947	2.9	188.2	187.9	188.2	0.3
AW	94,583	1,806	29,726	3.9	192.5	192.5	192.9	0.4
AX	97,013	1,205	20,084	3.1	193.2	193.1	193.8	0.7
AY	99,278	1,145	13,665	3.2	193.7	193.7	194.3	0.6
AZ	101,288	2,159	21,037	2.9	194.7	194.4	194.9	0.5
BA	104,003	3,240[2]	35,149	2.0	195.7	195.3	195.6	0.3
BB	105,378	2,704[2]	19,627	3.0	196.2	195.7	196.0	0.3
BC	108,418	2,384[2]	27,215	3.2	197.3	197.0	197.2	0.2
BD	110,818	1,340[2]	13,016	5.5	198.2	198.0	198.3	0.3
BE	112,953	1,418[2]	17,146	4.3	199.5	199.1	199.6	0.5
BF	115,459	2,258[2]	12,740	6.1	201.2	201.0	201.5	0.5
BG	118,939	3,003[2]	46,165	1.5	203.3	203.2	203.7	0.5
BH	122,848	1,302[2]	16,652	4.3	204.1	204.0	204.5	0.5
BI	126,088	2,613	23,755	3.3	205.7	205.7	206.2	0.5
BJ	128,800	2,110	29,477	2.6	206.7	206.7	207.5	0.8
BK	131,352	2,100	19,528	4.0	207.8	207.8	208.7	0.9
BL	133,734	3,900[3]	40,320	2.0	208.9	208.9	209.9	1.0
BM	136,080	4,000[3]	25,449	2.9	209.9	209.9	210.7	0.8
BN	138,473	3,721[3]	27,503	2.7	211.0	211.0	211.8	0.8
BO	140,270	2,984[3]	19,933	3.8	211.9	211.9	212.6	0.7
BP	141,917	2,282[3]	12,625	5.9	213.2	213.2	213.8	0.6
BQ	143,487	779	4,816	15.5	215.0	215.0	215.5	0.5

[1]Stream distance in feet above Lewis County boundary

FLOODING SOURCE		FLOODWAY			1-PERCENT-ANNUAL-CHANCE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY (FEET NAVD)	WITHOUT FLOODWAY (FEET NAVD)	WITH FLOODWAY (FEET NAVD)	INCREASE (FEET)
CHEHALIS RIVER (continued)								
BR	146,604	265	6,250	12.0	225.1	225.1	225.5	0.4
BS	150,367	257	7,501	10.0	230.2	230.2	230.9	0.7
BT	152,180	297	8,233	9.1	231.6	231.6	232.5	0.9
BU	153,957	997	10,766	6.9	233.5	233.5	234.3	0.8
BV	156,697	2,512	44,773	1.1	233.9	233.9	234.7	0.8
BW	160,176	4,276	40,214	1.2	233.9	233.9	234.8	0.9
BX	163,950	3,948	25,788	1.9	234.4	234.4	235.3	0.9
BY	166,620	4,013	29,620	1.7	235.0	235.0	235.8	0.8
BZ	171,423	3,571	20,604	2.6	236.9	236.9	237.6	0.7
CA	175,589	2,192	12,634	4.3	241.9	241.9	242.6	0.7
CB	178,207	842	6,495	8.3	247.7	247.7	248.1	0.4
CC	182,044	182	4,087	13.1	252.7	252.7	253.2	0.5
CD	185,111	245	5,197	10.3	260.6	260.6	261.1	0.5
CE	186,310	1,330	10,147	5.3	262.9	262.9	263.1	0.2
CF	188,477	1,310	8,727	6.0	264.1	264.1	264.9	0.8
CG	191,677	1,715	11,700	4.5	268.0	268.0	269.0	1.0
CH	194,019	686	5,626	9.2	270.3	270.3	271.2	0.9
CI	198,234	1,110	9,266	5.5	276.6	276.6	277.4	0.8
CJ	200,589	886	7,443	6.8	280.7	280.7	281.0	0.3
CK	203,769	1,060	6,656	7.6	286.9	286.9	287.8	0.9
CL	206,574	1,040	9,698	5.1	294.5	294.5	295.4	0.9
CM	208,691	1,025	5,060	9.8	297.4	297.4	298.1	0.7
CN	211,820	384	6,759	7.3	303.1	303.1	303.7	0.6

[1]Stream distance in feet above Lewis County boundary

FLOODING SOURCE		FLOODWAY			1-PERCENT-ANNUAL-CHANCE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY (FEET NAVD)	WITHOUT FLOODWAY (FEET NAVD)	WITH FLOODWAY (FEET NAVD)	INCREASE (FEET)
CHEHALIS RIVER (continued)								
CO	214,658[1]	234	4,602	10.5	306.3	306.3	306.7	0.4
CP	215,758[1]	383	6,060	8.0	308.4	308.4	308.7	0.3
CQ	218,618[1]	238	4,883	9.8	312.3	312.3	312.5	0.2
CR	220,667[1]	262	5,768	6.9	316.3	316.3	316.5	0.2
CS	223,863[1]	271	4,981	7.9	320.8	320.8	321.1	0.3
CT	225,766[1]	242	3,859	10.2	323.6	323.6	323.7	0.1
CU	105.110[2]	300	2,779	8.3	353.9	353.9	354.9	1.0
CV	105.810[2]	280[3]	2,494	9.2	361.6	361.6	362.4	0.8
CW	106.200[2]	145	2,111	10.9	367.2	367.2	367.5	0.3
CX	106.350[2]	215	2,732	8.0	370.1	370.1	370.2	0.1
CY	106.750[2]	157	2,406	6.2	372.9	372.9	373.2	0.3
CZ	106.970[2]	140[3]	1,462	10.2	374.2	374.2	374.5	0.3

[1] Stream distance in feet above Lewis County boundary [2] Stream distance in miles above mouth
[3] Mapped floodway widths have been adjusted to reflect topographic redelineation, see Section 4.2 for further explanation

FLOODING SOURCE		FLOODWAY			1-PERCENT-ANNUAL-CHANCE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)[3]	MEAN VELOCITY (FEET PER SECOND)[3]	REGULATORY (FEET NAVD)	WITHOUT FLOODWAY (FEET NAVD)	WITH FLOODWAY (FEET NAVD)	INCREASE (FEET)
CHINA CREEK								
A	0.10	60[2]	----	----	177.0	175.7[4]	176.7	1.0
B	0.17	65	----	----	177.0	175.9[4]	176.9	1.0
C	0.21	42	----	----	177.0	176.0[4]	177.0	1.0
D	0.35	45	----	----	177.0	176.1[4]	177.1	1.0
E	0.37	40	----	----	177.0	176.1[4]	177.1	1.0
F	0.51	40	----	----	177.0	176.1[4]	177.1	1.0
G	0.53	39	----	----	177.0	176.3[4]	177.3	1.0
H	0.58	32	----	----	177.0	176.4[4]	177.4	1.0
I	0.62	35	----	----	177.0	176.5[4]	177.5	1.0
J	0.64	30	----	----	177.0	176.5[4]	177.5	1.0
K	0.67	31	----	----	177.0	176.7[4]	177.7	1.0
L	0.71	30	----	----	177.0	176.7[4]	177.7	1.0
M	0.73	34	----	----	177.0	176.8[4]	177.8	1.0
N	0.76	30	----	----	177.0	177.0[4]	178.0	1.0
O	0.80	28	----	----	177.1	177.1[4]	178.1	1.0
P	0.83	30	----	----	177.3	177.3[4]	178.3	1.0
Q	0.87	30	----	----	177.5	177.5[4]	178.5	1.0
R	0.90	23	----	----	177.5	177.5[4]	178.5	1.0
S	0.93	35	----	----	177.9	177.9[4]	178.9	1.0
T	0.95	30	----	----	178.0	178.0[4]	179.0	1.0
U	1.02	40	----	----	178.6	178.6[4]	179.6	1.0
V	1.06	25	----	----	179.5	179.5[4]	180.5	1.0
W	1.09	28	----	----	180.0	180.0[4]	181.0	1.0

[1] Stream distance in miles above mouth [2] Mapped floodway has been updated to reflect new study on the Chehalis River
[3] Data Not Available [4] Elevation computed without consideration of ponding effects from Chehalis River

FLOODING SOURCE		FLOODWAY			1-PERCENT-ANNUAL-CHANCE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)[3]	MEAN VELOCITY (FEET PER SECOND)[3]	REGULATORY (FEET NAVD)	WITHOUT FLOODWAY (FEET NAVD)	WITH FLOODWAY (FEET NAVD)	INCREASE (FEET)
CHINA CREEK (continued)								
X	1.13	25	----	----	180.2	180.2[4]	181.2	1.0
Y	1.17	30	----	----	181.0	181.0[4]	182.0	1.0
Z	1.22	40	----	----	181.1	181.1[4]	182.1	1.0
AA	1.23	30	----	----	181.6	181.6[4]	182.6	1.0
AB	1.27	30	----	----	182.0	182.0[4]	183.0	1.0
AC	1.40	25	----	----	183.9	183.9[4]	184.9	1.0
AD	1.41	20	----	----	183.9	183.9[4]	184.9	1.0
AE	1.44	32	----	----	185.7	185.7[4]	186.7	1.0
AF	1.91	120	----	----	190.3	188.6[4]	189.6	1.0
AG	2.33	37	----	----	191.0	191.0	192.0	1.0
AH	2.36	57	----	----	191.5	191.5	192.5	1.0
AI	2.43	39	----	----	192.3	192.3	193.3	1.0
AJ	2.44	181	----	----	192.7	192.7	193.7	1.0
AK	2.92	86	----	----	193.8	193.8	194.8	1.0
AL	3.05	61	----	----	195.8	195.8	196.8	1.0
AM	3.32	30/50[2]	----	----	202.0	202.0	203.0	1.0
AN	3.60	36	----	----	208.3	208.3	209.3	1.0
AO	3.66	42	----	----	210.0	210.0	211.0	1.0
AP	3.74	49	----	----	211.2	211.2	212.2	1.0
AQ	3.78	57	----	----	214.6	214.6	215.6	1.0
AR	3.94	28	----	----	220.3	220.3	221.3	1.0
AS	4.39	31	----	----	241.4	241.4	242.4	1.0
AT	4.55	62	----	----	248.2	248.2	249.2	1.0

[1] Stream distance in miles above mouth [2] Left Channel/Right Channel [3] Data Not Available
[4] Elevation computed without consideration of ponding effects from Skookumchuck River

TABLE 16

FEDERAL EMERGENCY MANAGEMENT AGENCY

LEWIS COUNTY, WA

AND INCORPORATED AREAS

FLOODWAY DATA

CHINA CREEK

FLOODING SOURCE		FLOODWAY			1-PERCENT-ANNUAL-CHANCE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY (FEET NAVD)	WITHOUT FLOODWAY (FEET NAVD)	WITH FLOODWAY (FEET NAVD)	INCREASE (FEET)
CISPUS RIVER								
A	12.20	139	2,093	12.0	1,181.2	1,181.2	1,182.2	1.0
B	12.59	228	3,131	8.0	1,189.1	1,189.1	1,189.8	0.7
C	13.04	197	2,294	10.9	1,195.8	1,195.8	1,196.2	0.4
D	13.27	207	2,644	9.5	1,200.8	1,200.8	1,201.2	0.4
E	13.59	221	2,499	10.0	1,206.3	1,206.3	1,206.8	0.5
F	13.81	239	2,179	11.5	1,212.0	1,212.0	1,212.4	0.4
G	14.10	907	4,439	5.6	1,220.9	1,220.9	1,221.4	0.5
H	14.43	1,391	6,556	3.8	1,227.9	1,227.9	1,228.6	0.7
I	14.85	1,140	4,524	5.5	1,234.9	1,234.9	1,235.9	1.0
J	14.95	330	2,011	12.5	1,236.8	1,236.8	1,237.7	0.9
K	15.00	218	3,033	8.3	1,241.5	1,241.5	1,241.5	0.0
L	15.22	200	2,690	9.3	1,243.1	1,243.1	1,243.6	0.5
M	15.60	305	2,505	10.0	1,250.6	1,250.6	1,251.3	0.7
N	16.23	950	7,702	3.3	1,267.9	1,267.9	1,268.5	0.6
O	16.46	430	4,109	6.1	1,271.7	1,271.7	1,272.7	1.0
P	16.64	670	3,620	6.9	1,275.4	1,275.4	1,275.8	0.4

[1] Stream distance in miles above mouth

TABLE 16

FEDERAL EMERGENCY MANAGEMENT AGENCY

LEWIS COUNTY, WA

AND INCORPORATED AREAS

FLOODWAY DATA

CISPUS RIVER

FLOODING SOURCE		FLOODWAY			1-PERCENT-ANNUAL-CHANCE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)[2]	MEAN VELOCITY (FEET PER SECOND)[3]	REGULATORY (FEET NAVD)	WITHOUT FLOODWAY (FEET NAVD)	WITH FLOODWAY (FEET NAVD)	INCREASE (FEET)
COAL CREEK								
A	0.00	165[2]	----	----	181.3	178.9[4]	179.9	1.0
B	1.17	265	----	----	181.3	180.5[4]	181.5	1.0
C	1.36	70	----	----	181.5	181.5	182.5	1.0
D	1.80	120	----	----	183.6	183.6	184.6	1.0
E	2.10	30	----	----	188.7	188.7	189.7	1.0
F	2.72	35	----	----	198.6	198.6	199.6	1.0
G	3.02	30	----	----	206.3	206.3	207.3	1.0
H	3.28	22	----	----	215.9	215.9	216.9	1.0
I	3.72	20[2]	----	----	229.2	229.2	229.9	0.7

[1] Stream distance in miles above mouth
[2] Mapped floodway widths have been adjusted to reflect topographic redelineation, see Section 4.2 for further explanation
[3] Data Not Available [4] Elevation computed without consideration of backwater effects from Salzer Creek

TABLE 16

FEDERAL EMERGENCY MANAGEMENT AGENCY

LEWIS COUNTY, WA

AND INCORPORATED AREAS

FLOODWAY DATA

COAL CREEK

FLOODING SOURCE		FLOODWAY			1-PERCENT-ANNUAL-CHANCE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)[4]	MEAN VELOCITY (FEET PER SECOND)[4]	REGULATORY (FEET NAVD)	WITHOUT FLOODWAY (FEET NAVD)	WITH FLOODWAY (FEET NAVD)	INCREASE (FEET)
COFFEE CREEK								
A	0.03	46[2]	----	----	186.5	185.6[5]	186.6	1.0
B	0.18	55[2]	----	----	186.5	185.6[5]	186.6	1.0
C	0.26	56[2]	----	----	186.5	186.1[5]	187.1	1.0
D	0.30	155[2]	----	----	186.5	186.5[5]	187.5	1.0
E	0.34	220/1,243[3]	----	----	190.7	186.6[6]	187.6	1.0
F	0.43	155/480[3]	----	----	190.7	186.7[6]	187.7	1.0
G	0.74	80/1,552[3]	----	----	190.7	191.4[6]	192.4	1.0
H	0.76	113/1,707[3]	----	----	194.6	192.2[6]	193.2	1.0
I	1.02	39	----	----	195.5	195.5	196.5	1.0
J	1.18	48	----	----	198.2	198.2	199.2	1.0
K	1.20	31	----	----	204.9	204.9	205.9	1.0
L	1.55	34	----	----	205.4	205.4	206.4	1.0
M	1.61	25	----	----	208.5	208.5	209.5	1.0
N	1.63	25	----	----	208.5	208.5	209.5	1.0
O	1.79	41	----	----	208.7	208.7	209.7	1.0
P	1.81	41	----	----	208.8	208.8	209.8	1.0
Q	1.96	45	----	----	208.9	208.9	209.9	1.0
R	2.12	29	----	----	209.0	209.0	210.0	1.0
S	2.13	102	----	----	209.0	209.0	210.0	1.0
T	2.40	673	----	----	209.0	209.0	210.0	1.0

[1] Stream distance in miles above mouth
[2] Mapped floodways widths have been adjusted to reflect topographic redelineation, see Section 4.2 for further explanation
[3] Coffee Creek width/combined Coffee Creek-Skookumchuck River width
[4] Data Not Available
[5] Elevation computed without consideration of backwater effects from Skookumchuck River
[6] Elevation computed without consideration of ponding effects from Skookumchuck River

TABLE 16

FEDERAL EMERGENCY MANAGEMENT AGENCY

LEWIS COUNTY, WA

AND INCORPORATED AREAS

FLOODWAY DATA

COFFEE CREEK

FLOODING SOURCE		FLOODWAY			1-PERCENT-ANNUAL-CHANCE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY (FEET NAVD)	WITHOUT FLOODWAY (FEET NAVD)	WITH FLOODWAY (FEET NAVD)	INCREASE (FEET)
COWLITZ RIVER								
A	29.073	1,740	15,040	4.9	82.7	82.7	83.7	1.0
B	29.735	721	9,110	8.1	85.8	85.8	86.8	1.0
C	30.403	596	10,090	7.3	89.3	89.3	90.0	0.7
D	30.846	483	9,160	8.0	91.1	91.1	91.6	0.5
E	31.159	1,090	18,680	3.9	92.7	92.7	93.2	0.5
F	31.537	659	9,940	7.4	93.2	93.2	93.7	0.5
G	31.760	1,007	14,810	5.0	94.4	94.4	95.1	0.7
H	31.973	1,018	12,370	6.0	94.6	94.6	95.3	0.7
I	32.425	2,246	18,980	3.9	96.1	96.1	97.0	0.9
J	32.996	759	8,110	8.6	98.2	98.2	99.1	0.9
K	33.509	1,510	16,280	4.3	101.7	101.7	102.3	0.6
L	34.228	727	7,270	9.6	104.4	104.4	105.4	1.0
M	34.367	728	9,020	7.7	106.0	106.0	106.7	0.7
N	34.774	1,281	13,390	5.2	110.1	110.1	110.5	0.4
O	35.314	647	8,730	8.0	112.4	112.4	113.3	0.9
P	35.971	763	7,120	9.8	116.8	116.8	117.6	0.8
Q	36.298	1,279	15,310	4.5	121.4	121.4	122.2	0.8
R	36.856	1,168[2]	12,150	5.7	124.7	124.7	125.5	0.8

[1] Stream distance in miles above confluence with Columbia River
[2] Mapped floodway widths have been adjusted to reflect topographic redelineation, see Section 4.2 for further explanation

TABLE 16

FEDERAL EMERGENCY MANAGEMENT AGENCY

LEWIS COUNTY, WA

AND INCORPORATED AREAS

FLOODWAY DATA

COWLITZ RIVER

FLOODING SOURCE		FLOODWAY			1-PERCENT-ANNUAL-CHANCE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY (FEET NAVD)	WITHOUT FLOODWAY (FEET NAVD)	WITH FLOODWAY (FEET NAVD)	INCREASE (FEET)
COWLITZ RIVER (continued)								
S	91.120	239[2]	5,090	12.2	864.2	864.2	865.2	1.0
T	91.492	315[2]	5,820	10.7	867.6	867.6	868.4	0.8
U	92.175	898[2]	11,680	5.3	871.6	871.6	872.0	0.4
V	92.610	648[2]	9,790	6.3	872.6	872.6	873.1	0.5
W	93.056	393	7,160	8.7	873.9	873.9	874.5	0.6
X	93.746	340	7,010	8.9	878.3	878.3	878.7	0.4
Y	93.913	279	6,340	9.8	878.8	878.8	879.2	0.4
Z	94.410	1,895	22,080	2.8	881.6	881.6	882.1	0.5
AA	94.927	2,064	20,060	3.1	882.1	882.1	882.7	0.6
AB	95.302	577	10,620	5.9	882.7	882.7	883.3	0.6
AC	95.597	410	7,540	8.2	883.2	883.2	883.8	0.6
AD	96.034	236	6,770	9.2	884.7	884.7	885.3	0.6
AE	96.593	962	15,900	3.9	886.8	886.8	887.5	0.7
AF	97.034	1,667	24,910	2.5	887.8	887.8	888.6	0.8
AG	97.608	2,942	41,190	1.5	888.4	888.4	889.2	0.8
AH	97.995	3,188	4,190	1.5	888.6	888.6	889.4	0.8
AI	98.642	4,140	51,250	1.2	889.1	889.1	889.9	0.8
AJ	98.937	3,900	49,820	1.2	889.2	889.2	890.1	0.9
AK	99.444	2,310	18,490	3.3	889.4	889.4	890.3	0.9
AL	100.063	3,690	41,510	1.5	890.2	890.2	891.2	1.0
AM	100.557	3,380	39,320	1.5	890.6	890.6	891.6	1.0
AN	101.424	5,214[2]	42,840	1.4	891.1	891.1	892.1	1.0
AO	102.278	5,830[2]	50,760	1.2	891.7	891.7	892.6	0.9

[1] Stream distance in miles above confluence with Columbia River

[2] Mapped floodway widths have been adjusted to reflect topographic redelineation, see Section 4.2 for further explanation

FLOODING SOURCE		FLOODWAY			1-PERCENT-ANNUAL-CHANCE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY (FEET NAVD)	WITHOUT FLOODWAY (FEET NAVD)	WITH FLOODWAY (FEET NAVD)	INCREASE (FEET)
COWLITZ RIVER (continued)								
AP	102.849	3,349	24,250	2.5	892.1	892.1	893.1	1.0
AQ	102.940	3,175[2]	20,520	2.9	892.3	892.3	893.3	1.0
AR	102.972	3,610	22,560	2.7	892.9	892.9	893.3	0.4
AS	103.410	4,890[2]	46,670	1.3	894.1	894.1	894.7	0.6
AT	103.798	5,050	49,000	1.2	894.4	894.4	895.1	0.7
AU	104.578	1,900	13,510	4.4	895.7	895.7	896.3	0.6
AV	104.998	1,060	12,940	4.6	898.3	898.3	899.0	0.7
AW	105.323	1,110	11,980	5.0	899.8	899.8	900.5	0.7
AX	106.044	2,660	19,510	2.9	903.5	903.5	904.1	0.6
AY	106.636	3,200[2]	25,740	2.2	905.1	905.1	905.7	0.6
AZ	107.665	3,540	36,130	1.6	906.5	906.5	907.1	0.6
BA	108.132	3,660[2]	28,620	2.0	907.1	907.1	907.8	0.7
BB	109.075	4,035[2]	16,588	3.4	909.3	909.3	909.9	0.6
BC	110.273	3,880	14,690	3.8	915.1	915.1	915.5	0.4
BD	111.088	3,920	19,630	2.9	919.4	919.4	919.9	0.5
BE	112.232	3,420[2]	12,640	4.5	924.7	924.7	925.3	0.6
BF	112.691	2,890	19,420	2.9	928.6	928.6	929.5	0.9
BG	113.744	2,630[2]	17,480	3.2	934.4	934.4	935.1	0.7
BH	114.432	2,980	15,100	3.6	939.5	939.5	940.0	0.5
BI	114.961	2,110	13,550	4.0	943.3	943.3	943.9	0.6
BJ	115.756	820	9,010	6.1	949.9	949.9	950.7	0.8
BK	115.839	487	6,390	8.6	951.0	951.0	951.6	0.6
BL	115.872	460	6,940	7.9	952.0	952.0	952.2	0.2

[1] Stream distance in miles above confluence with Columbia River

[2] Mapped floodway widths have been adjusted to reflect topographic redelineation, see Section 4.2 for further explanation

FLOODING SOURCE		FLOODWAY			1-PERCENT-ANNUAL-CHANCE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY (FEET NAVD)	WITHOUT FLOODWAY (FEET NAVD)	WITH FLOODWAY (FEET NAVD)	INCREASE (FEET)
COWLITZ RIVER (continued)								
BM	116.819	1,463	14,840	3.7	957.7	957.7	958.7	1.0
BN	117.804	2,380	14,550	3.8	965.1	965.1	965.9	0.8
BO	118.548	2,197	15,520	3.5	975.5	975.5	976.5	1.0
BP	119.014	1,753	15,270	3.6	980.7	980.7	981.7	1.0
BQ	119.562	1,570	10,650	5.1	985.6	985.6	986.3	0.7
BR	119.890	2,280	15,710	3.5	990.9	990.9	991.3	0.4
BS	120.058	2,470	12,430	4.4	992.1	992.1	992.5	0.4
BT	120.278	2,115	11,050	5.0	994.6	994.6	995.5	0.9
BU	120.930	300	4,720	11.3	1,004.3	1,004.3	1,004.9	0.6
BV	121.415	338	5,740	8.9	1,011.7	1,011.7	1,012.2	0.5
BW	121.657	939	11,670	4.4	1,014.7	1,014.7	1,015.1	0.4
BX	121.890	2,130	17,550	2.8	1,016.0	1,016.0	1,016.3	0.3
BY	122.131	3,400[2]	19,220	2.4	1,017.6	1,017.6	1,017.8	0.2
BZ	122.457	1,890	9,420	4.9	1,021.8	1,021.8	1,021.9	0.1
CA	122.757	639	5,490	8.4	1,028.2	1,028.2	1,028.4	0.2
CB	123.298	2,361	14,070	3.3	1,036.3	1,036.3	1,037.3	1.0
CC	123.919	1,460[2]	9,210	5.0	1,045.7	1,045.7	1,046.7	1.0
CD	124.587	2,390	18,620	2.4	1,053.4	1,053.4	1,054.1	0.7
CE	124.942	1,620[2]	7,250	6.2	1,058.4	1,058.4	1,058.8	0.4
CF	125.261	614	4,480	10.0	1,066.9	1,066.9	1,067.0	0.1
CG	125.306	730	6,980	6.5	1,068.6	1,068.6	1,068.6	0.0
CH	125.877	905[2]	6,540	7.0	1,075.3	1,075.3	1,075.8	0.5
CI	126.386	1,090	8,960	5.1	1,083.8	1,083.8	1,084.8	1.0

[1] Stream distance in miles above confluence with Columbia River

[2] Mapped floodway widths have been adjusted to reflect topographic redelineation, see Section 4.2 for further explanation

FLOODING SOURCE		FLOODWAY			1-PERCENT-ANNUAL-CHANCE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY (FEET NAVD)	WITHOUT FLOODWAY (FEET NAVD)	WITH FLOODWAY (FEET NAVD)	INCREASE (FEET)
COWLITZ RIVER (continued)								
CJ	126.695	742[2]	5,660	8.1	1,088.3	1,088.3	1,088.7	0.4
CK	127.463	1,111	8,330	5.0	1,103.6	1,103.6	1,104.6	1.0
CL	128.617	1,600[2]	9,450	4.0	1,128.1	1,128.1	1,128.9	0.8
CM	129.395	1,470[2]	7,320	5.2	1,151.2	1,151.2	1,151.7	0.5
CN	130.185	563[2]	4,480	7.8	1,174.6	1,174.6	1,174.9	0.3
CO	130.788	640	5,100	6.8	1,189.0	1,189.0	1,189.8	0.8
CP	131.371	523	4,180	6.3	1,202.1	1,202.1	1,202.5	0.4
CQ	131.484	125	1,200	13.3	1,205.6	1,205.6	1,206.6	1.0
CR	131.643	164	2,650	10.0	1,210.6	1,210.6	1,211.1	0.5

[1] Stream distance in miles above confluence with Columbia River
[2] Mapped floodway widths have been adjusted to reflect topographic redelineation, see Section 4.2 for further explanation

FLOODING SOURCE		FLOODWAY			1-PERCENT-ANNUAL-CHANCE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY (FEET NAVD)	WITHOUT FLOODWAY (FEET NAVD)	WITH FLOODWAY (FEET NAVD)	INCREASE (FEET)
DILLENBAUGH CREEK								
A	4.061	24	73	4.4	202.0	202.0	202.0	0.0
B	4.108	21	58	5.5	203.2	203.2	203.2	0.0
C	4.146	27	47	6.9	205.2	205.2	205.2	0.0
D	4.455	25	85	3.8	219.0	219.0	219.3	0.3
E	4.871	299	355	0.9	228.5	228.5	229.4	0.9
F	5.250	32	88	3.7	239.0	239.0	239.2	0.2

[1] Stream distance in miles above confluence with Chehalis River

TABLE 16

FEDERAL EMERGENCY MANAGEMENT AGENCY

LEWIS COUNTY, WA

AND INCORPORATED AREAS

FLOODWAY DATA

DILLENBAUGH CREEK

FLOODING SOURCE		FLOODWAY			1-PERCENT-ANNUAL-CHANCE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY (FEET NAVD)	WITHOUT FLOODWAY (FEET NAVD)	WITH FLOODWAY (FEET NAVD)	INCREASE (FEET)
ELK CREEK								
A	0.020	121	1,070	5.2	316.8	304.6[2]	304.6	0.0
B	0.480	69	670	8.3	316.8	308.5[2]	308.5	0.0
C	0.580	107	829	6.7	316.8	310.4[2]	310.4	0.0
D	1.160	85	681	8.2	319.2	319.2	319.3	0.1
E	1.530	85	665	7.0	325.3	325.3	325.4	0.1
F	1.760	53	328	14.3	345.7	345.7	345.7	0.0
G	2.150	74	577	7.3	360.2	360.2	360.4	0.2
H	2.187	69	512	8.2	360.8	360.8	361.0	0.2
I	2.600	146	796	5.3	368.8	368.8	368.9	0.1
J	2.850	86	432	9.7	373.2	373.2	373.4	0.2

[1] Stream distance in miles above mouth
[2] Elevation computed without consideration of backwater effects from Chehalis River

FLOODING SOURCE		FLOODWAY			1-PERCENT-ANNUAL-CHANCE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY (FEET NAVD)	WITHOUT FLOODWAY (FEET NAVD)	WITH FLOODWAY (FEET NAVD)	INCREASE (FEET)
HALL CREEK								
A	0.052	212	528	4.6	1,018.6[2]	1,012.5[4]	1,012.5	0.0
B	0.151	33	254	9.5	1,018.6[2]	1,014.6[4]	1,014.9	0.3
C	0.170	107	747	3.2	1,018.6[2]	1,016.0[4]	1,017.0	1.0
D	0.580	188	789	3.1	1,018.6	1,018.6	1,019.3	0.7
E	0.963	117	421	5.7	1,022.8	1,022.8	1,023.8	1.0
F	1.122	184[3]	458	5.3	1,032.1	1,032.1	1,033.0	0.9
G	1.139	224	1,891	1.3	1,037.1	1,037.1	1,038.0	0.9
H	1.725	85	355	6.8	1,038.7	1,038.7	1,039.6	0.9
I	1.778	20	181	13.4	1,042.0	1,042.0	1,042.0	0.0
J	1.917	255	2,727	0.9	1,048.2	1,048.2	1,048.6	0.4
K	2.358	229	1,557	0.4	1,048.3	1,048.3	1,048.8	0.5
L	2.655	272	2,128	0.1	1,049.5	1,048.3	1,048.8	0.5
M	2.935	35	65	4.8	1,049.5	1,049.5	1,049.8	0.3
N	3.219	105	294	1.1	1,057.3	1,057.3	1,057.8	0.5

[1] Stream distance in miles above confluence with Cowlitz River
[2] Elevation includes backwater effect from Cowlitz River
[3] Width does not include small areas of high ground
[4] Elevation computed without consideration of backwater effects from Cowlitz River

FLOODING SOURCE		FLOODWAY			1-PERCENT-ANNUAL-CHANCE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY (FEET NAVD)	WITHOUT FLOODWAY (FEET NAVD)	WITH FLOODWAY (FEET NAVD)	INCREASE (FEET)
HANAFORD CREEK								
A	1,116	177	2,345	2.0	202.2	202.2	203.1	0.9
B	2,196	416	2,875	1.7	202.9	202.9	203.9	1.0
C	3,236	255	1,798	2.7	204.0	204.0	204.9	0.9
D	4,346	612	2,599	1.6	205.2	205.2	206.1	0.9
E	6,026	1,328	7,514	0.7	206.0	206.0	206.8	0.8
F	7,981	2,377	9,084	0.8	206.2	206.2	207.1	0.9
G	9,231	2,258[2]	8,173	0.6	206.5	206.5	207.3	0.8
H	10,856	2,476	9,755	0.5	206.7	206.7	207.4	0.7
I	12,256	1,741	7,469	0.6	206.9	206.9	207.6	0.7
J	13,666	1,997	8,716	0.4	207.1	207.1	207.7	0.6
K	15,021	1,293	5,739	0.6	207.1	207.1	208.0	0.9
L	16,081	659/1,433[3]	7,238	4.3	208.7	208.7	209.6	0.9
M	17,336	804/1,384[3]	14,554	0.3	211.9	211.9	212.6	0.7
N	18,826	1,607/2,032[3]	19,858	0.2	211.9	211.9	212.6	0.7
O	20,536	1,658/2,057[3]	15,970	0.2	211.9	211.9	212.6	0.7
P	22,331	2,047	14,125	0.2	211.9	211.9	212.7	0.8
Q	23,381	1,925	12,409	0.2	211.9	211.9	212.7	0.8
R	24,966	828	4,331	1.2	212.4	212.4	213.1	0.7
S	26,416	783	4,975	1.0	213.2	213.2	213.8	0.6
T	27,901	775	4,682	0.9	213.8	213.8	214.2	0.4
U	28,876	815	4,382	2.5	215.0	215.0	215.4	0.4
V	29,136	845	5,700	1.4	216.4	216.4	216.6	0.2
W	29,891	2,065	19,079	0.2	216.6	216.6	216.9	0.3

[1] Stream distance in feet above confluence with Skookumchuck River
[2] Width does not include “islands” in the floodplain
[3] Width in Lewis County/Total Width at cross section

FLOODING SOURCE		FLOODWAY			1-PERCENT-ANNUAL-CHANCE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY (FEET NAVD)	WITHOUT FLOODWAY (FEET NAVD)	WITH FLOODWAY (FEET NAVD)	INCREASE (FEET)
HANAFORD CREEK (continued)								
X	31,841	2,070	20,470	0.1	216.6	216.6	216.9	0.3
Y	33,451	1,869	16,076	0.2	216.6	216.6	216.9	0.3

[1] Stream distance in feet above confluence with Skookumchuck River

FLOODING SOURCE		FLOODWAY			1-PERCENT-ANNUAL-CHANCE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY (FEET NAVD)	WITHOUT FLOODWAY (FEET NAVD)	WITH FLOODWAY (FEET NAVD)	INCREASE (FEET)
LACAMAS CREEK								
A	3.80	69	365	6.6	193.4	193.4	194.4	1.0
B	3.84	36	185	13.0	195.6	195.6	195.6	0.0
C	4.26	141	544	4.4	213.9	213.9	213.9	0.0
D	4.59	64	278	8.3	223.8	223.8	223.8	0.0
E	4.62	99	429	5.4	225.9	225.9	225.9	0.0
F	4.65	57	301	7.6	226.6	226.6	226.6	0.0
G	4.94	150	480	4.8	237.1	237.1	237.9	0.8
H	5.14	69	318	7.2	244.7	244.7	245.6	0.9
I	5.49	144	616	3.7	254.5	254.5	254.6	0.1
J	5.81	147	336	5.1	268.3	268.3	268.3	0.0
K	6.19	83	323	5.3	279.0	279.0	279.0	0.0
L	6.41	81	196	8.7	286.3	286.3	286.3	0.0
M	6.45	73	522	3.3	288.4	288.4	288.4	0.0
N	6.47	68	271	6.3	288.5	288.5	288.5	0.0
O	6.72	132	450	3.8	295.1	295.1	295.1	0.0
P	7.03	61	242	7.0	302.9	302.9	303.2	0.3
Q	7.06	26	229	7.4	305.8	305.8	305.8	0.0
R	7.07	85	479	3.6	306.9	306.9	306.9	0.0
S	7.48	88	398	4.3	314.6	314.6	314.7	0.1
T	7.79	232	801	2.1	318.7	318.7	319.4	0.7
U	8.23	136	438	3.9	325.8	325.8	326.6	0.8
V	9.13	382	1,628	1.0	335.2	335.2	336.2	1.0
W	9.96	638	1,398	1.0	340.6	340.6	341.6	1.0

[1] Stream distance in miles above mouth

TABLE 16

FEDERAL EMERGENCY MANAGEMENT AGENCY

LEWIS COUNTY, WA

AND INCORPORATED AREAS

FLOODWAY DATA

LACAMAS CREEK

FLOODING SOURCE		FLOODWAY			1-PERCENT-ANNUAL-CHANCE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY (FEET NAVD)	WITHOUT FLOODWAY (FEET NAVD)	WITH FLOODWAY (FEET NAVD)	INCREASE (FEET)
LACAMAS CREEK (continued)								
X	10.29	170	526	2.7	344.7	344.7	345.7	1.0
Y	10.78	201	543	2.6	350.2	350.2	351.2	1.0
Z	11.19	286	791	1.8	354.1	354.1	354.6	0.5
AA	11.24	245	1,247	1.1	354.5	354.5	354.9	0.4
AB	11.28	353	620	1.8	354.7	354.7	355.1	0.4
AC	11.85	370	1,038	1.1	362.8	362.8	363.8	1.0
AD	12.17	73	245	4.5	367.8	367.8	368.6	0.8
AE	12.26	28	204	5.4	370.3	370.3	370.9	0.6
AF	12.27	175	456	2.4	370.8	370.8	371.5	0.7
AG	12.75	170	725	1.5	375.1	375.1	376.0	0.9
AH	13.11	52	162	6.8	379.3	379.3	380.1	0.8
AI	13.12	342	274	3.3	382.0	382.0	382.0	0.0
AJ	13.14	361	1,098	0.8	383.5	383.5	383.5	0.0
AK	13.67	152	294	3.1	391.7	391.7	392.1	0.4
AL	14.11	80	227	4.0	405.6	405.6	405.6	0.0
AM	14.36	77	208	4.3	414.7	414.7	415.1	0.4
AN	14.92	80	182	3.3	430.2	430.2	430.8	0.6
AO	14.96	20	124	4.8	433.0	433.0	433.6	0.6
AP	14.97	171	748	0.8	433.6	433.6	434.1	0.5
AQ	15.39	33	71	8.4	448.4	448.4	448.4	0.0
AR	16.18	77	191	3.1	471.8	471.8	472.0	0.2
AS	16.20	31	85	7.1	474.5	474.5	474.5	0.0
AT	16.21	61	275	2.2	475.5	475.5	475.5	0.0

[1] Stream distance in miles above mouth

FLOODING SOURCE		FLOODWAY			1-PERCENT-ANNUAL-CHANCE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY (FEET NAVD)	WITHOUT FLOODWAY (FEET NAVD)	WITH FLOODWAY (FEET NAVD)	INCREASE (FEET)
LACAMAS CREEK (continued)								
AU	16.24	23	84	7.1	475.7	475.7	475.9	0.2
AV	16.25	61	218	2.8	477.1	477.1	477.1	0.0
AW	16.55	60	246	2.4	481.8	481.8	482.8	1.0
AX	16.87	92	225	2.7	491.3	491.3	491.6	0.3
AY	17.26	60	110	5.5	502.0	502.0	502.2	0.2
AZ	17.64	42	148	3.4	514.5	514.5	514.7	0.2
BA	17.67	28	96	5.3	515.3	515.3	515.6	0.3
BB	17.69	59	121	4.2	516.8	516.8	516.8	0.0
BC	18.48	55	176	2.3	537.8	537.8	538.2	0.4
BD	18.50	21	69	5.9	538.1	538.1	538.5	0.4

[1] Stream distance in miles above mouth

FLOODING SOURCE		FLOODWAY			1-PERCENT-ANNUAL-CHANCE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY (FEET NAVD)	WITHOUT FLOODWAY (FEET NAVD)	WITH FLOODWAY (FEET NAVD)	INCREASE (FEET)
LAKE CREEK (TRIBUTARY TO TILTON RIVER)								
A	0.11	42	171	8.9	891.3	891.3	892.0	0.7
B	0.15	37	139	11.0	899.9	899.9	899.9	0.0
C	0.18	51	266	5.7	903.4	903.4	903.4	0.0
D	0.42	71	174	8.8	916.9	916.9	916.9	0.0
E	0.92	40	316	4.8	935.2	935.2	935.3	0.1
F	1.29	56	510	3.0	938.1	938.1	938.3	0.2
G	1.37	40	385	4.0	938.5	938.5	938.8	0.3
H	1.39	37	316	4.8	938.6	938.6	939.0	0.4
I	1.70	600[2]	3,066	0.5	939.5	939.5	940.5	1.0

[1] Stream distance in miles above confluence with Tilton River

[2] Mapped floodway widths have been adjusted to reflect topographic redelineation, see Section 4.2 for further explanation

TABLE 16

FEDERAL EMERGENCY MANAGEMENT AGENCY

LEWIS COUNTY, WA

AND INCORPORATED AREAS

FLOODWAY DATA

LAKE CREEK (TRIBUTARY TO TILTON RIVER)

FLOODING SOURCE		FLOODWAY			1-PERCENT-ANNUAL-CHANCE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY (FEET NAVD)	WITHOUT FLOODWAY (FEET NAVD)	WITH FLOODWAY (FEET NAVD)	INCREASE (FEET)
LINCOLN CREEK								
A	1,584	110	1,162	2.2	154.8	153.0[2]	153.6	0.6
B	2,991	379	4,536	1.0	154.9	153.9[2]	154.1	0.2
C	4,239	600	6,880	0.6	154.9	154.0[2]	154.3	0.3
D	5,962	500	4,519	0.8	154.9	154.0[2]	154.6	0.6
E	7,147	752	5,378	3.5	154.9	154.4[2]	155.3	0.9
F	9,282	1,938	11,586	0.3	156.0	156.0	156.8	0.8
G	13,126	2,000	12,048	0.3	156.1	156.1	156.9	0.8
H	16,216	1,666	10,370	0.3	156.3	156.3	157.1	0.8
I	21,446	1,800	13,536	0.3	156.4	156.4	157.3	0.9
J	25,613	1,800	10,537	0.3	156.6	156.6	157.5	0.9
K	29,551	1,500	6,740	0.6	157.3	157.3	158.2	0.9
L	30,666	1,625	7,820	1.9	159.5	159.5	159.8	0.3

[1] Stream distance in feet above confluence with Chehalis River [2] Elevation computed without consideration of backwater effects from Chehalis River

FLOODING SOURCE		FLOODWAY			1-PERCENT-ANNUAL-CHANCE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY (FEET NAVD)	WITHOUT FLOODWAY (FEET NAVD)	WITH FLOODWAY (FEET NAVD)	INCREASE (FEET)
McMURPHY CREEK								
A	0.222	41	25	4.5	140.1	140.1	140.1	0.0
B	0.245	55	62	1.8	142.0	142.0	142.9	0.9
C	0.292	74	82	1.3	144.6	144.6	145.6	1.0
D	0.306	60	80	1.4	149.1	149.1	150.1	1.0
E	0.332	35	128	0.9	150.3	150.3	151.3	1.0
F	0.413	14	33	4.2	152.1	152.1	152.3	0.2
G	0.432	47	150	0.9	154.8	154.8	155.0	0.2
H	0.445	40	28	5.0	155.4	155.4	155.4	0.0
I	0.466	50	79	1.8	157.6	157.6	157.6	0.0
J	0.523	23[2]	24	5.8	162.6	162.6	162.6	0.0
K	0.690	30	34	4.1	189.0	189.0	189.4	0.4

[1] Stream distance in miles above confluence with Olequa Creek
[2] Mapped floodway widths have been adjusted to reflect topographic redelineation, see Section 4.2 for further explanation

TABLE 16

FEDERAL EMERGENCY MANAGEMENT AGENCY

LEWIS COUNTY, WA

AND INCORPORATED AREAS

FLOODWAY DATA

McMURPHY CREEK

FLOODING SOURCE		FLOODWAY			1-PERCENT-ANNUAL-CHANCE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY (FEET NAVD)	WITHOUT FLOODWAY (FEET NAVD)	WITH FLOODWAY (FEET NAVD)	INCREASE (FEET)
MIDDLE FORK NEWAUKUM RIVER								
A	0.022	139	1,190	1.0	286.7	286.7	287.7	1.0
B	0.515	99	255	4.8	287.7	287.7	288.6	0.9
C	1.030	365	674	1.8	296.2	296.2	297.0	0.8
D	1.247	57	214	5.7	303.1	303.1	303.6	0.5

[1] Stream distance in miles above mouth

TABLE 16

FEDERAL EMERGENCY MANAGEMENT AGENCY

LEWIS COUNTY, WA

AND INCORPORATED AREAS

FLOODWAY DATA

MIDDLE FORK NEWAUKUM RIVER

FLOODING SOURCE		FLOODWAY			1-PERCENT-ANNUAL-CHANCE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY (FEET NAVD)	WITHOUT FLOODWAY (FEET NAVD)	WITH FLOODWAY (FEET NAVD)	INCREASE (FEET)
MINERAL CREEK								
A	1.45	293	1,793	6.9	1,334.1	1,334.1	1,335.1	1.0
B	1.50	159	1,770	7.0	1,336.9	1,336.9	1,337.8	0.9
C	1.55	218	2,045	6.1	1,338.3	1,338.3	1,338.8	0.5
D	2.00	365[2]	1,644	7.4	1,349.6	1,349.6	1,350.0	0.4
E	2.40	760[2]	4,788	2.5	1,365.0	1,365.0	1,365.6	0.6
F	2.53	824	3,022	4.0	1,370.3	1,370.3	1,371.3	1.0
G	3.09	320[2]	1,761	5.8	1,408.4	1,408.4	1,409.2	0.8
H	3.35	224[2]	894	11.2	1,424.8	1,424.8	1,425.8	1.0
I	3.40	183[2]	932	10.7	1,429.7	1,429.7	1,430.2	0.5
J	3.43	201[2]	1,968	5.1	1,432.5	1,432.5	1,432.6	0.1
K	3.81	126[2]	480	11.1	1,464.9	1,464.9	1,465.7	0.8
L	4.15	85[2]	501	10.6	1,503.4	1,503.4	1,504.0	0.6

[1] Stream distance in miles above mouth
[2] Mapped floodway widths have been adjusted to reflect topographic redelineation, see Section 4.2 for further explanation

FLOODING SOURCE		FLOODWAY			1-PERCENT-ANNUAL-CHANCE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY (FEET NAVD)	WITHOUT FLOODWAY (FEET NAVD)	WITH FLOODWAY (FEET NAVD)	INCREASE (FEET)
NEWAUKUM RIVER								
A	358	1,016	7,353	1.5	186.3	186.3	187.3	1.0
B	2,830	2,322	26,633	0.4	186.5	186.5	187.5	1.0
C	5,371	2,446	23,184	0.5	186.7	186.7	187.7	1.0
D	8,228	400	3,507	3.1	186.7	186.7	187.7	1.0
E	10,111	1,150	10,167	1.1	188.1	188.1	189.0	0.9
F	12,534	526	4,258	2.6	188.5	188.5	189.4	0.9
G	14,375	120	1,576	6.9	190.1	190.1	191.0	0.9
H	16,215	841	4,605	2.4	193.2	193.2	194.1	0.9
I	17,465	353	2,823	3.9	194.6	194.6	195.5	0.9
J	19,249	780	4,527	2.4	197.1	197.1	198.1	1.0
K	20,599	626	3,641	3.0	200.2	200.2	201.2	1.0
L	23,928	940	6,376	1.7	203.6	203.6	204.6	1.0
M	24,782	182	1,752	6.2	204.0	204.0	204.9	0.9
N	25,192	188	1,939	5.6	204.9	204.9	205.9	1.0
O	25,398	215	2,506	4.4	205.9	205.9	206.8	0.9
P	26,488	700	3,941	2.9	207.4	207.4	208.1	0.7
Q	27,875	842	4,718	2.7	208.8	208.8	209.8	1.0
R	29,577	1,235	5,961	2.2	210.4	210.4	211.4	1.0
S	30,989	274	2,010	6.6	212.0	212.0	212.9	0.9
T	32,798	570	3,341	4.0	216.4	216.4	217.4	1.0
U	35,349	620	4,271	3.1	220.0	220.0	221.0	1.0
V	37,481	360	2,645	5.0	222.7	222.7	223.6	0.9
W	39,348	700	2,500	5.3	227.3	227.3	227.8	0.5

[1] Stream distance in feet above confluence with Chehalis River

TABLE 16

FEDERAL EMERGENCY MANAGEMENT AGENCY

LEWIS COUNTY, WA

AND INCORPORATED AREAS

FLOODWAY DATA

NEWAUKUM RIVER

FLOODING SOURCE		FLOODWAY			1-PERCENT-ANNUAL-CHANCE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY (FEET NAVD)	WITHOUT FLOODWAY (FEET NAVD)	WITH FLOODWAY (FEET NAVD)	INCREASE (FEET)
NEWAUKUM RIVER (continued)								
X	39,988	447	1,889	7.0	229.3	229.3	230.3	1.0
Y	40,788	166	1,956	6.8	231.9	231.9	232.4	0.5
Z	41,332	131	1,634	8.1	234.2	234.2	234.9	0.7
AA	42,273	143	1,973	6.7	236.6	236.6	237.6	1.0
AB	43,145	283	3,906	3.4	239.9	239.9	240.7	0.8
AC	43,680	493	4,632	2.8	240.4	240.4	241.1	0.7
AD	44,988	1,350	7,337	1.8	241.3	241.3	242.1	0.8
AE	45,931	1,650	5,410	2.7	242.4	242.4	243.1	0.7
AF	47,086	542	4,582	2.9	244.2	244.2	245.1	0.9
AG	49,068	1,192	3,485	3.8	247.3	247.3	248.2	0.9
AH	51,515	890	4,783	2.8	251.3	251.3	252.2	0.9
AI	53,549	550	2,920	4.5	255.6	255.6	256.5	0.9
AJ	56,409	1,049	4,553	2.9	261.7	261.7	262.2	0.5
AK	58,587	1,100	3,913	3.4	265.1	265.1	266.1	1.0

[1] Stream distance in feet above confluence with Chehalis River

TABLE 16

FEDERAL EMERGENCY MANAGEMENT AGENCY

LEWIS COUNTY, WA

AND INCORPORATED AREAS

FLOODWAY DATA

NEWAUKUM RIVER

FLOODING SOURCE		FLOODWAY			1-PERCENT-ANNUAL-CHANCE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY (FEET NAVD)	WITHOUT FLOODWAY (FEET NAVD)	WITH FLOODWAY (FEET NAVD)	INCREASE (FEET)
NO NAME CREEK (TRIBUTARY TO SILER CREEK)								
A	0.015	26	96	3.6	908.3[2]	905.1[2]	906.1	1.0
B	0.176	97	172	2.0	909.6	909.6	910.1	0.5
C	0.387	141	136	2.6	917.3	917.3	918.3	1.0

[1] Stream distance in miles above mouth
[2] Elevation includes backwater effect from Siler Creek

TABLE 16

FEDERAL EMERGENCY MANAGEMENT AGENCY

LEWIS COUNTY, WA

AND INCORPORATED AREAS

FLOODWAY DATA

NO NAME CREEK (TRIBUTARY TO SILER CREEK)

FLOODING SOURCE		FLOODWAY			1-PERCENT-ANNUAL-CHANCE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY (FEET NAVD)	WITHOUT FLOODWAY (FEET NAVD)	WITH FLOODWAY (FEET NAVD)	INCREASE (FEET)
NORTH FORK NEWAUKUM RIVER								
A	0.010	307	1,733	4.3	270.8	270.8	271.8	1.0
B	0.251	515	2,956	2.5	272.5	272.5	273.5	1.0
C	0.300	171[2]	928	8.0	272.6	272.6	273.6	1.0
D	0.327	152	1,148	6.4	274.6	274.6	274.7	0.1
E	0.633	115[2]	914	8.1	277.7	277.7	278.5	0.8
F	1.292	803	2,574	2.9	285.4	285.4	286.3	0.9
G	1.480	1,068[2]	3,294	1.9	287.1	287.1	287.9	0.8
H	1.825	399	1,942	3.2	289.2	289.2	290.2	1.0
I	2.280	124	1,067	5.9	293.0	293.0	294.0	1.0
J	2.777	143	1,036	6.1	298.0	298.0	298.8	0.8
K	2.839	75	600	10.5	298.6	298.6	299.4	0.8
L	2.873	110	845	7.4	301.0	301.0	301.2	0.2
M	3.219	151	1,027	6.1	305.6	305.6	306.0	0.4
N	3.715	122	908	6.9	311.0	311.0	312.0	1.0
O	4.113	134	802	7.3	317.7	317.7	318.1	0.4
P	4.455	170	1,136	5.5	322.7	322.7	323.2	0.5
Q	4.784	114	945	6.6	326.0	326.0	326.9	0.9
R	5.032	148[2]	941	6.7	329.6	329.6	330.2	0.6

[1] Stream distance in miles above mouth

[2] Mapped floodway widths have been adjusted to reflect topographic redelineation, see Section 4.2 for further explanation

TABLE 16

FEDERAL EMERGENCY MANAGEMENT AGENCY

LEWIS COUNTY, WA

AND INCORPORATED AREAS

FLOODWAY DATA

NORTH FORK NEWAUKUM RIVER

FLOODING SOURCE		FLOODWAY			1-PERCENT-ANNUAL-CHANCE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY (FEET NAVD)	WITHOUT FLOODWAY (FEET NAVD)	WITH FLOODWAY (FEET NAVD)	INCREASE (FEET)
OLEQUA CREEK								
A	2.35	230	1,687	6.0	98.8	98.8	99.8	1.0
B	2.53	110	1,507	6.8	101.2	101.2	101.7	0.5
C	2.79	115	1,425	7.0	104.3	104.3	104.6	0.3
D	2.99	137	1,463	6.8	106.3	106.3	106.7	0.4
E	3.06	168[2]	2,140	4.7	107.4	107.4	107.7	0.3
F	3.09	150[2]	1,243	8.1	107.4	107.4	107.7	0.3
G	3.43	140	1,579	6.3	113.3	113.3	113.6	0.3
H	3.72	48	597	7.9	118.3	118.3	118.7	0.4
I	3.80	92[2]	1,115	4.3	119.6	119.6	120.1	0.5
J	3.84	52	667	7.1	119.7	119.7	120.2	0.5
K	4.21	80	787	5.7	124.4	124.4	125.4	1.0
L	4.41	60	764	5.9	127.2	127.2	128.0	0.8
M	4.91	80	744	6.0	133.2	133.2	134.1	0.9
N	4.99	78	735	6.1	134.8	134.8	135.4	0.6
O	5.03	78	686	6.6	135.4	135.4	135.9	0.5
P	5.12	94	600	7.5	137.8	137.8	138.2	0.4
Q	10.04	102	571	5.6	243.7	243.7	243.7	0.0
R	10.41	60	374	8.6	252.9	252.9	252.9	0.0
S	10.67	71	424	7.6	259.7	259.7	259.7	0.0
T	10.70	66[2]	378	8.5	261.2	261.2	261.2	0.0
U	10.74	147[2]	609	5.3	265.2	265.2	265.2	0.0
V	10.87	199	856	3.8	266.7	266.7	266.7	0.0
W	11.21	129	518	6.2	272.9	272.9	272.9	0.0

[1] Stream distance in miles above mouth

[2] Mapped floodway widths have been adjusted to reflect topographic redelineation, see Section 4.2 for further explanation

TABLE 16

FEDERAL EMERGENCY MANAGEMENT AGENCY

LEWIS COUNTY, WA

AND INCORPORATED AREAS

FLOODWAY DATA

OLEQUA CREEK

FLOODING SOURCE		FLOODWAY			1-PERCENT-ANNUAL-CHANCE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY (FEET NAVD)	WITHOUT FLOODWAY (FEET NAVD)	WITH FLOODWAY (FEET NAVD)	INCREASE (FEET)
OLEQUA CREEK (continued)								
X	11.29	111[2]	726	4.0	274.3	274.3	274.3	0.0
Y	11.33	114	759	3.8	274.6	274.6	274.6	0.0
Z	11.58	72	294	9.9	279.6	279.5	279.6	0.1
AA	11.62	92	397	7.3	282.2	282.2	282.2	0.0
AB	11.64	110	618	4.7	283.3	283.3	283.3	0.0
AC	11.72	109	439	6.6	284.2	284.2	284.2	0.0
AD	11.77	90	486	6.0	285.2	285.2	285.2	0.0
AE	11.81	102	466	6.2	286.0	286.0	286.0	0.0
AF	12.02	112	460	6.3	290.4	290.4	290.4	0.0
AG	12.18	92	291	5.0	293.7	293.7	293.7	0.0
AH	12.35	52	261	5.6	296.8	296.8	297.0	0.2
AI	12.38	59	310	4.7	297.4	297.4	297.6	0.2
AJ	12.39	63	306	4.8	297.5	297.5	297.7	0.2
AK	12.82	63	215	6.8	308.2	308.2	308.2	0.0
AL	12.89	40[2]	160	9.2	311.5	311.5	311.7	0.2
AM	13.02	81	330	2.2	316.4	316.4	316.4	0.0
AN	13.49	52	206	3.5	337.7	337.7	338.2	0.5
AO	13.94	44[2]	123	5.9	362.3	362.3	362.5	0.2
AP	14.38	51	153	3.5	388.5	388.5	388.7	0.2
AQ	14.61	90[2]	96	5.5	395.8	395.8	395.8	0.0
AR	14.65	26	90	5.9	400.3	400.3	400.3	0.0
AS	14.69	62	154	3.4	402.4	402.4	402.4	0.0

[1] Stream distance in miles above mouth

[2] Mapped floodway widths have been adjusted to reflect topographic redelineation, see Section 4.2 for further explanation

TABLE 16

FEDERAL EMERGENCY MANAGEMENT AGENCY

LEWIS COUNTY, WA

AND INCORPORATED AREAS

FLOODWAY DATA

OLEQUA CREEK

FLOODING SOURCE		FLOODWAY			1-PERCENT-ANNUAL-CHANCE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY (FEET NAVD)	WITHOUT FLOODWAY (FEET NAVD)	WITH FLOODWAY (FEET NAVD)	INCREASE (FEET)
OLEQUA CREEK (continued)								
AT	14.78	57	152	3.5	405.3	405.3	405.3	0.0
AU	14.81	31	86	6.1	408.7	408.7	408.7	0.0
AV	14.84	43	159	3.3	410.2	410.2	410.3	0.1
AW	15.30	65	146	2.1	422.2	422.2	422.2	0.0
AX	15.82	46	101	3.0	437.8	437.8	437.8	0.0
AY	16.06	16	46	6.5	447.6	447.6	447.6	0.0
AZ	16.09	8	76	3.9	452.5	452.5	453.1	0.6
BA	16.12	102	410	0.7	452.9	452.9	453.5	0.6
BB	16.66	98	134	2.2	462.5	462.5	462.8	0.3

[1] Stream distance in miles above mouth

FLOODING SOURCE		FLOODWAY			1-PERCENT-ANNUAL-CHANCE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY (FEET NAVD)	WITHOUT FLOODWAY (FEET NAVD)	WITH FLOODWAY (FEET NAVD)	INCREASE (FEET)
ROUNDTOP CREEK								
A	0.34	110	180	10.5	1,377.1	1,377.1	1,377.1	0.0
B	0.83	100	483	3.9	1,395.7	1,395.7	1,396.5	0.8
C	0.86	80	367	5.2	1,396.2	1,396.2	1,397.0	0.8
D	0.87	67	333	5.7	1,396.6	1,396.6	1,397.1	0.5
E	1.00	49	249	7.6	1,402.0	1,402.0	1,402.4	0.4

[1] Stream distance in miles above confluence with Mineral Creek

FLOODING SOURCE		FLOODWAY			1-PERCENT-ANNUAL-CHANCE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY (FEET NAVD)	WITHOUT FLOODWAY (FEET NAVD)	WITH FLOODWAY (FEET NAVD)	INCREASE (FEET)
SALZER CREEK								
A	2,322	413[2]	7,581	0.1	181.3	178.1[3]	178.6	0.5
B	3,627	7,559[2]	90,869	0.0	181.3	178.1[3]	178.6	0.5
C	5,777	5,573[2]	53,667	0.0	181.3	178.1[3]	178.6	0.5
D	6,337	4,844[2]	50,849	0.0	181.3	178.1[3]	178.6	0.5
E	7,208	870[2]	8,477	0.1	181.3	178.1[3]	178.7	0.6
F	8,513	876[2]	5,060	0.1	181.3	178.1[3]	178.7	0.6
G	9,067	1,064[2]	4,768	0.1	181.3	178.1[3]	178.7	0.6
H	10,097	947[2]	5,887	0.1	181.3	178.1[3]	178.8	0.7
I	10,572	1,108	6,453	0.1	181.3	178.1[3]	178.8	0.7
J	11,088	1,482	5,898	0.1	181.3	178.1[3]	178.8	0.7
K	12,028	1,617	5,470	0.1	181.4	178.3[3]	178.9	0.6
L	12,548	1,636	10,769	0.1	181.4	178.5[3]	179.0	0.5
M	13,806	1,364	9,226	0.1	181.4	178.6[3]	179.1	0.5
N	15,950	1,515	8,515	0.1	181.4	178.6[3]	179.1	0.5
O	18,232	1,140	4,341	0.5	181.4	179.5[3]	179.6	0.1
P	20,614	1,232	2,937	0.2	181.5	180.5[3]	180.6	0.1
Q	24,446	749	1,261	1.3	185.8	185.8	185.8	0.0
R	24,935	657	1,530	2.1	188.0	188.0	188.3	0.3
S	27,787	1,956	7,968	1.7	191.4	191.4	191.5	0.1

[1] Stream distance in feet above confluence with Chehalis River [2] Width is width of channel floodway only
[3] Elevation computed without consideration of backwater effects from Chehalis River

FLOODING SOURCE		FLOODWAY			1-PERCENT-ANNUAL-CHANCE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)[2]	MEAN VELOCITY (FEET PER SECOND)[2]	REGULATORY (FEET NAVD)	WITHOUT FLOODWAY (FEET NAVD)	WITH FLOODWAY (FEET NAVD)	INCREASE (FEET)
SALZER CREEK MIDDLE FORK								
CA	0.200	345	---	---	191.4	189.9[3]	190.9	1.0
CB	0.444	150	---	---	196.3	196.3	197.3	1.0

[1] Stream distance in miles above mouth [2] Data Not Available [3] Elevation computed without consideration of backwater effects from Salzer Creek

TABLE 16

FEDERAL EMERGENCY MANAGEMENT AGENCY

LEWIS COUNTY, WA

AND INCORPORATED AREAS

FLOODWAY DATA

SALZER CREEK MIDDLE FORK

FLOODING SOURCE		FLOODWAY			1-PERCENT-ANNUAL-CHANCE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)[2]	MEAN VELOCITY (FEET PER SECOND)[2]	REGULATORY (FEET NAVD)	WITHOUT FLOODWAY (FEET NAVD)	WITH FLOODWAY (FEET NAVD)	INCREASE (FEET)
SALZER CREEK NORTH FORK								
A	0.15	935	---	---	198.5	198.5	199.5	1.0
B	0.57	300	---	---	206.8	206.8	207.8	1.0

[1] Stream distance in miles above mouth [2] Data Not Available

TABLE 16

FEDERAL EMERGENCY MANAGEMENT AGENCY

LEWIS COUNTY, WA

AND INCORPORATED AREAS

FLOODWAY DATA

SALZER CREEK NORTH FORK

FLOODING SOURCE		FLOODWAY			1-PERCENT-ANNUAL-CHANCE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)[2]	MEAN VELOCITY (FEET PER SECOND)[2]	REGULATORY (FEET NAVD)	WITHOUT FLOODWAY (FEET NAVD)	WITH FLOODWAY (FEET NAVD)	INCREASE (FEET)
SALZER CREEK SOUTH FORK								
BA	0.48	295	---	---	192.7	192.7	193.7	1.0
BB	0.63	280	---	---	196.4	196.4	197.4	1.0
BC	1.53	50	---	---	205.9	205.9	206.9	1.0
BD	1.74	60	---	---	209.4	209.4	210.4	1.0
BE	2.06	135	---	---	212.6	212.6	213.6	1.0
BF	2.40	100	---	---	218.1	218.1	219.1	1.0
BG	2.89	20	---	---	226.4	226.4	227.4	1.0
BH	3.22	30	---	---	235.3	235.3	236.3	1.0
BI	4.17	50	---	---	251.5	251.5	252.5	1.0

[1] Stream distance in miles above mouth [2] Data Not Available

FLOODING SOURCE		FLOODWAY			1-PERCENT-ANNUAL-CHANCE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY (FEET NAVD)	WITHOUT FLOODWAY (FEET NAVD)	WITH FLOODWAY (FEET NAVD)	INCREASE (FEET)
SCHEUBER BYPASS								
A	1,296	1,007	9,549	1.3	181.8	179.0[2]	179.1	0.1
B	1,816	959	7,007	1.8	181.9	179.1[2]	179.2	0.1
C	2,596	967	6,173	2.1	182.1	179.6[2]	179.6	0.0
D	3,176	1,205	8,349	1.8	182.4	180.0[2]	180.0	0.0
E	3,786	1,490	11,490	1.4	182.5	180.2[2]	180.2	0.0
F	4,586	2,322	18,534	0.9	182.6	180.3[2]	180.3	0.0
G	5,526	1,876	16,219	1.1	182.7	180.4[2]	180.4	0.0
H	6,186	2,247	21,341	0.9	182.8	180.4[2]	180.4	0.0
I	7,286	4,395	38,096	0.4	182.9	180.4[2]	180.4	0.0
J	8,476	3,614	41,217	0.3	182.9	180.4[2]	180.4	0.0
K	9,456	3,377	34,114	0.1	182.9	180.4[2]	180.4	0.0
L	10,646	3,373	34,073	0.0	182.9	180.4[2]	180.4	0.0
M	11,846	3,157	17,985	0.0	182.9	180.4[2]	180.4	0.0
N	13,096	1,696	11,104	0.0	182.9	180.4[2]	180.4	0.0
O	13,846	1,313	4,488	0.0	183.0	180.4[2]	180.4	0.0
P	14,646	190	270	0.4	183.0	180.5[2]	180.5	0.0

[1] Stream distance in feet above confluence with Chehalis River [2] Elevation computed without consideration of backwater effects from Chehalis River

TABLE 16

FEDERAL EMERGENCY MANAGEMENT AGENCY

LEWIS COUNTY, WA

AND INCORPORATED AREAS

FLOODWAY DATA

SCHEUBER BYPASS

FLOODING SOURCE		FLOODWAY			1-PERCENT-ANNUAL-CHANCE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY (FEET NAVD)	WITHOUT FLOODWAY (FEET NAVD)	WITH FLOODWAY (FEET NAVD)	INCREASE (FEET)
SILER CREEK								
B	0.817	725	1,616	1.1	890.2[2]	878.5	879.5	1.0
C	0.987	58	397	4.6	890.2[2]	879.4	880.4	1.0
D	1.003	50	300	6.1	890.2[2]	879.5	880.5	1.0
E	1.045	265	1,115	1.6	890.2[2]	880.9	881.6	0.7
F	1.367	826	4,722	0.3	890.4[2]	881.2	882.0	0.8
G	1.647	557	3,293	0.5	890.4[2]	881.4	882.2	0.8
H	2.104	100	306	5.0	890.5[2]	885.8	886.8	1.0
I	2.716	46	237	6.5	900.3	900.3	900.8	0.5
J	2.848	27	163	9.4	904.5	904.5	905.4	0.9
K	2.866	111	552	2.8	907.3	907.3	907.5	0.2
L	3.039	90	379	3.3	911.3	911.3	911.8	0.5

[1] Stream distance in miles above confluence with Cowlitz River
[2] Elevation includes backwater effect from Cowlitz River

FLOODING SOURCE		FLOODWAY			1-PERCENT-ANNUAL-CHANCE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY (FEET NAVD)	WITHOUT FLOODWAY (FEET NAVD)	WITH FLOODWAY (FEET NAVD)	INCREASE (FEET)
SILVER CREEK								
A	0.476	211	1,300	8.1	905.2	905.2	905.2	0.0
B	0.740	304	1,430	7.4	914.9	914.9	914.9	0.0
C	0.812	177	1,410	9.0	917.7	917.7	918.7	1.0
D	0.820	177	1,440	8.8	918.6	918.6	919.2	0.6
E	1.141	182	1,050	12.1	941.5	941.5	941.5	0.0
F	1.360	101[2]	930	13.8	959.4	959.4	959.4	0.0

[1] Stream distance in miles above confluence with Cowlitz River
[2] Mapped floodway widths have been adjusted to reflect topographic redelineation, see Section 4.2 for further explanation

TABLE 16

FEDERAL EMERGENCY MANAGEMENT AGENCY

LEWIS COUNTY, WA

AND INCORPORATED AREAS

FLOODWAY DATA

SILVER CREEK

FLOODING SOURCE		FLOODWAY			1-PERCENT-ANNUAL-CHANCE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY (FEET NAVD)	WITHOUT FLOODWAY (FEET NAVD)	WITH FLOODWAY (FEET NAVD)	INCREASE (FEET)
SKOOKUMCHUCK RIVER								
A	1,093	450	6,336	2.6	177.0	175.0[4]	175.4	0.4
B	1,373	1,150	19,440	2.9	177.1	175.5[4]	175.9	0.4
C	2,704	1,700	19,562	3.6	178.0	177.4[4]	177.8	0.4
D	4,163	1,790	12,432	1.4	180.2	180.2	181.1	0.9
E	5,249	1,760	9,381	1.8	180.4	180.4	181.3	0.9
F	7,947	1,290	6,879	5.1	183.0	183.0	183.9	0.9
G	8,410	1,637	9,630	5.6	185.3	185.3	186.1	0.8
H	10,647	2,768[2]	13,645	1.3	189.0	189.0	189.9	0.9
I	10,805	2,319[2]	11,985	1.2	189.5	189.5	190.3	0.8
J	11,851	1,500[2]	3,602	4.0	190.8	190.8	191.2	0.4
K	14,138	830	6,761	2.4	194.7	194.7	194.7	0.0
L	14,903	620	4,518	2.5	195.3	195.3	195.4	0.1
M	16,665	206	1,738	6.5	198.2	198.2	198.2	0.0
N	17,822	630	6,952	3.3	200.4	200.4	200.7	0.3
O	19,466	728	5,671	1.6	201.7	201.7	202.4	0.7
P	21,598	887[3]	4,346	1.8	202.7	202.7	203.2	0.5
Q	23,148	1,080[3]	3,554	2.5	204.6	204.6	204.8	0.2
R	24,684	858[3]	5,244	3.1	207.5	207.5	207.5	0.0
S	25,976	1,046	6,088	2.8	208.6	208.6	208.7	0.1
T	27,921	684	4,478	3.1	210.1	210.1	211.0	0.9
U	29,788	1,300	5,651	2.7	212.2	212.2	213.1	0.9

[1] Stream distance in feet above confluence with Chehalis River [2] Width includes "island" in floodway [3] Width is width of channel floodway only
[4] Elevation computed without consideration of backwater effects from Chehalis River

TABLE 16

FEDERAL EMERGENCY MANAGEMENT AGENCY

LEWIS COUNTY, WA

AND INCORPORATED AREAS

FLOODWAY DATA

SKOOKUMCHUCK RIVER

FLOODING SOURCE		FLOODWAY			1-PERCENT-ANNUAL-CHANCE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY (FEET NAVD)	WITHOUT FLOODWAY (FEET NAVD)	WITH FLOODWAY (FEET NAVD)	INCREASE (FEET)
SOUTH FORK CHEHALIS RIVER								
A	890	1,500	18,463	1.3	234.7	228.6[2]	228.9	0.3
B	2,750	1359	12,320	2.0	234.7	228.7[2]	229.1	0.4
C	3,920	2064	16,741	1.5	234.8	228.9[2]	229.3	0.4
D	6,690	2919	17,887	1.3	234.9	229.2[2]	229.7	0.5
E	10,505	4015	7,289	3.0	235.0	230.5[2]	231.3	0.8
F	16,268	2550	7,403	3.2	236.7	236.0[2]	236.5	0.5
G	17,951	2309	5,839	5.8	240.2	240.2	240.4	0.2
H	20,598	1650	9,878	2.3	243.0	243.0	243.9	0.9
I	25,741	413	3,679	6.1	246.4	246.4	247.2	0.8
J	31,338	1,151	5,913	2.7	253.2	253.2	253.5	0.3
K	34,262	206	1,510	10.5	257.2	257.2	257.4	0.2
L	36,432	354[3]	1926	3.4	258.8	258.8	259.3	0.5

[1] Stream distance in feet above confluence with Chehalis River [2] Elevation computed without consideration of backwater effects from Chehalis River
[3] Mapped floodway widths have been adjusted to reflect topographic redelineation, see Section 4.2 for further explanation

TABLE 16

FEDERAL EMERGENCY MANAGEMENT AGENCY

LEWIS COUNTY, WA

AND INCORPORATED AREAS

FLOODWAY DATA

SOUTH FORK CHEHALIS RIVER

FLOODING SOURCE		FLOODWAY			1-PERCENT-ANNUAL-CHANCE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY (FEET NAVD)	WITHOUT FLOODWAY (FEET NAVD)	WITH FLOODWAY (FEET NAVD)	INCREASE (FEET)
SOUTH FORK NEWAUKUM RIVER								
AI	11.44	277	1,449	3.8	271.5	271.5	272.0	0.5
AJ	11.51	105	678	8.0	271.9	271.9	272.5	0.6
AK	11.57	194	1,354	4.0	273.5	273.5	274.3	0.8
AL	11.60	132	752	7.2	273.8	273.8	274.5	0.7
AM	11.80	109[2]	779	7.0	278.4	278.4	278.7	0.3
AN	12.67	208	1,060	5.1	293.3	293.3	294.1	0.8
AO	13.17	370	1,328	4.1	301.0	301.0	302.0	1.0
AP	13.37	380	1,452	3.7	304.0	304.0	304.8	0.8
AQ	13.42	158[2]	569	9.6	304.9	304.9	305.1	0.2
AR	13.44	648	1,921	2.8	307.0	307.0	307.0	0.0
AS	13.84	247	1,022	5.3	309.4	309.4	310.4	1.0
AT	14.32	241	1,014	5.4	318.0	318.0	318.1	0.1
AU	14.68	141	752	7.2	323.7	323.7	324.5	0.8
AV	14.70	120	722	7.5	324.7	324.7	325.2	0.5
AW	14.75	166	862	6.3	326.9	326.9	327.0	0.1
AX	15.57	305[2]	1,428	3.8	338.7	338.7	339.6	0.9
AY	15.62	147	833	6.5	339.5	339.5	340.2	0.7
AZ	15.64	148	1,024	5.3	340.6	340.6	340.9	0.3
BA	16.19	372[2]	1,713	3.2	345.8	345.8	346.0	0.2
BB	16.46	104	559	9.2	348.9	348.9	349.0	0.1
BC	16.82	210	1,109	4.6	357.1	357.1	358.0	0.9
BD	17.56	256	1,146	4.5	371.6	371.6	372.0	0.4
BE	17.86	94	689	7.5	376.6	376.6	377.5	0.9

[1] Stream distance in miles above mouth

[2] Mapped floodway widths have been adjusted to reflect topographic redelineation, see Section 4.2 for further explanation

FLOODING SOURCE		FLOODWAY			1-PERCENT-ANNUAL-CHANCE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY (FEET NAVD)	WITHOUT FLOODWAY (FEET NAVD)	WITH FLOODWAY (FEET NAVD)	INCREASE (FEET)
SOUTH FORK NEWAUKUM RIVER (continued)								
BF	17.89	140	752	6.8	378.1	378.1	378.5	0.4
BG	17.91	248	1,226	4.2	379.4	379.4	379.4	0.0
BH	18.08	200	1,115	4.6	380.8	380.8	381.3	0.5
BI	18.53	135	647	7.9	388.9	388.9	389.3	0.4
BJ	18.98	126	710	7.2	397.6	397.6	398.2	0.6
BK	19.26	152[2]	767	6.7	401.6	401.6	401.6	0.0
BL	19.65	234	829	6.2	406.6	406.6	407.0	0.4
BM	20.10	145	796	6.1	415.3	415.3	415.4	0.1
BN	20.92	456[3]	1236	3.9	429.5	429.5	430.5	1.0
BO	21.23	164	915	5.3	434.7	434.7	435.2	0.5
BP	21.62	168	627	7.7	445.9	445.9	446.5	0.6
BQ	22.16	154	926	5.2	461.2	461.2	462.0	0.8
BR	22.77	186	956	5.1	471.9	471.9	472.0	0.1
BS	23.03	129	719	6.7	477.7	477.7	478.3	0.6
BT	23.09	125	1,045	4.6	478.6	478.6	479.6	1.0
BU	23.13	219	1,032	4.7	479.2	479.2	480.1	0.9
BV	23.49	109	610	7.9	487.4	487.4	487.4	0.0
BW	23.91	63	493	9.8	500.1	500.1	501.0	0.9

[1] Stream distance in miles above mouth
[2] Mapped floodway widths have been adjusted to reflect topographic redelineation, see Section 4.2 for further explanation
[3] Width does not include small areas of high ground

FLOODING SOURCE		FLOODWAY			1-PERCENT-ANNUAL-CHANCE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY (FEET NAVD)	WITHOUT FLOODWAY (FEET NAVD)	WITH FLOODWAY (FEET NAVD)	INCREASE (FEET)
SOUTH FORK TILTON RIVER								
A	0.12	125	529	11.8	1,043.0	1,043.0	1,043.0	0.0
B	0.15	180	1,497	4.2	1,046.1	1,046.1	1,046.1	0.0
C	0.18	174	1,123	5.6	1,046.4	1,046.4	1,046.4	0.0
D	0.63	293	1,858	3.4	1,085.8	1,085.8	1,086.8	1.0
E	1.05	107	641	9.7	1,112.0	1,112.0	1,112.4	0.4

[1] Stream distance in miles above mouth

FLOODING SOURCE		FLOODWAY			1-PERCENT-ANNUAL-CHANCE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY (FEET NAVD)	WITHOUT FLOODWAY (FEET NAVD)	WITH FLOODWAY (FEET NAVD)	INCREASE (FEET)
STEARNS CREEK								
A	3,764	1,922[2]	4,342	1.7	193.6	190.5[3]	190.7	0.2
B	3,964	4,728	29,220	1.1	194.1	190.5[3]	190.8	0.3
C	5,395	5,704	52,562	0.1	194.1	190.6[3]	190.8	0.2
D	6,831	7,850	88,518	0.0	194.1	190.6[3]	190.8	0.2
E	8,191	6,118	95,672	0.0	194.1	190.6[3]	190.8	0.2
F	11,010	5,125	82,166	0.0	194.1	190.6[3]	190.8	0.2
G	12,177	2,400	32,903	0.1	194.1	190.6[3]	190.8	0.2
H	13,523	2,000	23,555	0.1	194.1	190.6[3]	190.8	0.2
I	15,031	1,600	16,057	0.2	194.1	190.6[3]	190.8	0.2
J	15,999	1,650	14,773	0.3	194.1	190.6[3]	190.8	0.2
K	18,309	500	2,294	2.0	194.2	190.7[3]	191.4	0.7
L	20,194	258	1,398	5.8	195.3	195.3	196.0	0.7
M	22,494	210	1,681	2.1	200.4	199.6[3]	200.1	0.5
N	23,839	800	5,974	1.5	201.0	199.9[3]	200.8	0.9

[1] Stream distance in feet from confluence with Chehalis River [2] Width is width of channel floodway only
[3] Elevation computed without consideration of backwater effects from Chehalis River

TABLE 16

FEDERAL EMERGENCY MANAGEMENT AGENCY

LEWIS COUNTY, WA

AND INCORPORATED AREAS

FLOODWAY DATA

STEARNS CREEK

FLOODING SOURCE		FLOODWAY			1-PERCENT-ANNUAL-CHANCE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY (FEET NAVD)	WITHOUT FLOODWAY (FEET NAVD)	WITH FLOODWAY (FEET NAVD)	INCREASE (FEET)
STOWE CREEK								
A	0.100	26	112	11.8	390.5	390.5	390.5	0.0
B	0.210	39	172	7.8	404.7	404.7	404.7	0.0
C	0.320	78	492	2.7	411.8	411.8	411.8	0.0
D	0.470	37	125	10.6	414.9	414.9	414.9	0.0
E	0.503	100	351	3.8	419.5	419.5	419.5	0.0
F	0.710	26	125	10.6	424.4	424.0	424.4	0.4

[1] Stream distance in miles above mouth

TABLE 16

FEDERAL EMERGENCY MANAGEMENT AGENCY

LEWIS COUNTY, WA

AND INCORPORATED AREAS

FLOODWAY DATA

STOWE CREEK

FLOODING SOURCE		FLOODWAY			1-PERCENT-ANNUAL-CHANCE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY (FEET NAVD)	WITHOUT FLOODWAY (FEET NAVD)	WITH FLOODWAY (FEET NAVD)	INCREASE (FEET)
SURREY CREEK								
A	0.676	51	288	3.9	905.2[2]	897.7	898.7	1.0
B	0.746	89	572	2.0	905.2[2]	898.3	899.0	0.7
C	0.793	183	626	1.8	905.2[2]	898.5	899.2	0.7
D	1.063	800	3,591	0.3	905.2[2]	898.8	899.7	0.9
E	1.616	260	764	1.5	905.2[2]	901.0	901.6	0.6
F	1.874	82	207	5.4	911.2	911.2	912.2	1.0

[1] Stream distance in miles above mouth
[2] Flooding controlled by Cowlitz River

FLOODING SOURCE		FLOODWAY			1-PERCENT-ANNUAL-CHANCE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY (FEET NAVD)	WITHOUT FLOODWAY (FEET NAVD)	WITH FLOODWAY (FEET NAVD)	INCREASE (FEET)
TILTON RIVER								
A	9.00	200	2,336	10.5	699.5	699.5	700.4	0.9
B	9.41	650	5,266	4.6	709.3	709.3	710.2	0.9
C	9.69	750	6,391	3.8	714.4	714.4	715.2	0.8
D	10.16	500	4,009	6.0	725.0	725.0	725.9	0.9
E	10.44	1,118	7,536	3.2	734.3	734.3	735.3	1.0
F	11.16	500	3,596	6.7	750.7	750.7	751.1	0.4
G	11.69	164	1,786	13.3	766.1	766.1	766.1	0.0
H	11.90	128	1,729	13.8	772.8	772.8	773.5	0.7
I	12.41	270	2,202	10.0	790.5	790.5	791.4	0.9
J	13.02	800	5,076	3.2	805.4	805.4	806.2	0.8
K	13.08	111	1,436	12.6	807.0	807.0	807.8	0.8
L	13.14	307	3,404	5.3	810.5	810.5	810.7	0.2
M	13.59	835	5,775	3.1	815.4	815.4	816.3	0.9
N	13.90	175	1,707	10.5	823.1	823.1	823.5	0.4
O	14.28	500	3,860	4.7	833.8	833.8	834.0	0.2
P	14.61	400	3,041	5.9	840.5	840.5	841.2	0.7
Q	15.05	640	5,312	3.4	847.9	847.9	848.6	0.7
R	15.25	120	1,445	12.4	850.5	850.5	851.2	0.7
S	15.37	94[2]	1,472	12.1	856.7	856.7	857.4	0.7
T	15.39	335	3,949	4.5	859.4	859.4	859.4	0.0
U	15.81	130	1,630	10.9	861.7	861.7	862.7	1.0
V	16.06	110	1,477	12.0	868.2	868.2	868.5	0.3
W	16.39	90	1,163	15.3	877.6	877.6	877.8	0.2

[1] Stream distance in miles above mouth

[2] Mapped floodway widths have been adjusted to reflect topographic redelineation, see Section 4.2 for further explanation

TABLE 16

FEDERAL EMERGENCY MANAGEMENT AGENCY

LEWIS COUNTY, WA

AND INCORPORATED AREAS

FLOODWAY DATA

TILTON RIVER

FLOODING SOURCE		FLOODWAY			1-PERCENT-ANNUAL-CHANCE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY (FEET NAVD)	WITHOUT FLOODWAY (FEET NAVD)	WITH FLOODWAY (FEET NAVD)	INCREASE (FEET)
TILTON RIVER (continued)								
X	16.66	210	2,894	5.9	886.9	886.9	887.1	0.2
Y	17.08	302[2,3]	2,055	8.3	891.2	891.2	891.9	0.7
Z	17.34	158	1,291	12.3	896.8	896.8	897.5	0.7
AA	17.68	109	1226	12.9	910.1	910.1	911.1	1.0
AB	17.70	156	1056	15.0	914.2	914.2	914.2	0.0
AC	17.86	655[3]	5.114	3.1	921.5	921.5	921.9	0.4
AD	18.16	121	1,017	15.3	926.3	926.3	926.8	0.5
AE	18.41	460	3,615	4.3	942.0	942.0	942.3	0.3
AF	18.64	450	3,664	4.2	946.3	946.3	947.2	0.9
AG	18.82	230	1,988	7.2	950.3	950.3	951.0	0.7
AH	19.13	330	2,625	5.5	962.5	962.5	963.4	0.9
AI	19.53	350	2,461	5.8	976.4	976.4	976.7	0.3
AJ	19.97	1,070	4,761	3.0	988.5	988.5	989.5	1.0
AK	20.28	244	1,350	10.1	1000.2	1000.2	1000.9	0.7
AL	20.57	450	3,126	4.4	1014.5	1014.5	1015.3	0.8
AM	20.86	250	1,562	8.8	1025.4	1025.4	1025.6	0.2
AN	20.92	80	1,051	13.0	1030.4	1030.4	1030.6	0.2
AO	20.96	370	3,381	4.0	1033.9	1033.9	1034.0	0.1
AP	21.09	200	1,807	7.6	1035.7	1035.7	1035.7	0.0
AQ	21.20	200	2,134	3.5	1038.7	1038.7	1039.2	0.5
AR	21.90	340[3]	897	8.3	1066.2	1066.2	1066.2	0.0

[1] Stream distance in miles above mouth
[2] Combined floodway width of Tilton River and Lake Creek (Tributary to Tilton River)
[3] Mapped floodway widths have been adjusted to reflect topographic redelineation, see Section 4.2 for further explanation

TABLE 16

FEDERAL EMERGENCY MANAGEMENT AGENCY

LEWIS COUNTY, WA

AND INCORPORATED AREAS

FLOODWAY DATA

TILTON RIVER

5.0 INSURANCE APPLICATION

For flood insurance rating purposes, flood insurance zone designations are assigned to a community based on the results of the engineering analyses. These zones are as follows:

Zone A

Zone A is the flood insurance rate zone that corresponds to the 1-percent-annual-chance floodplains that are determined in the FIS report by approximate methods. Because detailed hydraulic analyses are not performed for such areas, no base (1-percent-annual-chance) flood elevations (BFEs) or depths are shown within this zone.

Zone AE

Zone AE is the flood insurance rate zone that corresponds to the 1-percent-annual-chance floodplains that are determined in the FIS report by detailed methods. Whole-foot BFEs derived from the detailed hydraulic analyses are shown at selected intervals within this zone.

Zone AH

Zone AH is the flood insurance rate zone that corresponds to the areas of 1-percent annual chance shallow flooding (usually areas of ponding) where average depths are between 1 and 3 feet. Whole-foot base flood elevations derived from the detailed hydraulic analyses are shown at selected intervals within this zone.

Zone AO

Zone AO is the flood insurance rate zone that corresponds to the areas of 1-percent 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 detailed hydraulic analyses are shown within this zone.

Zone X

Zone X is the flood insurance rate zone that corresponds to areas outside the 0.2-percent-annual-chance floodplain, areas within the 0.2-percent-annual-chance floodplain, areas of 1-percent-annual-chance flooding where average depths are less than 1 foot, areas of 1-percent-annual-chance flooding where the contributing drainage area is less than 1 square mile (sq. mi.), and areas protected from the base flood by levees. No BFEs or depths are shown within this zone.

Table 17. Flood Insurance Zones Within Each Community

Community	Flood Insurance Zones
City of Centralia	AE, AH
City of Chehalis	AE, AH
Lewis County (Unincorporated Areas)	AE, A, AH, AO
City of Morton	A
City of Mossyrock	A
City of Napavine	AE
Town of Pe Ell	AE,A, AO
City of Toledo	AE
City of Vader	AE
City of Winlock	AE

6.0 FLOOD INSURANCE RATE MAP

The FIRM is designed for flood insurance and floodplain management applications.

For flood insurance applications, the map designates flood insurance rate zones as described in Section 5.0 and, in the 1-percent-annual-chance floodplains that were studied by detailed methods, shows selected whole-foot BFEs or average depths. Insurance agents use zones and base flood elevations in conjunction with information on structures and their contents to assign premium rates for flood insurance policies.

For floodplain management applications, the map shows by tints, screens, and symbols, the 1- and 0.2-percent-annual-chance floodplains, floodways, and the locations of selected cross sections used in the hydraulic analyses and floodway computations.

The countywide FIRM presents flooding information for the entire geographic area of Lewis County, Washington. Previously, FIRMs were prepared for each incorporated community and the unincorporated areas of the county identified as flood-prone. This countywide FIRM also includes flood-hazard information that was presented separately on Flood Boundary and Floodway Maps (FBFMs), where applicable. Historical data relating to the maps prepared for each community are presented in Table 18, "Community Map History.

COMMUNITY NAME	INITIAL IDENTIFICATION	FLOOD HAZARD BOUNDARY MAP REVISION DATE(S)	FLOOD INSURANCE RATE MAP EFFECTIVE DATE	FLOOD INSURANCE RATE MAP REVISION DATE(S)
Centralia, City of	March 15, 1974	December 13, 1977	June 1, 1982	N/A
Chehalis, City of	June 7, 1974	September 24, 1976	May 1, 1980	July 17, 2006
Lewis County (Unincorporated Areas)	November 29, 1974	November 29, 1977	December 15, 1981	July 17, 2006
Morton, City of	May 24, 1974	February 6, 1976	December 4, 1979	March 2, 1982
Mossyrock, City of	February 7, 1975	N/A	N/A	N/A
Napavine, Town of	July 17, 2006	N/A	July 17, 2006	N/A
Pe Ell, Town of	July 18, 1975	N/A	March 4, 1980	N/A
Toledo, City of	July 11, 1975	N/A	November 5, 1980	N/A
Vader, CIty of	September 5, 1975	June 4, 1976	September 14, 1979	N/A
Winlock, Town of	July 18, 1975	N/A	September 14, 1979	N/A

TABLE 17

FEDERAL EMERGENCY MANAGEMENT AGENCY

LEWIS COUNTY, WA

AND INCORPORATED AREAS

COMMUNITY MAP HISTORY

9.0 OTHER STUDIES

FIS reports have been published or are currently in progress for Cowlitz, Skamania, Wahkiakum, Pacific, Yakima, Thurston, Pierce, and Grays Harbor Counties, Washington. The Lewis County study is in agreement with these studies.

Information pertaining to revised and unrevised flood hazards for each jurisdiction within Lewis County has been compiled into this FIS. Therefore, this FIS supersedes all previously printed FIS reports, FIRMs, and/or FBFMs for all incorporated and unincorporated jurisdictions within Lewis County, and should be considered authoritative for the purposes of the NFIP.

8.0 LOCATION OF DATA

Information concerning the pertinent data used in the preparation of this study can be obtained by contacting FEMA, Mitigation Division, Federal Regional Center, 130 228th Street, SW, Bothell, Washington 98021-9796.

9.0 BIBLIOGRAPHY AND REFERENCES

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10.0 REVISIONS DESCRIPTION

This section has been added to provide information regarding significant revisions made since the original FIS was printed. Future revisions may be made that do not result in the republishing of the FIS. To ensure that any user is aware of all revisions, please contact the appropriate community map repository.

10.1 First Revision

This first revision includes the compilation of all single community FIRMs into countywide format using digital processes. This countywide FIRM was compiled with Base mapping provided by Lewis County.

Previously, FIRMs were prepared for each incorporated community and the unincorporated areas of the county identified as flood-prone. This countywide FIRM also includes flood-hazard information presented separately on Flood Boundary and Floodway Maps, where applicable. Historical data relating to the maps prepared for each community are presented in Table 18.

New data for this revision include:

A portion of the approximate Zone A boundaries were completed by Lewis County Department of Public Works GIS, for the Federal Emergency Management Agency (FEMA), under Contract No. EMS-2005-GR-0010. This study was completed in May 2007.

Detailed studies of the Chehalis, South Fork Chehalis, Skookumchuck Rivers and Hanaford, Lincoln, Salzer and Stearns Creeks were provided by Northwest Hydraulic Consultants, Inc., for the Federal Emergency Management Agency (FEMA), under IDIQ Contract EMS-2001-CO-0067, Task 19. This study was completed in June 2010.

Redelineation and a portion of the approximate Zone A boundaries were completed by Watershed VI Alliance, for the Federal Emergency Management Agency (FEMA), under Contract No. EMA-2002-CO-0048, Task Order HSTO050. This study was completed in September 2010.

The specific areas studied by detailed methods, reaches, dates of study, and study contractors are included in Table 1.

Details of the Hydrologic and Hydraulic Analyses are included in Sections 3.1 and 3.2 of this FIS.