FLOOD INSURANCE STUDY

VOLUME 1 OF 2

Notice

This preliminary FIS report includes only revised Flood Profiles and Floodway Data tables. See "Notice to Flood Insurance Study Users" page for additional details.

CLARK COUNTY, WASHINGTON
AND INCORPORATED AREAS

COMMUNITY NAME	COMMUNITY NUMBER
BATTLE GROUND, CITY OF	530025
CAMAS, CITY OF	530026
CLARK COUNTY (UNINCORPORATED AREAS)	530024
LA CENTER, CITY OF	530248
RIDGEFIELD, CITY OF	530298
VANCOUVER, CITY OF	530027
WASHOUGAL, CITY OF	530028
YACOLT, TOWN OF	530269

CLARK COUNTY

PRELIMINARY DATE: December 30, 2015

Federal Emergency Management Agency

FLOOD INSURANCE STUDY NUMBER
53011CV001B

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) report may not contain all data available within the Community Map Repository. Please contact the Community Map Repository for any additional data.

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.

This preliminary FIS report does not include unrevised Floodway Data Tables or unrevised Flood Profiles. These Floodway Data Tables and Flood Profiles will appear in the final FIS report.

Initial Countywide FIS Effective Date: **September 05, 2012**
Revised Countywide Date: **To Be Determined**

TABLE OF CONTENTS

Volume 1 – To Be Determined

Volume 1 (Continued) – To Be Determined

FIGURES

TABLES

EXHIBITS

VOLUME 2 – To Be Determined

EXIBITS

FLOOD INSURANCE STUDY
CLARK COUNTY 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 Clark County, including the Cities of Battleground, Camas, La Center, Ridgefield, Vancouver, Washougal; the Towns of Yacolt; Unincorporated areas of Clark County (referred to collectively herein as Clark 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.

Please note that the City of Woodland is geographically located in Cowlitz and Clark Counties. The City of Woodland is not included in this FIS report. See the separately published FIS report and Flood Insurance Rate Map (FIRM) for flood-hazard information.

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.

The Digital Flood Insurance Rate Map (DFIRM) and FIS report for this countywide study have been produced in digital format. Flood hazard information was converted to meet the Federal Emergency Management Agency (FEMA) DFIRM database specifications and Geographic Information System (GIS) format requirements. The flood hazard information was created and is provided in a digital format so that it can be incorporated into a local GIS and be accessed more easily by the community.

1.2 Authority and Acknowledgments

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

Pre-Countywide Analyses

Information on the authority and acknowledgements for each jurisdiction included in this countywide FIS, as compiled from their previously printed FIS reports, is shown below:

Clark County (Unincorporated Areas):	The original hydrologic and hydraulic analyses for Burnt Bridge Creek, the Columbia River, the East Fork Lewis River, Gee Creek, Lacamas Creek, the Lewis River, Mill Creek, Salmon Creek, an Unnamed Tributary to Gee Creek, the Washougal River, and Weaver Creek were performed by the U.S. Army Corps of Engineers (USACE), Portland District, for FEMA, under Interagency Agreement No. IAA-H-l0-77, Project Order No. 15; Interagency Agreement No. IAA-H-7-76, Project Order No. 1; Interagency Agreement No. IAA-H-16-75, Project Order No. 10, 16, and 19; Interagency Agreement No. IAA-H-20-74, Project Order No. 17. This work was completed in November 1979.
City of Camas:	The hydrologic and hydraulic analyses for this study were performed by the U.S. Army Corps of Engineers, Portland District, for the Federal Insurance Administration, under Inter-Agency Agreement No. IAA-H-10-77, Project Order No. 15. This work, which was completed in July 1979, covered all significant flooding sources affecting the City of Camas.
City of Washougal:	The hydrologic and hydraulic analyses for this study were performed by the U.S. Army Corps of Engineers, Portland District, for the Federal Insurance Administration, under Inter-Agency Agreement No. IAA-H-10-77, Project Order No. 15. This work, which was completed in May 1979, covered all significant flooding sources affecting the City of Washougal.

The Cities of Battle Ground, La Center, Ridgefield, Vancouver and the Town of Yacolt have no previously printed FIS reports.

September 5, 2012
The Initial Countywide FIS Report

The hydrologic and hydraulic analyses for this study were performed by WEST Consultants Inc., for FEMA, under Contract No. EMS-2001-CO-0068. This study was completed in August 2005. Gee Creek, Lacamas Creek, Mill Creek, Salmon Creek, and Weaver Creek were restudied entirely. A Portion of Burnt Bridge Creek was restudied. China Ditch, Curtin Creek, Fifth Plain Creek, Packard Creek, Padden Creek, Spring Branch Creek, and Whipple Creek were studied by detailed methods. Little Matney Creek, Matney Creek, Morgan Creek, Mud Creek, and Shanghai Creek were studied by approximate methods. The hydrologic and hydraulic analyses for this study were performed by WEST Consultants Inc., for FEMA, under Contract No. EMS-2001-CO-0068. This study was completed in August 2005. Gee Creek, Lacamas Creek, Mill Creek, Salmon Creek, and Weaver Creek were restudied entirely. A Portion of Burnt Bridge Creek was restudied. China Ditch, Curtin Creek Fifth Plain Creek, Packard Creek, Padden Creek, Spring Branch Creek, and Whipple Creek were studied by detailed methods. Little Matney Creek, Matney Creek, Morgan Creek, Mud Creek, and Shanghai Creek were studied by approximate methods.

This Physical Map Revision

The hydrologic and hydraulic analyses for this Physical Map Revision (PMR) were performed by Strategic Alliance for Risk Reduction (STARR) for FEMA, under Contract No. Contract Number HSFEHQ-09-D-0370-HSFE10-10-J-00106. The work was completed in June 2013.

Base map information shown on the FIRM was derived from multiple sources in digital format provided by Clark County and the U.S. Geological Survey (USGS) produced at a scale of 1:24,000 from National Agricultural Imagery Program mosaic photography dated 2013 or later. The projection used in the preparation of this map is Universal Transverse Mercator (UTM) Zone 10, and the horizontal datum used is North American Datum 1983, GRS 1980 spheroid.

1.3 Coordination

An initial meeting is held with representatives from FEMA, the community, and the study contractor to explain the nature and purpose of a FIS, and to identify the streams to be studied or restudied. A final meeting is held with representatives from FEMA, the community, and the study contractor to review the results of the study.

Pre-Countywide Analyses

The initial and final meeting dates for previous FIS reports for Clark County and its communities are listed in the following table:

Table 1 - CCO Meeting Dates for Pre-Countywide Study

Community	FIS Date	Initial Meeting	Final Meeting
Battle Ground, City of	September 09, 2012	November 16, 1976	March 4, 1980
Camas, City of	*	*	March 5, 1980
Clark County (Unincorporated Areas)	*	*	September 1, 1981
La Center, City of	*	*	September 26, 1986
Ridgefield, City of	*	November 16, 1976	June 10, 1980
Vancouver ,City of	*	May 22, 1975	June 10, 1980
Washougal, City of	*	March 30, 1979	November 18, 1979
Yacolt, Town of	*	*	*

*Data not available

September 5, 2012
The Initial Countywide FIS Report

For the initial countywide study, the final CCO meeting held on September 15, 2010, and attended by representatives of FEMA, Michael Baker Jr. Inc., the Washington Department of Ecology, the Port of Camas-Washougal, and the local communities of the Cities of Camas, Ridgefield, Vancouver, and Washougal; and Clark County. All problems raised at that meeting have been addressed.

This Physical Map Revision

The results of this study were reviewed at the final meeting held on _____, and attended by representatives of _____. All issues and/or concerns raised at the meeting have been addressed.

2.0 AREA STUDIED

2.1 Scope of Study

This FIS covers the geographic area of Clark 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 through June 2013.

Table 2 – Limits of Detailed Study

The following streams were studied by detailed methods in this FIS report:

Flooding Source	Limits of Detailed Study
Washougal River	At Confluence with Columbia River

The limits of detailed study are indicated on the Flood Profiles (Exhibit 1) and on the FIRM (Exhibit 2).

Pre-Countywide Analysis

The November 1979 study performed by USACE provided a detailed study along Burnt Bridge Creek from City of Vancouver corporate limits to approximately 0.22 mile upstream of Northeast 152nd Avenue. The Columbia River was studied by detailed method from Clark-Cowlitz County boundary to Clark-Skamania County boundary. The East Fork Lewis River was studied by detailed method from its confluence with the Lewis River to upstream of Boy Scout Camp. The Lewis River was studied by detailed method from its confluence with the Columbia River to approximately 500 feet downstream of Merwin Dam. Unnamed Tributary to Gee Creek was studied by detailed method from its confluence with Gee Creek to approximately 500 feet upstream of Northwest 54th Avenue. The Washougal River was studied by detailed method from its confluence with the Columbia River to approximately 0.86 miles upstream of City of Washougal corporate limits. In addition, approximate methods were used to continue the East Fork Lewis River and Lewis River studies to Big Tree Creek and the Clark-Skamania County boundary, respectively. Cedar Creek, Chelatchie Creek, and Unnamed Tributary to Chelatchie Creek were studied by approximate method.

The August 2005 study performed by West Consultants Inc provided new detailed information for Burnt Bridge Creek from the downstream face of the Interstate 205 culvert to approximately 1 mile upstream of Northeast 137th Avenue. Gee Creek, Lacamas Creek, Mill Creek, Salmon Creek, and Weaver Creek were restudied entirely. China Ditch, Curtin Creek, Fifth Plain Creek, Packard Creek, Padden Creek, Spring Branch Creek, and Whipple Creek were studied entirely by detail method. The study also provided approximate study for Little Matney Creek, Matney Creek, Morgan Creek, Mud Creek, and Shanghai Creek.

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 Clark County.

September 5, 2012
The Initial Countywide FIS Report

For the initial countywide FIS, the FIS report and FIRM were converted to countywide format, and the flooding information for the entire county, including both incorporated and unincorporated areas, is shown. Also, the vertical datum was converted from the National Geodetic Vertical Datum of 1929 (NGVD29) to the North American Vertical Datum of 1988 (NAVD88). In addition, the Transverse Mercator, State Plane coordinates, previously referenced to the North American Datum of 1927 (NAD27), are now referenced to the North American Datum of 1983 (NAD83).

The initial countywide FIS incorporated the Letter of Map Revisions (LOMRs) issued by FEMA, for the projects listed in Table 3, "Initial Countywide Letters of Map Change (LOMCs).

Table 3 – Initial Countywide Letters of Map Change (LOMCs)

Community	Case Number	Stream(s) / Project Identifier	Date Issued
Clark County (Unincorporated Areas)	94-10-039P	The 1-percent-annual-chance flood for Unnamed Tributary to Curtin Creek is contained in a channel and culvert west of Northeast Meadows Drive	June 21, 1994
Clark County (Unincorporated Areas)	04-10-0710P	Cold Creek from approximately 750 feet downstream to approximately 600 feet upstream of Northeast 58th Avenue	June 6, 2005

FIRM Notes to Users

Each FIS report provides floodplain data, which may include a combination of the following: 10-, 4-, 2-, 1-, and 0.2-percent-annual-chance flood elevations (the 1-percent-annual-chance flood elevation is also referred to as the Base Flood Elevation (BFE)); delineations of the 1-percent-annual-chance and 0.2-percent -annual-chance-floodplains; and 1-percent-annual-chance floodway. This information is presented on the FIRM and/or in many components of the FIS report, including Flood Profiles and Floodway Data tables. Figure 1 presents important considerations for using the information contained in this FIS report and the FIRM and is provided in response to changes in format and content.

Figure 1 – FIRM Note to Users

NOTES TO USERS

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

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

For community and countywide map dates, refer to Table 9 in this FIS Report.

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

PRELIMINARY FIS REPORT: FEMA maintains information about map features, such as street locations and names, in or near designated flood hazard areas. Requests to revise information in or near designated flood hazard areas may be provided to FEMA during the community review period, at the final Consultation Coordination Officer's meeting, or during the statutory 90-day appeal period. Approved requests for changes will be shown on the final printed FIRM.

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

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

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

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

PROJECTION INFORMATION: The projection used in the preparation of the map was Universal Transverse Mercator. The horizontal datum was North American Datum 1983. Differences in datum, spheroid, projection or State Plane zones used in the production of FIRMs for adjacent jurisdictions may result in slight positional differences in map features across jurisdiction boundaries. These differences do not affect the accuracy of the FIRM

Figure 1 – FIRM Notes to Users (Continued)

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

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

Local vertical monuments may have been used to create the map. To obtain current monument information, please contact the appropriate local community.

BASE MAP INFORMATION: Base map information is panel-specific. The map panels should be referenced for this information.

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

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

NOTES FOR FIRM INDEX

REVISIONS TO INDEX: As new studies are performed and FIRM panels are updated within Clark County, Washington and Incorporated Areas, corresponding revisions to the FIRM Index will be incorporated within the FIS Report to reflect the effective dates of those panels. Please refer to Table 9 of this FIS Report to determine the most recent FIRM revision date for each community. The most recent FIRM panel effective date will correspond to the most recent index date.

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

Figure 2 – FIRM Legend

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

Special Flood Hazard Areas subject to inundation by the 1% annual chance flood (Zones A, AE, AH, AO, AR, A99, V and VE)

Zone A — The flood insurance rate zone that corresponds to the 1% annual chance floodplains. No base (1% annual chance) flood elevations (BFEs) or depths are shown within this zone.

Zone AE — The flood insurance rate zone that corresponds to the 1% annual chance floodplains. Base flood elevations derived from the hydraulic analyses are shown within this zone, either at cross section locations or as static whole-foot elevations that apply throughout the zone.

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

Zone AO — The flood insurance rate zone that corresponds to the areas of 1% annual chance shallow flooding (usually sheet flow on sloping terrain) where average depths are between 1 and 3 feet. Average whole-foot depths derived from the hydraulic analyses are shown within this zone.

Zone AR — The flood insurance rate zone that corresponds to areas that were formerly protected from the 1% annual chance flood by a flood control system that was subsequently decertified. Zone AR indicates that the former flood control system is being restored to provide protection from the 1% annual chance or greater flood.

Zone A99 — The flood insurance rate zone that corresponds to areas of the 1% annual chance floodplain that will be protected by a Federal flood protection system where construction has reached specified statutory milestones. No base flood elevations or flood depths are shown within this zone.

Zone V — The flood insurance rate zone that corresponds to the 1% annual chance coastal floodplains that have additional hazards associated with storm waves. Base flood elevations are not shown within this zone.

Zone VE — Zone VE is the flood insurance rate zone that corresponds to the 1% annual chance coastal floodplains that have additional hazards associated with storm waves. Base flood elevations derived from the coastal analyses are shown within this zone as static whole-foot elevations that apply throughout the zone.

Regulatory Floodway determined in Zone AE.

OTHER AREAS OF FLOOD HAZARD

Shaded Zone X: Areas of 0.2% annual chance flood hazards and areas of 1% annual chance flood hazards with average depths of less than 1 foot or with drainage areas less than 1 square mile.

Future Conditions 1% Annual Chance Flood Hazard – Zone X: The flood insurance rate zone that corresponds to the 1% annual chance floodplains that are determined based on future-conditions hydrology. No base flood elevations or flood depths are shown within this zone.

Zone X Protected by Accredited Levee: Areas protected by an accredited levee, dike or other flood control structures. See Notes to Users for important information.

OTHER AREAS

Zone D (Areas of Undetermined Flood Hazard): The flood insurance rate zone that corresponds to unstudied areas where flood hazards are undetermined, but possible

Unshaded Zone X: Areas determined to be outside the 0.2% annual chance floodplain

FLOOD HAZARD AND OTHER BOUNDARY LINES

Flood Zone Boundary (white line)

Limit of Study

Jurisdiction Boundary

Limit of Moderate Wave Action (LiMWA): Indicates the inland limit of the area affected by waves greater than 1.5 feet

GENERAL STRUCTURES

Aqueduct
Channel
Culvert
Storm Sewer

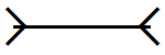
Channel, Culvert, Aqueduct, or Storm Sewer

Dam
Jetty
Weir

Dam, Jetty, Weir

Levee, Dike or Floodwall accredited or provisionally accredited to provide protection from the 1% annual chance flood

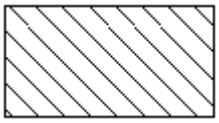
Levee, Dike or Floodwall not accredited to provide protection from the 1% annual chance flood.



Bridge

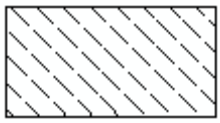
Bridge

COASTAL BARRIER RESOURCES SYSTEM (CBRS) AND OTHERWISE PROTECTED AREAS (OPA): *CBRS areas and OPAs are normally located within or adjacent to Special Flood Hazard Areas. See Notes to Users for important information.*



CBRS AREA
09/30/2009

Coastal Barrier Resources System Area: Labels are shown to clarify where this area shares a boundary with an incorporated area or overlaps with the floodway.



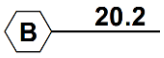
OTHERWISE PROTECTED AREA
09/30/2009

Otherwise Protected Area

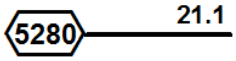
REFERENCE MARKERS

River mile Markers

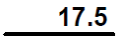
CROSS SECTION & TRANSECT INFORMATION



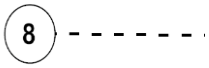
Lettered Cross Section with Regulatory Water Surface Elevation (BFE)



Numbered Cross Section with Regulatory Water Surface Elevation (BFE)



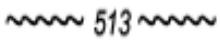
Unlettered Cross Section with Regulatory Water Surface Elevation (BFE)



Coastal Transect

Profile Baseline: Indicates the modeled flow path of a stream and is shown on FIRM panels for all valid studies with profiles or otherwise established base flood elevation.

Coastal Transect Baseline: Used in the coastal flood hazard model to represent the 0.0-foot elevation contour and the starting point for the transect and the measuring point for the coastal mapping.



Base Flood Elevation Line (shown for flooding sources for which no cross sections or profile are available)

ZONE AE
(EL 16)

Static Base Flood Elevation value (shown under zone label)

ZONE AO
(DEPTH 2)

Zone designation with Depth

ZONE AO
(DEPTH 2)
(VEL 15 FPS)

Zone designation with Depth and Velocity

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

Table 4 is a list of the locations where FIRMs for Clark County can be viewed. Please note that the maps at these locations are for reference only and are not for distribution. Also, please note that only the maps for the community listed in the table are available at that particular repository. A user may need to visit another repository to view maps from an adjacent community.

Table 4 – Community Map Repositories

Community	Address	City	State	Zip Code
CITY OF BATTLE GROUND	City Hall 109 Southwest 1st Street	Battle Ground	WA	98604
CITY OF CAMAS	City Hall 616 North East Fourth Avenue	Camas	WA	98607
CLARK COUNTY (UNINCORPORATED AREAS)	Clark County 1300 Franklin Street	Vancouver	WA	98660
LA CENTER, CITY OF	City Hall 214 East Fourth Street	La Center	WA	98629
RIDGEFIELD, CITY OF	City Hall 230 Pioneer Street	Ridgefield	WA	98642
VANCOUVER, CITY OF	City Hall 210 East 13th Street	Vancouver	WA	98668
CITY OF WASHOUGAL	City Hall 1701 C. Street	Washougal	WA	98671
YACOLT, CITY	City Hall 105 East Yacolt Road	Yacolt	WA	98675

2.2 Community Description

Clark County is in southwestern Washington. Adjacent counties are Cowlitz on the north; Skamania on the east; and Multnomah and Columbia Counties, Oregon, on the south and west, respectively. Vancouver, the County seat, is in the southwestern corner of Clark County, and is linked to Portland, Oregon, by the Interstate Highway 5 Bridge over the Columbia River.

Clark County occupies an area of 627 square miles between the Pacific Coast Range on the west and the Cascade Range on the east. The western and southern areas are primarily agricultural lands. The eastern and northern areas of the county are steep, forested foothills and mountains of the Cascade Range.

The soils of the northern and eastern areas are well drained, while those of the western and southern areas are poorly to moderately drained. Most of the development in the county is along the Columbia River. However, there are small areas of development throughout the County. The population of the unincorporated areas of Clark County rose from 345,238 in 2000 to 425,363 in 2010.

The City of Camas is in southeastern Clark County, in southwestern Washington. It is approximately 12 miles east of Portland, Oregon, at the confluence of Columbia and Washougal Rivers. Camas is bordered by the City of Washougal to the east, unincorporated areas of Clark County to the west and north, and Columbia River to the south.

Economic activity in Camas is centered around the Port of Camas- Washougal and the wood-products industry. Commercial development is primarily in the south-central section of Camas. Residential development is spread throughout the city. The only development in the flood plain is a small area just upstream of the mouth of Washougal River. The 2010 census reported a population of 19,395.

Columbia River is the major inland waterway in the Northwestern United States. It drains an area of approximately 241,000 square miles of southwestern Canada and Northwestern United States upstream of Camas. Washougal River drains approximately 168 square miles in Washington. It flows through the eastern part of Camas, in a southerly direction, to its confluence with Columbia River. Lacamas Creek flows from the southern end of Lacamas Lake to its confluence with Washougal River in Camas, and drains an area of approximately 63 square miles. It flows in a southerly direction and forms part of the northern corporate limits of Camas. The unnamed flume flows in a southerly direction from the southern end of Lacamas Lake to a Crown Zellerbach settling reservoir near 12th Avenue. Elevations range from 550 feet in the east to approximately sea level on the banks of Columbia River.

The climate in Camas is characterized by mild, wet winters and warm summers. Mean temperatures range from 38°F in January to 67°F in July. The annual precipitation is more than 40 inches, most of which occurs between October and March.

The City of Vancouver, a fast-growing suburb of Portland, Oregon, is the largest incorporated City in Clark County, with a population of approximately 161, 791 in 2010. The total population of the incorporated areas of Clark County was 425,363 in 2010.

Economic activity centers on industrial products, which include, in order of amount produced, lumber, pulp, paper, aluminum, carborundum, and chemicals. Agriculture is also an important industry, the major products being dairy products, livestock, poultry, vegetables, berries, and orchard fruit. In 1970, 25 percent of the Clark County work force was employed in Oregon.

The Columbia River, which forms the southern and western boundaries of the county, is the major inland waterway in the northwestern United States. It drains an area of approximately 241,000 square miles of southwestern Canada and northwestern United States upstream of Vancouver, Washington.

From its source on the northwestern slopes of Mount Adams, the Lewis River flows southwesterly along the northern boundary of Clark County. It drains 1,046 square miles of rugged, heavily timbered land before joining the Columbia River near Ridgefield. The East Fork Lewis River, with headwaters in the Gifford Pinchot National Forest of Skamania County, drains 212 square miles of mountainous timber land and flows westerly before entering the Lewis River near the City of La Center.

As it flows westerly and southerly into the Columbia River at Camas, the Washougal River drains 168 square miles of steep, forested land. Salmon Creek, a tributary of the Lake River, drains 92 square miles of moderately sloping agricultural land in western Clark County. Many of the small streams of Clark County flow southerly or westerly from sources in steep timberland, pass through lower reaches of gently sloping agricultural land or residential areas, and finally enter the Columbia River.

Clark County has a temperate marine climate typical of western Washington. Summers are dry with mild temperatures, and winters are rainy with occasional snow. At Vancouver, average annual temperatures range from a daily high of 62.1 to a low of 41.8 degrees Fahrenheit (°F) to a mean daily maximum of 80°F in July. Average annual precipitation varies from 39 inches at Vancouver to 75 inches at Yacolt in north central Clark County. More than 65 percent of the annual precipitation occurs from November through March.

Washougal is in southeastern Clark County, in southwestern Washington. It is approximately 12 miles east of Portland, Oregon, near the confluence of Columbia and Washougal Rivers. Washougal is bordered by the City of Camas to the west, Washougal River to the north, unincorporated areas of Clark County to the east, and Columbia River to the south.

Economic activity in Washougal is centered around the woolen industry, the Port of Camas-Washougal, and the lumber industry. Commercial development is primarily within a rectangular area bounded by A, C, 15th, and 24th Streets. Residential development is spread through- out the city. The only development in the flood plain is the small amount of residential development along the northern corporate limits of the city from l0th Street to 28th Street on Washougal River. Washougal's population grew from 8,595 in 2000 to 14,095 in 2010.

Columbia River is the major inland waterway in the Northwestern United States. It drains an area of approximately 241,000 square miles of southwestern Canada and Northwestern United States upstream of Washougal. Washougal River drains approximately 168 square miles in Washington.

The climate *in* the vicinity of Washougal is characterized by mild, wet winters and warm summers. Mean temperatures range from 38°F in January to 67°F in July. The annual precipitation is more than 40 inches, most of which occurs between October and March.

The vegetation in eastern Washougal is forest, and to the north and south, the area is developed. Soil consists of a fine sandy loam that is exceptionally well drained and is underlain by gravelly sand.

2.3 Principal Flood Problems

Although many large Columbia River floods have occurred in Clark County, existing flood control storage will reduce the severity of future floods. The June 1948 and June 1956 floods were typical spring-summer floods caused by snowmelt runoff. Although less significant than the aforementioned floods, the December 1964 flood is noteworthy because it was an unusually large winter flood resulting primarily from rainfall. Peak discharges at the USGS gage at The Dalles, Oregon, for the June 1948 and June 1956 floods were 1,010,000 and 823,000 cubic feet per second (cfs), respectively. Discharges are given for The Dalles (approximately 55 miles upstream of Vancouver) rather than at Clark County because The Dalles is the first gage upstream of the mouth of the Columbia River with a reliable stage-discharge relationship. The discharge of the December 1964 flood is not comparable to the floods of 1948 and 1956 because large inflows occurred downstream of The Dalles. The estimated return periods for the 1948 and 1956 floods were 48 years and 18 years, respectively. The Columbia River floods of 1948 and 1956 caused light damage to residential areas of Clark County. Most of the damage in the unincorporated areas occurred in low lying farm and industrial areas. Emergency flood fighting measures along the Columbia River and temporary evacuation reduced damage.

The largest flood of record on the Lewis River occurred in December 1933. At the USGS gage at Ariel (station no. 14220500), the discharge was 129,000 cfs.

The historical patterns of flooding along Salmon Creek, the East Fork Lewis River, the Washougal River, Burnt Bridge Creek, and Mill Creek are similar. Overbank flooding has been minor on the upper reaches; however, near the confluence with a larger stream, backwater effects produce more frequent overbank flooding.

A combination of intense rainfall and snowmelt caused major East Fork Lewis River floods in January 1972 and December 1977. At the gage near Heisson (River Mile (RM) 20.2), the discharge for both floods was 19,200 cfs with an approximate return interval of the 1- percent-annual-chance flood. These two floods caused minor damage in Clark County.

The largest flood during the 35 years of gaging record on Salmon Creek occurred in December 1977, with a discharge of 2,600 cfs at the gage below Rock Creek at RM 22.1. January 1954 and December 1964 were also major floods on Salmon Creek, with discharges of 1,500 and 1,460 cfs, respectively. Those floods caused only minor damage.

The only major floods on Burnt Bridge Creek have been caused by Columbia River backwater. Although it is not large for the size of the area drained, the highest flow observed on Burnt Bridge Creek was 176 cfs in December 1955. Minor flood damage was observed in adjacent unincorporated areas.

The largest flood along the Washougal River, since a USGS stream gage was established in 1944, 6 miles upstream of the City of Washougal, occurred in December 1977. The flood was an extremely rare event, greater that a 0.2-percent-annual-chance flood at the gage site, and had an estimated peak discharge of 40,400 cfs at the gage. Because there was little overbank flooding and limited development outside of the Cities of Camas and Washougal along the river, only minor damage occurred. Other large floods along the Washougal River occurred in January 1972 and December 1964, with return periods of 18 years and 9 years and peak discharges of 27,700 cfs and 25,100 cfs, respectively. Records of past floods on the remaining flooding sources in Clark County are not well documented, but past floods have caused only minor damage.

2.4 Flood Protection Measures

Levees exist in the study areas that provide the county with some degree of protection against flooding. However, it has been ascertained that some of these levees may not protect the community from rare events such as the 1-percent-annual-chance flood. The criteria used to evaluate protection against the 1-percent-annual-chance flood are 1) adequate design, including freeboard, 2) structural stability, and 3) proper operation and maintenance. Levees that do not protect against the 1-pecent-annual-chance flood are not considered in the hydraulic analysis of the 1-percent-annual-chance floodplain.

The Port of Camas Washougal Levee provides 1-percent –annual –chance flood protection from overflow of the Columbia River in the Incorporated Areas of Clark County, Washington.

Other levees may exist within Clark County. Levees not identified in this section are not known to have the necessary features to provide protection from a flood with a 1-percent chance of annual occurrence.

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 10-, 50-, 100-, or 500-year period (recurrence interval) have been selected as having special significance for floodplain management and for flood insurance rates. These events, commonly termed the 10-, 50-, 100-, and 500-year floods, have a 10-, 2-, 1-, and 0.2-percent 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 (100-year) 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.

Although the recurrence interval represents the long-term, average period between floods of a specific magnitude, rare floods could occur at short intervals or even within the same year. The risk of experiencing a rare flood increases when periods greater than 1 year are considered. For example, the risk of having a flood that equals or exceeds the 100-year flood (1-percent chance of annual exceedance) during the term of a 30-year mortgage is approximately 26 percent (about 3 in 10); for any 90-year period, the risk increases to approximately 60 percent (6 in 10).The analyses reported herein reflect flooding potentials based on conditions existing in the community at the time of completion of this study. Maps and flood elevations will be amended periodically to reflect future changes.

The engineering analyses described here incorporate the results of previously issued Letters of Map Change (LOMCs) listed in Table 3, "Initial Countywide Letters of Map Change", which include Letters of Map Revision (LOMRs). For more information about LOMRs, refer to Section 2.0, "FIRM Revisions."

3.1 Hydrologic Analyses

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

September 5, 2012
The Initial Countywide FIS Report

The stage discharge relationship on the Columbia River is influenced by ocean tides and Willamette River backwater; thus, flood frequencies are more reliably determined for river stages than for discharges. Stage-frequency curves for seven locations on the Columbia River between RM 50 and RM 123 were developed using existing for fall-winter, and spring-summer flood seasons. Those locations include USGS gage No. 14144700 on the Columbia River at Vancouver, Washington, and USGS gage No. 1421172 on Willamette River at the Morrison Street Bridge. Both gages were established in 1876.

The fall and winter curves and spring and summer curves at each location were combined by statistical methods to obtain combined stage-frequency curves. Those stage-frequency curves are the basis for the Columbia River flood profiles presented in this study.

The discharges used in floodway computations for the Columbia River were correlated, based on data at USGS gage No. 14105700 (established in 1857) at The Dalles, Washington to yield water-surface profiles similar to those prepared using the combined stage-frequency curves.

The Lewis River stream gage records were statistically analyzed using the standard Log-Pearson Type III distribution, as outlined by the U.S. Water Resources Council Natural and regulated discharge-frequency curves were developed for the USGS gages at Ariel and Amboy, using data from 1912 to 1978. Peak annual flows used in deriving the natural discharge-frequency curve were calculated by combining observed flows at the gage and by correlating with flow information for adjacent gaging stations in the Lewis River basin and working downstream to Merwin Dam. The regulated discharge-frequency relationship was developed by comparison of natural versus regulated discharges for six flood events in the basin. The regulated discharges for these floods were based on the PP&L plan of flood control operation, considering 70,000 acre-feet of flood control storage at Merwin Dam.

The following streams and respective periods of USGS gaging records were analyzed in the same manner as the Lewis River, the Washougal River, from 1944 to 1978; and the East Fork Lewis River, from 1929 to 1974.

Lake River and Vancouver Lake are submerged by the Columbia River during large floods; therefore, the hydrologic analysis of the Columbia River includes the Lake River and Vancouver Lake.

Stream gage records were not available for the Gee Creek basin (Gee Creek and Unnamed Tributary to Gee Creek). Rain gage recordings were used to estimate precipitation frequencies for selected recurrence intervals used in this study.

The USACE HEC-l flood hydrograph computer program was then used to develop peak discharges.

Burnt Bridge Creek discharge-frequency data were based on records from the USGS crest stage gage at RM 2.9 and on an analysis of rainfall and runoff characteristics of Burnt Bridge Creek basin and the general region.

A discharge-frequency curve was developed for Cedar Creek basin using 21 years of recorded data at the USGS gage on Cedar Creek near Ariel and discharges obtained using the regional method presented in Procedure for Determination of Maximum Annual Flood Peak and Volume Frequencies for Portland District. That report utilizes multiple regression analysis to determine discharges of an ungaged basin for selected recurrence intervals using the drainage area and normal annual precipitation. Cedar Creek basin includes Cedar Creek, Chelatchie Creek, and Unnamed Tributary to Chelatchie Creek.

Flood flow frequencies for Salmon Creek, Curtin Creek, Mill Creek, Weaver Creek and Morgan Creek were based on a statistical analysis of the results of a long-term simulation using the Hydrological Simulation Program Fortran (HSPF) computer program. The HSPF program is a continuous rainfall-runoff watershed model. Continuous simulation of multiple years to several decades allows the watershed to be evaluated under a variety of flow conditions ranging from low summer base flows to periods of winter flooding. In particular, continuous modeling allows simulation of floods in response to a wide variety of individual storm characteristics and sequence of storm events. The development of the HSPF model for the Salmon Creek watershed is documented in Hydrologic Analysis of Salmon Creek Watershed using the HSPF Model. The model results at various locations within the watershed were analyzed in accordance with criteria outlined in *Bulletin 17B* (Interagency Advisory Committee on Water Data, 1982). Discharge-frequency data were computed using the HEC-FFA computer program (HEC, 1992) developed by the Hydrologic Engineering Center of the USACE, using a systematic record of 61 years.

A discharge-frequency curve was developed for Spring Branch Creek, Mud Creek, Whipple Creek, and China Ditch using the regional method presented in Magnitude and Frequency of Floods in Washington. That report utilizes multiple regression analyses to determine discharges of an ungaged basin for selected recurrence intervals using drainage area and normal annual precipitation data.
The discharge-frequency data for the Little Washougal River, Fifth Plain Creek, and Lacamas Creek and Lake were also determined using the regional method.
Peak discharge-drainage area relationships for the streams studied by detailed methods in Clark County are shown in Table 5, "Summary of Discharges".

This Physical Map Revision

The drainage areas were delineated using automated GIS routines and a 30-meter cell size Digital Elevation Model (DEM) obtained from National Elevation Dataset (NED) (USGS, 2011a) as well as the National Hydrography Dataset (USGS, 2011b).

The Washougal watershed drainage area varied significantly from the drainage area reported in the effective FIS. The drainage area delineated for the current study was verified using Hydrologic Unit Codes to the 6th level (12 digit, commonly known as HUC-12), obtained from the Watershed Boundary Dataset (OBL, 2008). The actual delineations from the effective FIS were not available for comparison.

The Washougal River gage station is included in the regression report for Washington (USGS, 1997). In this report, weighted discharges are provided. No additional gage records have been taken since the report was published. The report did not, however, include data for the 0.2-percent-annual-chance event. The 0.2-percent-annual-chance discharge was determined by using a log-probability plot.

A summary of the drainage area-peak discharge relationships for the streams studied by detailed methods is shown in Table 5 "Summary of Discharges".

Table 5 – Summary of Discharges

FLOODING SOURCE AND LOCATION	DRAINAGE AREA (SQ. MILES)	PEAK DISCHARGES (cfs) 10%-ANNUAL-CHANCE	2%-ANNUAL-CHANCE	1%-ANNUAL-CHANCE	0.2%-ANNUAL-CHANCE
Burnt Bridge Creek					
At mouth	22	115	220	255	330
At USGS Gage	20	120	230	270	340
At N.E. 112th Avenue	5.0	55	110	135	180
China Ditch					
At mouth	9.0	495	665	740	915
Curtin Creek					
At mouth	11.0	335	460	520	670
At NE 109th Street	5.0	225	360	405	530
At NE 83rd Street	1.0	60	85	95	130

Table 5 – Summary of Discharges (Continued)
PEAK DISCHARGES (cfs)

FLOODING SOURCE AND LOCATION	DRAINAGE AREA (SQ. MILES)	10%-ANNUAL-CHANCE	2%-ANNUAL-CHANCE	1%-ANNUAL-CHANCE	0.2%-ANNUAL-CHANCE
East Fork Lewis River					
At mouth	212.0	19,200	24,400	26,900	32,000
Upstream of confluence with Lockwood Creek	185.0	17,000	21,700	23,800	28,300
Approximately 17,000feet downstream of Daybreak Road	165.0	20,650	28,630	32, 200	40,900
At Daybreak Road	152.0	18,600	26,050	29,300	37,210
At Lewisville Park	150.0	15,300	19,400	21,400	25,400
Fifth Plain Creek					
At mouth	20.0	1,280	1,750	1,960	2,460
Upstream of China Ditch	9.0	650	895	1,000	1,260
Upstream of Shanghai Creek	5.0	360	495	555	700
At 119th Street	3.0	225	315	350	445
Gee Creek					
At Burlington Northern Railroad	13	850	1,010	1,080	1,260
At County Road	9	580	695	745	870
Lacamas Creek					
At Goodwin Road	53.0	4,170	5,740	6,430	8,080
At Fourth Plain Road	23	1,990	2,740	3,060	3,850

Table 5 – Summary of Discharges (Continued)
PEAK DISCHARGES (cfs)

FLOODING SOURCE AND LOCATION	DRAINAGE AREA (SQ. MILES)	10%-ANNUAL-CHANCE	2%-ANNUAL-CHANCE	1%-ANNUAL-CHANCE	0.2%-ANNUAL-CHANCE
Lewis River					
At mouth	1046	75,000[1]	114,000[1]	132,700[1]	181,000[1]
At Woodland	820	54,400[1]	86,300[1]	102,000[1]	142,000[1]
At USGS Gage near Ariel	731	49,000[1]	79,000[1]	94,000[1]	132,000[1]
Mill Creek					
At mouth	12	670	985	1,140	1,570
Downstream of Unnamed Tributary (RM 0.85)	11.0	595	865	1,000	1,370
Upstream of Unnamed Tributary (RM 0.85)	9.0	510	780	915	1,300
At confluence with (RM 3.12)	7.0	285	585	685	975
At NE 199th Street	5.0	290	415	480	655
Packard Creek					
At mouth	2.0	135	180	200	250
Upstream of Unnamed Tributary (RM 1.0)	1.0	43	58	64	79
Padden Creek					
At confluence with Curtin Creek	1.0	39	45	48	53
Downstream of NE 76th Street	1.0	21[2]	21[2]	22[2]	22[2]
At Interstate 205	0.7	43	57	64	79
Salmon Creek					
At mouth	88.0	3,230	4,460	5,020	6,490
At County Gage SMN020, Klineline Park	80.0	2,970	4,100	4,620	5,970

Table 5 – Summary of Discharges (Continued)

FLOODING SOURCE AND LOCATION	DRAINAGE AREA (SQ. MILES)	PEAK DISCHARGES (cfs) 10%-ANNUAL-CHANCE	2%-ANNUAL-CHANCE	1%-ANNUAL-CHANCE	0.2%-ANNUAL-CHANCE
Below Mill Creek	72.0	2,710	3,730	4,210	5,430
Downstream of Confluence with Curtin Creek	60.0	2,330	3,250	3,700	4,860
Salmon Creek (Continued)					
At County Gage SMN045, NE 156th Street	45.0	1,960	2,740	3,110	4,090
Downstream of Confluence with Morgan Creek	31.0	1,290	1,920	2,240	3,140
At County Gage S-01, Battle Ground, WA	18.0	1,130	1,770	2,110	3,120
Spring Branch Creek					
At mouth	2.0	105	140	155	190
Unnamed Tributary to Gee Creek					
At mouth	2.0	85	100	105	125
Washougal River					
At Mouth	211	39,522	51,453	56,672	68,976
At Camas	146	28,063	36,534	40,241	48,977
At 3rd Street	146	27,971	36,416	40,110	48,818
At Route 140	144	27,703	36,066	39,725	48,350
Just Upstream of Little Washougal River	117	22,838	29,733	32,749	39,859
At Gage	107	21,017	27,362	30,138	36,681
Upstream of Unnamed Tributary (RM 3.45)	4.0	225	330	385	535
At NE 167th Ave	2.0	85	125	150	205

Table 5 – Summary of Discharges (Continued)
PEAK DISCHARGES (cfs)

FLOODING SOURCE AND LOCATION	DRAINAGE AREA (SQ. MILES)	10%-ANNUAL-CHANCE	2%-ANNUAL-CHANCE	1%-ANNUAL-CHANCE	0.2%-ANNUAL-CHANCE
Whipple Creek					
At mouth	11.0	510	685	755	925
Upstream of Unnamed Tributary (RM 1.19)	10.0	450	600	665	815
Upstream of Packard Creek (RM 2.47)	6.0	320	430	475	580
Upstream of NE 157th Ave (RM 4.53)	5.0	240	320	355	435
Whipple Creek (Continued)					
Upstream of Interstate 5 Freeway (RM 6.45)	2.0	115	150	170	210
Upstream of NE 179th Street (RM 7.74)	1.0	55	75	85	110
At mouth	168	29,800	39,000	43,000	51,900
At USGS Gage (RM 9.2)	108	21,500	28,400	31,300	38,000
Weaver Creek					
At mouth	7.0	350	495	565	755
At NE 199th Street	6.0	310	440	500	665
Upstream of Unnamed Tributary (RM 3.45)	4.0	225	330	385	535
At NE 167th Ave	2.0	85	125	150	205
Whipple Creek					
At mouth	11.0	510	685	755	925
Upstream of					

Table 5 – Summary of Discharges (Continued)
PEAK DISCHARGES (cfs)

FLOODING SOURCE AND LOCATION	DRAINAGE AREA (SQ. MILES)	10%-ANNUAL-CHANCE	2%-ANNUAL-CHANCE	1%-ANNUAL-CHANCE	0.2%-ANNUAL-CHANCE
Whipple Creek					
Unnamed Tributary (RM 1.19)	10.0	450	600	665	815
Upstream of Packard Creek (RM 2.47)	6.0	320	430	475	580
Upstream of NE 157th Ave (RM 4.53)	5.0	240	320	355	435
Upstream of Interstate 5 Freeway (RM 6.45)	2.0	115	150	170	210
Upstream of NE 179th Street (RM 7.74)	1.0	55	75	85	110

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 FIRM represent rounded whole-foot elevations and may not exactly reflect the elevations shown on the Flood Profiles or in the Floodway Data Table 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 report in conjunction with the data shown on the FIRM.

September 05, 2012
The Initial Countywide FIS Report

For the Lewis River, the East Fork Lewis River, Burnt Bridge Creek, the Washougal River, and an Unnamed Tributary to Gee Creek, water surface elevations (WSELs) of floods of the selected recurrence intervals were computed through use of the USACE HEC-2 step backwater computer program.

For the Columbia River, the HEC-2 program was only used for the floodway determination. Flood profiles were derived directly from the combined stage-frequency curves described in Section 3.1. The starting WSELs for the HEC-2 analyses were calculated using the slope-area method for Unnamed Tributary to Gee Creek, Burnt Bridge Creek, and the Washougal River. The Lewis River starting WSELs were selected to correspond with estimated Columbia River elevations at the time the Lewis River peaks. The East Fork Lewis River starting WSELs were based on the Lewis River elevations at their confluence.

Cross sections for the Columbia River were based on several sources of data: a USACE condition survey in June 1977 was used for the underwater portion; a USACE topographical survey of Columbia River and USGS topographic maps were used for the above-water portions.

Cross sections for original Burnt Bridge Creek study were obtained from City of Vancouver topographic maps, dated 1974. The underwater sections were obtained by field measurements.

Cross sections for the backwater analysis of the Lewis River, the East Fork Lewis River, an Unnamed Tributary to Gee Creek, and Washougal River were taken from field surveys and topographic maps.

For Salmon Creek, Curtin Creek, Mill Creek, Weaver Creek, China Ditch, Spring Branch Creek, Whipple Creek, Gee Creek, Packard Creek, Padden Creek, Fifth Plain Creek, Lacamas Creek, and the additional study upstream of the previous study area of Burnt Bridge Creek, WSELs of floods of the selected recurrence intervals were computed through use of the HEC-RAS step-backwater computer program, Version 3.1.2.

Starting WSELs for Salmon Creek, Curtin Creek, Mill Creek, Weaver Creek, China Ditch, Spring Branch Creek, Whipple Creek, Gee Creek, Packard Creek, and Fifth Plain Creek, were based on normal depth. Starting WSELs for Lacamas Creek above Lacamas Lake were based on Lacamas Lake WSELs. Starting WSELs for Burnt Bridge Creek were based on WSEL reported in the previous FIS for Clark County.

Cross sections for the backwater analyses were obtained from topographic maps compiled from aerial photographs, and LiDAR data. Below water sections were obtained by field surveys. All bridges and culverts were surveyed to obtain elevation data and structural geometry.

Channel roughness factors (Manning's "n") used in the hydraulic computations were chosen by engineering judgment and based on field observations of the stream and floodplain areas.

This Physical Map Revision

WSELs of the 10-, 4-, 2-, 1-, and 0.2-percent-annual-chance floods for Washougal River in Clark County were estimated using the USACE HEC-RAS 4.1.0 computer program (HEC, 2010). Cross sectional geometries for the detailed analysis of these streams were comprised of field-run survey data and a digital terrain model (DTM) generated from LiDAR data collected by the DOGAMI in 2011 (DOGAMI, 2011). Topography for the upper portion of Washougal River was based on LiDAR from 2002 (Clark, 2002). Surveyed channel sections were transferred upstream and downstream to LiDAR-generated cross sections and were blended with LiDAR data to create a consistent channel profile. Floodway encroachment stations were established, first using Method 4. The Method 4 encroachment stations were imported and the method 1 encroachment analysis was then executed to create the final floodway.

Roughness coefficients are provided in Table 6. Roughness coefficients are values representing the frictional resistance water experiences when passing overland or through a channel. They are used in the calculations to determine water surface elevations. Greater detail (including assumptions, analysis, and results) is available in the archived project documentation.

Manning's Roughness were determined based on surface conditions in the channel and on the overbanks based on site visit, aerial photography and photographs. Manning's roughness used in the modeling is summarized in Table 6.

Table 6 – Roughness Coefficients Manning's "n" Values

STREAM	CHANNEL "n"	OVERBANK "n"
Burnt Bridge Creek From City of Vancouver corporate limits to approximately 0.22 mile upstream of Northeast 152nd Avenue	0.024 to 0.07	0.045 to 0.12
From downstream face of I-205 culvert to approximately 1 mile upstream of Northeast 137th Avenue	0.04 to 0.050	0.050 to 0.120
China Ditch	0.035 to 0.040	0.030 to 0.060
Curtin Creek	0.038 to 0.065	0.040 to 0.100
East Fork Lewis River	0.032 to 0.070	0.020 to 0.107
Fifth Plain Creek	0.040 to 0.060	0.037 to 0.120

Table 6 – Roughness Coefficients Manning's "n" Values (Continued)

STREAM	CHANNEL "n"	OVERBANK "n"
Gee Creek	0.045 to 0.080	0.050 to 0.120
Lacamas Creek	0.045 to 0.055	0.050 to 0.150
Lewis River	0.032 to 0.047	0.058 to 0.100
Mill Creek	0.040 to 0.080	0.035 to 0.100
Packard Creek	0.050 to 0.080	0.050 to 0.120
Padden Creek	0.040 to 0.060	0.040 to 0.070
Salmon Creek	0.040 to 0.070	0.055 to 0.150
Spring Branch Creek	0.045 to 0.060	0.050 to 0.100
Unnamed Tributary to Gee Creek	0.050	0.080 to 0.120
Washougal River	0.035 to 0.005	0.05 to 0.12
Weaver Creek	0.040 to 0.090	0.040 to 0.100
Whipple Creek	0.050 to 0.120	0.050 to 0.150

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).

The profile baselines depicted on the FIRM represent the hydraulic modeling baselines that match the flood profiles on this FIS report. As a result of improved topographic data, the profile baseline, in some cases, may deviate significantly from the channel centerline or appear outside the Special Flood Hazard Area.

The hydraulic analyses for this study were based on unobstructed flow. The flood elevations shown on the Flood Profiles (Exhibit 1) 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 in use for newly created or revised FIS reports and FIRMs was NGVD. With the finalization of NAVD, many FIS reports and FIRMs are being prepared using NAVD as the referenced vertical datum.

Flood elevations shown in this FIS Report and on the FIRMs are referenced to NAVD88. These flood elevations must be compared to structure and ground elevations referenced to the same vertical datum.

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

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

For additional information regarding conversion between NGVD and NAVD, visit the NGS website at www.ngs.noaa.gov, or contact the NGS at the following address:

Vertical Network Branch, N/CG13
National Geodetic Survey, NOAA
Silver Spring Metro Center 3
1315 East-West Highway
Silver Spring, Maryland 20910
(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 the 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.

Table 7 – Vertical Datum Conversions

Quadrangle Name	Quadrangle Corner	Latitude	Longitude	Conversion from NGVD29 to NAVD88 (feet)
Camas	NE	45.625	-122.375	3.432
Washougal	NE	45.625	-122.250	3.447

Average Conversion from NGVD29 to NAVD88 = 3.439 (FEET)

4.0 FLOODPLAIN MANAGEMENT APPLICATIONS

The NFIP encourages State and local governments to adopt sound floodplain management programs. Therefore, each FIS provides 1-percent-annual-chance (100-year) flood elevations and delineations of the 1- and 0.2-percent-annual-chance (500-year) floodplain boundaries and 1-percent-annual-chance floodway to assist communities in developing floodplain management measures. This information is presented on the FIRM and in many components of the FIS report, including Flood Profiles, Floodway Data Table, and Summary of Stillwater Elevations Table. Users should reference the data presented in the FIS report as well as additional information that may be available at the local 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 cross sections, the boundaries were interpolated using topographic maps at a scale of 1:24,000, with a contour interval of 2 feet.

Each flooding source included in the project scope has been studied and mapped using professional engineering and mapping methodologies that were agreed upon by FEMA, DOGAMI, and Clark County as appropriate to the risk level. Flood risk is evaluated based on factors such as known flood hazards and projected impact on the built environment. Engineering analyses were performed for each studied flooding source to calculate its 1% annual chance flood elevations; elevations corresponding to other floods (e.g. 10-, 4-, 2-, 0.2-percent annual chance, etc.) may have also been computed for certain flooding sources.

Engineering models and methods are described in detail in Section 5.0 of this FIS Report. The modeled elevations at cross sections were used to delineate the floodplain boundaries on the FIRM; between cross sections, the boundaries were interpolated using elevation data from various sources. More information on specific mapping methods is provided in Section 6.0 of this FIS Report.

Depending on the accuracy of available topographic data, study methodologies employed (Section 5.0), and flood risk, certain flooding sources may be mapped to show both the 1% and 0.2% annual chance floodplain boundaries, regulatory water surface elevations (BFEs), and/or a regulatory floodway. Similarly, other flooding sources may be mapped to show only the 1% annual chance floodplain boundary on the FIRM, without published water surface elevations. In cases where the 1% and 0.2% annual chance floodplain boundaries are close together, only the 1% annual chance floodplain boundary is shown on the FIRM, "Map Legend for FIRM", describes the flood zones that are used on the FIRMs to account for the varying levels of flood risk that exist along flooding sources within the project area indicate the flood zone designations for each flooding source and each community within the Lower Columbia-Sandy sub-basin (HUC-8 #17080001), respectively.

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

Small areas within the floodplain boundaries may lie above the flood elevations but cannot be shown due to limitations of the map scale and/or lack of detailed topographic data.

The 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, AH, and the 0.2-percent-annual-chance floodplain boundary corresponds to the boundary of areas of moderate flood hazards. 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 boundary is shown on the FIRM (Exhibit 2).

4.2 Floodways

Encroachment on floodplains, such as structures and fill, reduces flood-carrying capacity, increases flood heights and velocities, and increases flood hazards in areas beyond the encroachment itself. One aspect of floodplain management involves balancing the economic gain from floodplain development against the resulting increase in flood hazard. For purposes of the NFIP, a floodway is used as a tool to assist local communities in 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 FIS report and on the FIRM were computed for certain stream segments on the basis of equal-conveyance reduction from each side of the floodplain. Floodway widths were computed at cross sections. Between cross sections, the floodway boundaries were interpolated. The results of the floodway computations have been tabulated for selected cross sections (Table 8). In cases where the floodway and 1-percent-annual-chance floodplain boundaries are either close together or collinear, only the floodway boundary has been shown.

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)
S	121	*	*	*	35.0	*	*	*
T	123	*	*	*	35.2	*	*	*
U	123	*	*	*	35.4	*	*	*
V	124	*	*	*	35.5	*	*	*
W	126	*	*	*	35.7	*	*	*
X	127	*	*	*	35.9	*	*	*

[1]Stream Distance In Miles Above Confluence With Pacific Ocean

TABLE 8

FEDERAL EMERGENCY MANAGEMENT AGENCY

CLARK COUNTY, WA
AND INCORPORATED AREAS

FLOODWAY DATA

FLOODING SOURCE: COLUMBIA 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)
A	0	39	386	13.3	35.0	35.0	35.9	0.9
B	0	45	638	8.0	42.0	42.0	43.0	1.0
C	0	150	3,926	2.4	43.5	43.5	44.3	0.7
D	0	180	4,263	2.1	43.5	43.5	44.4	0.9
E	0	240	5,075	1.8	43.5	43.5	44.4	0.9
F	0	145	2,863	2.8	43.5	43.5	44.4	0.9
G	0	80	1,417	4.4	43.6	43.6	44.5	0.9
H	1	65	844	7.7	44.1	44.1	45.0	0.9
I	1	64	522	11.5	50.4	50.4	51.3	0.9
J	1	113	608	10.1	99.9	99.9	99.9	0.0
K	1	76	525	11.0	104.5	104.5	104.5	0.0
L	1	61	486	10.4	115.5	115.5	116.0	0.5
M	1	63	547	9.2	116.8	116.8	117.4	0.6
N	1	40	513	13.0	125.1	125.1	125.8	0.7
O	1	54	677	9.3	132.8	132.8	133.5	0.7
P	1	55	351	14.4	149.0	149.0	149.4	0.4
Q	1	56	718	11.2	158.8	158.8	159.8	1.0
R	1	51	696	11.7	160.4	160.4	161.2	0.8
S	1	45	671	11.1	163.5	163.5	164.2	0.7

[1]Stream Distance In Miles Above Confluence With The Washougal River

TABLE 8

FEDERAL EMERGENCY MANAGEMENT AGENCY

CLARK COUNTY, WA
AND INCORPORATED AREAS

FLOODWAY DATA

FLOODING SOURCE: COLUMBIA 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)[2]	WITHOUT FLOODWAY (FEET NAVD)	WITH FLOODWAY (FEET NAVD)	INCREASE (FEET)
A	211	588	0	7.7	35.0	17.3	18.3	1.0
B	1,901	1,002	0	5.1	35.0	19.6	20.1	0.5
C	2,453	357	4,241	13.4	35.0	19.8	20.4	0.6
D	2,734	674	8,922	8.3	35.0	25.8	25.8	0.0
E	2,944	1,315	16,411	6.1	35.0	26.6	26.6	0.0
F	5,496	514	5,657	7.3	35.0	28.4	28.5	0.1
G	6,594	450	5,625	7.2	35.0	29.6	30.1	0.5
H	8,066	355	4,972	8.1	35.0	31.2	32.1	0.9
I	9,098	374	4,693	8.6	35.0	32.8	33.5	0.7
J	10,067	213	3,327	12.1	35.0	34.2	34.6	0.4
K	10,228	189	3,209	12.5	35.0	34.9	35.2	0.3
L	11,107	366	5,519	7.3	38.4	38.4	38.5	0.1
M	12,219	220	3,293	12.2	39.1	39.1	39.5	0.4
N	13,347	198	3,365	11.9	43.0	43.0	43.3	0.3
O	14,341	252	4,465	9.0	46.1	46.2	46.9	0.7
P	15,508	161	3,142	12.6	48.1	48.1	48.8	0.7
Q	15,894	212	4,335	9.2	50.8	50.8	51.2	0.4
R	16,911	295	4,356	9.1	52.4	52.4	52.7	0.3
S	18,019	250	3,542	11.2	54.4	54.4	55.4	1.0
T	18,899	187	2,825	14.1	56.9	56.9	57.6	0.7
U	20,001	450	3,797	10.5	60.5	60.5	61.4	0.9

[1]Stream Distance In Feet Above Confluence With Columbia River

[2]Elevation Was Computed Without Consideration of Backwater From Columbia River

TABLE 8

FEDERAL EMERGENCY MANAGEMENT AGENCY

CLARK COUNTY, WA

AND INCORPORATED AREAS

FLOODWAY DATA

FLOODING SOURCE: WASHOUGAL 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)
V	20,407	290	3,016	13.2	61.2	61.2	62.2	1.0
W	21,196	291	3,473	11.4	65.0	65.0	65.9	0.9
X	22,159	172	2,966	13.4	68.5	68.5	69.5	1.0
Y	23,506	192	3,416	11.6	76.2	76.2	76.5	0.3
Z	24,086	203	3,821	10.4	78.4	78.4	78.6	0.2
AA	24,774	217	3,341	11.9	80.1	80.1	80.3	0.2
AB	25,768	177	3,265	12.2	83.9	83.9	84.0	0.1
AC	26,696	191	4,269	9.3	86.9	86.9	87.1	0.2
AD	27,423	185	2,980	13.3	87.6	87.6	87.9	0.3
AE	28,634	190	3,407	11.7	93.0	93.0	93.1	0.1
AF	29,546	212	3,190	12.5	96.2	96.2	96.3	0.1
AG	30,653	207	3,178	10.3	101.1	101.1	101.2	0.1
AH	31,618	221	3,420	9.6	104.0	104.0	104.2	0.2
AI	32,661	180	2,533	12.9	107.1	107.1	107.4	0.3
AJ	33,669	153	2,728	12.0	112.5	112.5	112.8	0.3
AK	34,685	198	3,086	10.6	117.0	117.0	117.2	0.2
AL	35,705	185	2,797	11.7	120.8	120.8	121.0	0.2
AM	36,723	180	2,655	12.3	125.6	125.6	125.7	0.1
AN	37,729	158	2,525	13.0	130.7	130.7	130.8	0.1
AO	38,545	186	3,280	10.0	134.8	134.8	134.9	0.1
AP	39,210	154	2,363	13.9	136.4	136.4	136.6	0.2

[1]Stream Distance In Feet Above Confluence With Columbia River

TABLE 8

FEDERAL EMERGENCY MANAGEMENT AGENCY

CLARK COUNTY, WA
AND INCORPORATED AREAS

FLOODWAY DATA

FLOODING SOURCE: WASHOUGAL 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)
AQ	39,720	225	3,295	9.9	140.3	140.3	140.4	0.1
AR	40,761	143	2,143	15.3	143.9	143.9	144.1	0.2
AS	42,762	202	3,329	9.8	157.2	157.2	157.5	0.3
AT	43,751	147	1,882	17.4	161.4	161.4	161.8	0.4
AU	44,785	89	1,771	18.5	169.3	169.3	169.8	0.5
AV	45,439	130	2,239	13.5	182.0	182.0	182.0	0.0
AW	46,178	188	2,793	10.8	186.4	186.4	186.5	0.1
AX	46,878	177	2,849	10.6	188.9	188.9	189.0	0.1
AY	47,858	201	3,196	9.4	192.0	192.0	192.1	0.1
AZ	48,912	172	2,660	11.3	194.7	194.7	194.9	0.2
BA	49,873	210	2,935	10.3	198.4	198.4	198.7	0.3

[1] Stream Distance In Feet Above Confluence With Columbia River

TABLE 8

FEDERAL EMERGENCY MANAGEMENT AGENCY

CLARK COUNTY, WA
AND INCORPORATED AREAS

FLOODWAY DATA

FLOODING SOURCE: WASHOUGAL RIVER

The area between the floodway and 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 water surface elevation WSEL of the 1-percent-annual-chance flood more than 1 foot at any point. Typical relationships between the floodway and the floodway fringe and their significance to floodplain development are shown in Figure 3.

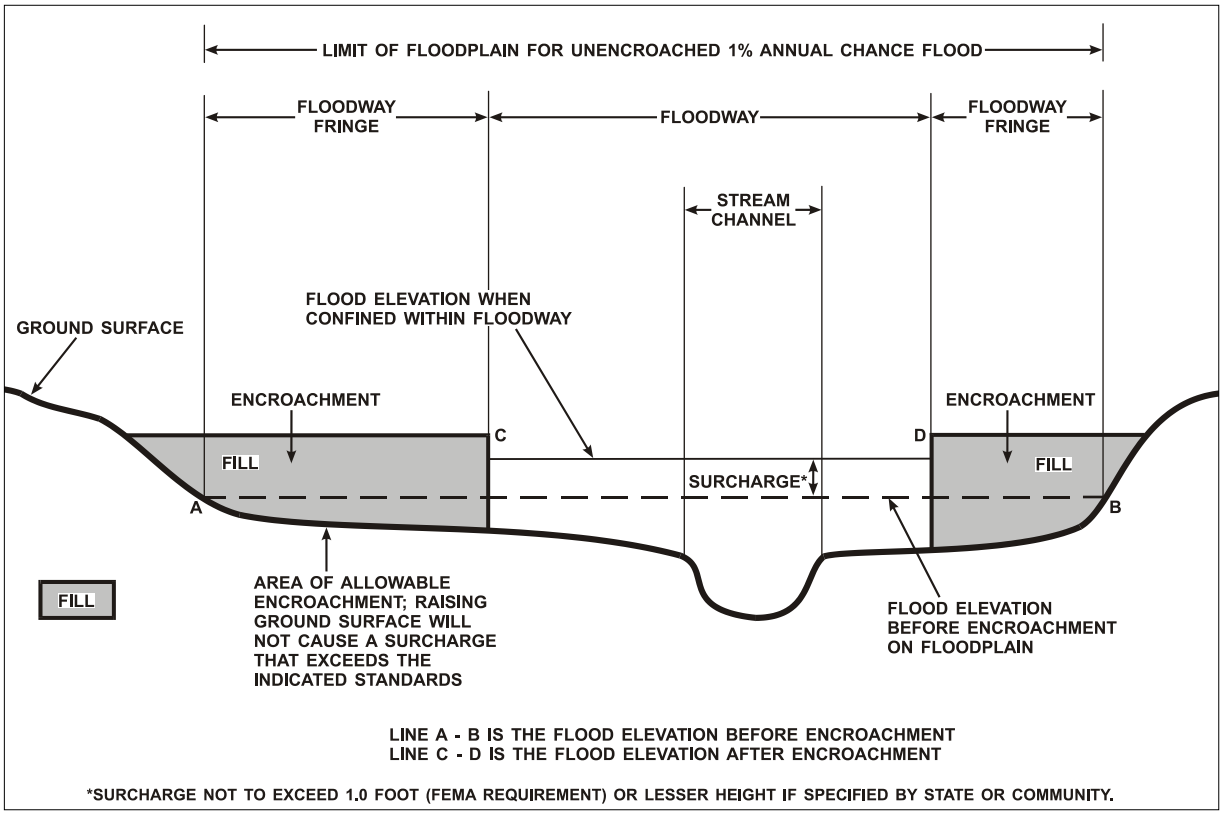


Figure 3 - Floodway Schematic

5.0 INSURANCE APPLICATIONS

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 risk zone that corresponds to the 1-percent-annual-chance floodplains that are determined in the FIS by approximate methods. Because detailed hydraulic analyses are not performed for such areas, no BFEs or base flood depths are shown within this zone.

Zone AE

Zone AE is the flood insurance risk zone that corresponds to the 1-percent-annual-chance floodplains that are determined in the FIS by detailed methods. In most instances, 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 risk 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 BFEs derived from the detailed hydraulic analyses are shown at selected intervals within this zone.

Zone X

Zone X is the flood insurance risk 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, and areas protected from the 1-percent-annual-chance flood by levees. No BFEs or base flood depths are shown within this zone.

Zone D

Zone D is the flood insurance risk zone that corresponds to unstudied areas where flood hazards are undetermined, but possible.

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 risk 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 the zones and BFEs 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 Clark 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 that was presented separately on Flood Boundary and Floodway Maps, where applicable. Historical data relating to the maps prepared for each community are presented in Table 9.

COMMUNITY NAME	INITIAL IDENTIFICATION	FLOOD HAZARD BOUNDARY MAP REVISION DATE	FIRM EFFECTIVE DATE	FIRM REVISION DATE
Battle Ground, City of	May 24, 1974	December 26, 1975	April 15, 1981	None
Camas, City of	June 14, 1974	June 11, 1976	February 18, 1981	None
Clark County (Unincorporated Areas)	September 6, 1974	June 7, 1977	August 2, 1982	July 19, 2000 August 19, 1986 May 2, 1991
La Center, City of	November 12, 1976	None	September 29, 1986	
Ridgefield, City of	January 24, 1975	None	May 19, 1981	
Vancouver, City of	August 2, 1974	November 14, 1975	August 17, 1981	
Washougal, City of	March 15, 1974	August 6, 1976	March 2, 1981	May 17, 1982
Yocolt, Town of	July 2, 1976	None	None	

TABLE 9

FEDERAL EMERGENCY MANAGEMENT AGENCY

CLARK COUNTY, WA AND INCORPORATED AREAS

COMMUNITY MAP HISTORY

Table 10: Listing of NFIP Jurisdictions

Community	CID	HUC-8 Sub-Basin(s)	Located on FIRM Panel(s)
City of Camas City of Camas	530026	17080001, 17090012	53011C0531D, 53011C0532E, 53011C0533D, 53011C0534E, 53011C0553E
Clark County Clark County	530024	17080001, 17080002, 17090012	53011C0416D, 53011C0417D, 53011C0418D, 53011C0419E, 53011C0436D, 53011C0437E, 53011C0438E, 53011C0439E, 53011C0450D, 53011C0470E, 53011C0475D, 53011C0531D, 53011C0532E, 53011C0534E, 53011C0553E, 53011C0554E, 53011C0555E, 53011C0560E, 53011C0562E, 53011C0570E, 53011C0600D
City of Washougal	530028	17080001	53011C0532E, 53011C0534E, 53011C0553E, 53011C0554E, 53011C0555E, 53011C0560E, 53011C0562E, 53011C0565D

7.0 OTHER STUDIES

This report either supersedes or is compatible with all previous studies on streams studied in this report and should be considered authoritative for 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, Federal Insurance and Mitigation Division, Region X, Federal Regional Center, 130 228th Street, SW, Bothell, Washington 98021-9796.

9.0 BIBLIOGRAPHY AND REFERENCE

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