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Flood-Inundation Maps for a 9.1–Mile Reach of the Coast Fork Willamette River near Creswell and Goshen, Lane County, Oregon

Scientific Investigations Report 2016–5029

U.S. Department of the Interior
U.S. Geological Survey

Cover: Photograph showing Coast Fork Willamette River and gage house at State Highway 58 near Goshen, Oregon, on December 18, 2015, when measured streamflow was 11,700 cubic feet per second. Photograph credit: U.S. Geological Survey.

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U.S. Geological Survey
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Conversion Factors

Inch/Pound to SI

Multiply	By	To obtain
	Length	
foot (ft)	0.3048	meter (m)
mile (mi)	1.609	kilometer (km)
	Area	
square mile (mi^2)	2.590	square kilometer (km^2)
	Flow rate	
cubic foot per second (ft^3/s)	0.02832	cubic meter per second (m^3/s)
	Hydraulic gradient	
foot per mile (ft/mi)	0.1894	meter per kilometer (m/km)

Datums

Vertical coordinate information is referenced to either (1) stage, the height above an arbitrary datum established at a streamgage, or (2) elevation, the height above North American Vertical Datum of 1988 (NAVD 88).

Horizontal coordinate information is referenced to the North American Datum of 1983 (NAD 83).

Flood-Inundation Maps for a 9.1-Mile Reach of the Coast Fork Willamette River near Creswell and Goshen, Lane County, Oregon

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Abstract

Digital flood-inundation maps for a 9.1-mile reach of the Coast Fork Willamette River near Creswell and Goshen, Oregon, were developed by the U.S. Geological Survey (USGS) in cooperation with the U.S. Army Corps of Engineers (USACE). The inundation maps, which can be accessed through the USGS Flood Inundation Mapping Science Web site at http://water.usgs.gov/osw/flood_inundation/, depict estimates of the areal extent and depth of flooding corresponding to selected stages at the USGS streamgage at Coast Fork Willamette River near Goshen, Oregon (14157500), at State Highway 58. Current stage at the streamgage for estimating near-real-time areas of inundation may be obtained at http://waterdata.usgs.gov/or/nwis/uv/?site_no=14157500&PARAmeter_cd=00065,00060. In addition, the National Weather Service (NWS) forecasted peak-stage information may be used in conjunction with the maps developed in this study to show predicted areas of flood inundation.

In this study, areas of inundation were provided by USACE. The inundated areas were developed from flood profiles simulated by a one-dimensional unsteady step-backwater hydraulic model. The profiles were checked by the USACE using documented high-water marks from a January 2006 flood. The model was compared and quality assured using several other methods. The hydraulic model was then used to determine eight water-surface profiles at various flood stages referenced to the streamgage datum and ranging from 11.8 to 19.8 ft, approximately 2.6 ft above the highest recorded stage at the streamgage (17.17 ft) since 1950. The intervals between stages are variable and based on annual exceedance probability discharges, some of which approximate NWS action stages.

The areas of inundation and water depth grids provided to USGS by USACE were used to create interactive flood-inundation maps. The availability of these maps with current stage from USGS streamgage and forecasted stream stages from the NWS provide emergency management personnel and residents with information that is critical for flood response activities, such as evacuations and road closures as well as for post flood recovery efforts.

Introduction

The Coast Fork Willamette River joins the Middle Fork Willamette River to form the Willamette River upstream of the population center of Springfield and Eugene, Oregon (population 351,715; U.S. Census Bureau, 2012) in Lane County. The Coast Fork Willamette River contributes to flooding in the Springfield-Eugene area and may flood the community of Creswell, which is located along its banks (fig. 1). The U.S. Army Corps of Engineers (USACE) operates dams that regulate flow of the Coast Fork Willamette River and has conducted studies to calculate the flood frequency and inundation areas along the Coast Fork Willamette River. Based on the these studies, the U.S. Geological Survey (USGS), in cooperation with USACE, developed flood inundation maps that focus on the area near the USGS streamgage on the Coast Fork Willamette River near Goshen (14157500).

Development on flood plains within the study area is varied, with a mix of residential, recreational, and commercial structures, and areas of agriculture, grass fields, wetlands, and forest. Since 1967, two U.S. Army Corps of Engineers dams regulate flow and provide flood control in the Coast Fork Willamette River—the Cottage Grove Dam on the Coast Fork Willamette River and the Dorena Dam on the Row River, a tributary to the Coast Fork Willamette River. These two projects reduce much of the flooding immediately downstream and, in concert with dams on the Middle Fork Willamette River, reduce flood risk in the highly developed Eugene-Springfield area.

Prior to this study, officials from Lane County and the Cities of Creswell and Goshen relied on several information sources to make decisions on how best to alert the public about and mitigate flooding along the Coast Fork Willamette River. One source of information is the Federal Emergency Management Agency (FEMA) Digital Flood Insurance Rate Map (Federal Emergency Management Agency, 2011). The Digital Flood Insurance Rate Map shows the extent of flooding in Lane County along the Coast Fork Willamette River for selected flows.

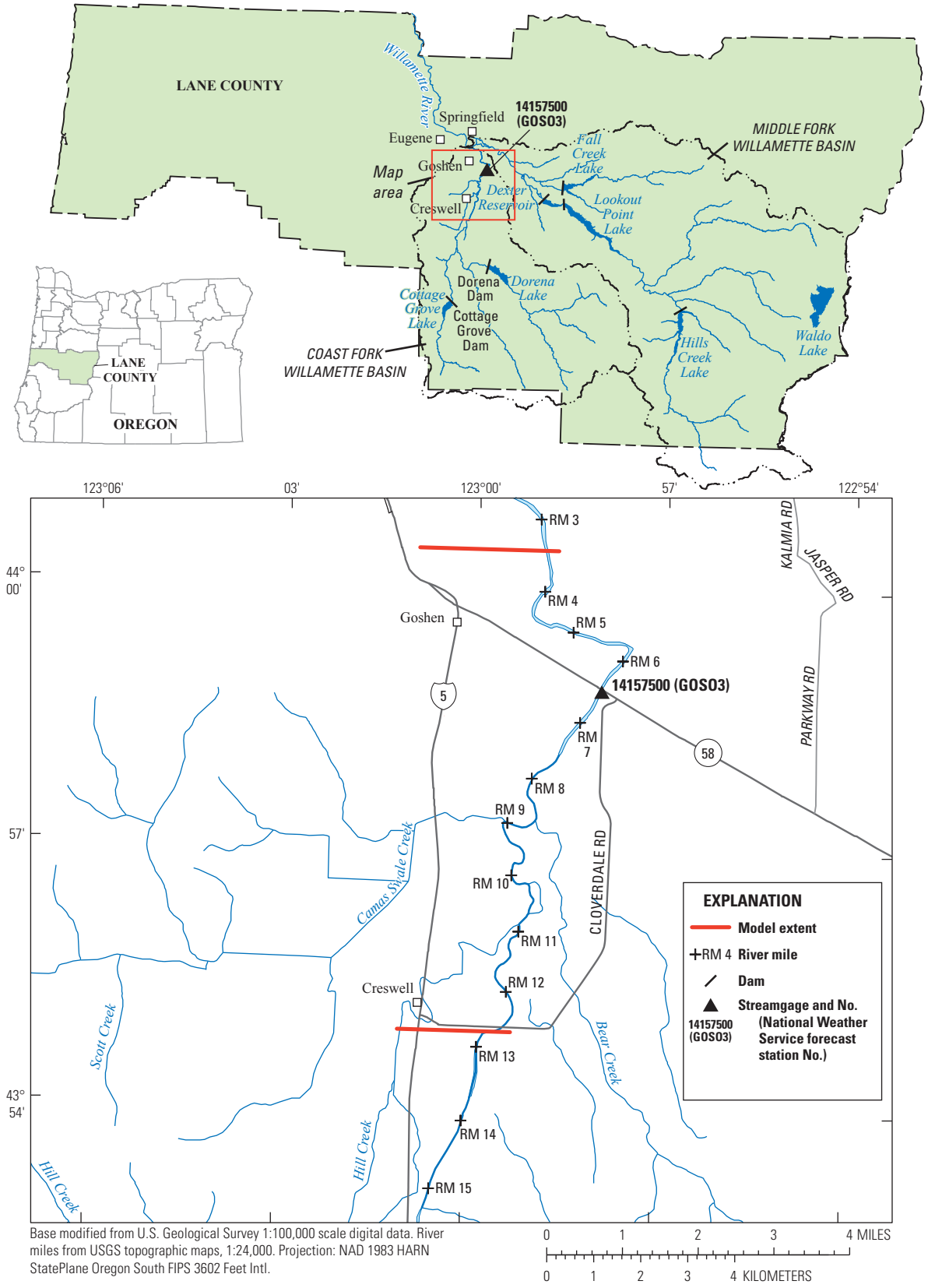

Figure 1. Location of study reach along the Coast Fork Willamette River near Goshen, Oregon, and location of U.S. Geological Survey (USGS) streamgage and National Weather Service (NWS) forecast site.

A second source of information is the U.S. Geological Survey streamgage (table 1)—Coast Fork Willamette River near Goshen, Oregon (14157500) at State Highway 58—from which current and historical stages can be obtained. Current stage at the streamgage for estimating near-real-time areas of inundation may be obtained at http://waterdata.usgs.gov/or/nwis/uv/?site_no=14157500&PARAmeter_cd=00065,00060 (U.S. Geological Survey, 2016). Stage is the height of the water surface above an arbitrary datum established at the streamgage (streamgage datum) and, for the Coast Fork Willamette River near Goshen streamgage, can be converted to water-surface elevations referenced to the North American Vertical Datum of 1988 (NAVD 88) by adding 477.5 ft. The streamgage datum is surveyed every 3 years according to USGS standards (Kenney, 2010) with the most recent survey in 2012. At the gage, stage is recorded every 15 minutes, and is converted to streamflow and transmitted to the Internet within 1 hour of collection.

A third source is the National Weather Service (NWS) forecast of peak stage for the USGS streamgage at the Coast Fork Willamette River near Goshen (forecast site GOSO3) through the Advanced Hydrologic Prediction Service (AHPS) Web site at http://water.weather.gov/ahps2/hydrograph.php?wfo=pqr&gage=goso3 (National Weather Service, 2015). The NWS forecast site used for forecasting floods is at the same location as the USGS streamgage used to measure stream stage and discharge.

For the Goshen streamgage, the NWS has three threshold stages (National Weather Service, 2015). At 11.8 ft stage, the river is at an *action* stage, a stage which, when reached by a rising stream, requires the NWS or a partner to take some type of mitigation action in preparation for possible significant flooding. *Flood* stage begins at 13.0 ft, and at 17.9 ft, a *major flood* stage is reached, which is defined as the stage to expect flooding of low-lying areas from Cloverdale Road and State Highway 58 downstream to the confluence with the Middle Fork Willamette River near Springfield and flooding of residential areas north of State Highway 58 near Goshen is likely. Flood-inundation maps were created for the action stage (11.8 ft) and major flood stage (17.9 ft), and for a stage of 13.2 ft, which approximates the flood stage of 13.0 ft.

Although USGS current stage and NWS forecast stage data are particularly useful for residents in the immediate vicinity of a streamgage, the data are of limited use to residents farther upstream or downstream because the water-surface elevation is not constant along the entire stream channel. Emergency management teams and property owners also typically lack information related to water depth at locations other than locations near USGS streamgages or NWS flood-forecast points. To help guide the general public in taking individual safety precautions and provide local officials with a tool to help efficiently manage emergency flood operations and flood-mitigation efforts, digital flood-inundation maps for a 9.1-mi reach of Coast Fork Willamette River were developed by the USGS in cooperation with the USACE. The reach was selected for developing flood-inundation maps because water elevations could be simulated by a model used in a recent flood insurance study for the area.

Table 1. Site information for the U.S. Geological Survey streamgage 14157500, Coast Fork Willamette River Basin near Goshen, Oregon.

[Location of station is shown in figure 1. Datum of streamgage is 477.5 ft above North American Vertical Datum of 1988. From 1905 to 1912, nonrecording streamgage at site 600 ft upstream at different datum. Latitude and longitude are in degrees, minutes, and seconds referenced to North American Datum of 1983. ft, feet; ft^3/s, cubic feet per second; mi^2, square miles]

Station name	Station No.	Drainage area (mi^2)	Latitude	Longitude	Period of record at current site	Maximum recorded stage (ft) at streamgage and date since 1950	Maximum discharge (ft^3/s) and date since 1950
Coat Fork Willamette River near Goshen, Oregon	14157500	642	43°58'50"	122°57'55"	1950 to current year (2014)	17.17 Nov. 19, 1996	33,400 Nov. 19, 1996

Purpose and Scope

The purpose of this report is to describe the development of estimated flood-inundation maps for a 9.1-mi reach of the Coast Fork Willamette River near Creswell and Goshen, Oregon. The maps and other useful flood information are available at the USGS Flood Inundation Mapping Science Web site (http://water.usgs.gov/osw/flood_inundation/). Users can select estimated inundation maps that correspond to (1) current stages at the USGS streamgage; (2) the NWS forecasted peak stage, or (3) other desired stream stages.

The scope of the study was limited to a 9.1-mi reach of the Coast Fork Willamette River, from the City of Creswell at Cloverdale Road to 3.0 river miles downstream of the Goshen streamgage (fig. 1). Tasks specific to development of the USGS maps were (1) computation of water-surface profiles by use of the HEC–RAS version 4.1.0 computer program (U.S. Army Corps of Engineers, 2010), (2) production of estimated flood-inundation maps at various stream stages by use of the HEC–GeoRAS computer program (U.S. Army Corps of Engineers, 2009) and a Geographic Information System (GIS), and (3) application of a Web interface that links to USGS real-time streamgage information and (or) NWS forecasted peak stage to facilitate the display of user-selected flood-inundation maps.

Maps were referenced to the stage at the streamgage on the Coast Fork Willamette River near Goshen, Oregon. The inundation areas were mapped for stages corresponding to annual streamflow exceedance probabilities (U.S. Army Corps of Engineers, 2013a) ranging from 11.8 to 19.8 ft, approximately 2.6 ft above the highest recorded stage at the streamgage (17.17 ft) since 1950.

Description of Study Area

The study area is the Coast Fork Willamette River reach near the towns of Goshen and Creswell, Oregon. The river is in the Willamette Valley physiographic province. The drainage area ranges from 554 mi^2 at the Cloverdale Road Bridge crossing to 642 mi^2 at the Coast Fork Willamette River near Goshen streamgage (14157500) (U.S. Geological Survey, 2014a). The headwaters of the Coast Fork Willamette River originate in a mountainous area of southern Lane County. The Coast Fork Willamette River and its tributaries generally flow north through Lane County until the Coast Fork Willamette River joins with the Middle Fork Willamette River near Springfield, Oregon. In the foothills and lower mountainous areas of the Coast Fork Willamette River Basin, average terrain slope is 15–20 percent (U.S. Army Corps of Engineers, 2013a). Minor tributaries in the study area include Bear Creek, Camas Swale Creek, and Hill Creek, all of which join the Coast Fork Willamette River within the 9.1-mi study reach. The land in the study reach is mostly classified as agricultural, with some areas classified as developed. Some large areas of woody wetlands are along the Coast Fork Willamette River and its tributaries (Fry and others, 2011). Within the study reach, two major road bridges (Highway 58 and Cloverdale Road) span the Coast Fork Willamette River. Major dams located upstream of the study reach at Dorena Lake on the Row River and Cottage Grove Lake on the Coast Fork Willamette River regulate flows within the study reach.

Since construction of flood control dams in the Coast Fork Willamette River drainage, flows have exceeded 30,000 ft^3/s (for reference, USACE regulates dams for a bankfull flow of 12,000 ft^3/s, U.S. Army Corps of Engineers, 2013a) on three occasions. The highest peak flow on November 19, 1996 was 33,400 ft^3/s and resulted in minor flooding of low lying areas in the study reach. The other two occasions of peak flow above 30,000 ft/s was 32,100 ft^3/s on December 24, 1964, and 31,000 ft^3/s on December 6, 1981.

Previous Studies

A Flood Insurance Study for Lane County (Federal Emergency Management Agency, 1999) was completed by the USACE. The study provided information on the water-surface profiles for the 1 and 0.2 percent annual exceedance probability discharges and associated floodplain maps for the Coast Fork Willamette River near Goshen, Oregon. As a result of that study, a Digital Flood Insurance Rate Map for Lane County was published (Federal Emergency Management Agency, 2011).

2013 Flood Insurance Study

The Flood Insurance Study completed in 1999 was re-evaluated with updated hydrology and hydraulics by the USACE from 2006 to 2011 (U.S. Army Corps of Engineers, 2013a, 2013b). The USACE study area was the Coast Fork Willamette and Middle Fork Willamette Rivers downstream of the USCAE dams to the respective river mouths. Annual exceedance probability flood discharges were calculated by the USACE using a period of record from 1936 to 2009, which included using models to estimate regulated flow for 1936–1949 when dams did not regulate flow on the Coast Fork Willamette River (U.S. Army Corps of Engineers, 2013a). Using a one-dimensional step-backwater unsteady HEC–RAS hydraulic model for simulation of water-surface profiles of the Coast Fork Willamette River, water-surface elevations and flood inundated areas at selected stream stages were estimated (U.S. Army Corps of Engineers, 2013b).

For tributaries, lateral inflow hydrographs were developed by the USACE. Hydrograph peak discharges for tributaries were estimated from regional regression equations from Cooper (2005). To create the shape of the hydrograph, the USACE created short-interval hydrographs for all local inflows using a spreadsheet macro. The macro interpolated daily values to shorter interval flow data. The macro applied a peaking factor to the daily flow, selected a time of peak, and estimated the slopes of the rising- and recession-limbs of the hydrograph. The macro either conserved volume, or added volume in cases where the peaking factor of the macro created a small increase in storm runoff. As a check, the macro-generated hydrographs were compared with a statistical analysis of hourly measured discharges collected during storms from nearby streamgages. The USACE short-interval hydrographs were used as input to a reservoir system model, HEC-ResSim version 3.0 (U.S. Army Corps of Engineers, 2007). A detailed description of the macro and analysis of hourly discharge for the USACE reservoir system model are presented in U.S. Army Corps of Engineers (2013a, p. 16–18).

U.S. Army Corps of Engineers updated the cross sections in the model based on hydrographic field survey data collected by USACE at various locations and times between 2006 and 2011. In some locations, the overbank elevations of the updated cross sections for the USACE model were calculated from digital elevation data obtained from Lane County. Digital elevation data included 5 × 5 ft cell lidar data collected in 2008 and 2011, and high-resolution, georeferenced aerial photographs taken in 2004 (U.S. Army Corps of Engineers, 2013b).

As part of the 2013 study, U.S. Army Corps of Engineers (2013a) measured structural dimensions of bridges and culverts to account for various manmade drainage structures (bridges, culverts, and roadway embankments) in and along the stream that can affect water-surface elevations during floods. A detailed description of the methods used to acquire and process the topographic and bathymetric data are available in U.S. Army Corps of Engineers (2013b).

The HEC–RAS model incorporated field observations and high-resolution aerial photographs to estimate initial (precalibration) Manning's roughness coefficients ("*n*" values) for energy-loss (friction-loss) calculations. The final Manning's *n* values used ranged from 0.030 to 0.048 for the main channel and 0.050 to 0.100 for the overbank areas modeled in this analysis (U.S. Army Corps of Engineers, 2013b). The downstream starting water-surface elevations boundary condition for all profiles of the Coast Fork Willamette River was calculated using normal depth.

The hydraulic model was calibrated by the USACE to gage data and high-water marks (HWM) along the main channel in January 2006 when the recorded peak discharge and stage were 19,100 ft^3/s and 14.43 ft, respectively (U.S. Army Corps of Engineers, 2013b). USACE field crews collected HWMs from the January 2006 flood from crest streamgages on the banks of the Coast Fork Willamette River (U.S. Army Corps of Engineers, 2013b). Model verification was accomplished by adjusting Manning's *n* values until the results of the hydraulic computations closely agreed with the known flood-discharge and stage values. In areas where ineffective flow occurred, the overbank characteristics were changed to reflect ponded conditions. Differences between collected and simulated elevations for the model calibrated to 2006 high-water marks in the study reach were within 0.29 ft except for one elevation that differed by 0.98 ft (table 2).

Several methods of USACE quality assurance of the HEC-RAS model were undertaken as part of this study. In addition to the comparison of HWMs and stage-discharge ratings, the 2013 USACE study and hydraulic model were internally reviewed by the USACE Portland District Hydraulics Section for technical content (U.S. Army Corps of Engineers, 2013b). The model also was reviewed by the FEMA Strategic Alliance for Risk Reduction, the group responsible for technical reviews of FEMA flood plain mapping.

Once the hydraulic model was calibrated, the model was used to develop water-surface profiles for eight stages (associated with annual exceedance probabilities) between 11.8 and 19.8 ft at the Coast Fork Willamette River near Goshen, Oregon (14157500). Discharges for all profiles at selected locations upstream and downstream of the streamgage were simulated by the USACE model. Using HEC-GeoRAS, the flood-inundation maps were developed by combining the water-surface profiles and DEM data.

Table 2. Surveyed high-water mark elevations and hydraulic-model elevations from the flood of January 2006, Coast Fork Willamette River near Goshen, Oregon.

[NAVD 88, North American Vertical Datum of 1988; ft, feet]

River mile	High-water mark elevation (ft above NAVD 88)	Modeled water-surface elevation (ft above NAVD 88)	Elevation difference (ft)
11.5	534.92	534.63	0.29
9.9	520.48	520.53	-0.05
8.8	510.53	509.55	0.98
7.4	500.71	500.62	0.09
6.4	491.93	492.06	-0.13

Water-Surface Profiles and Stage-Discharge Ratings

Flood-inundation mapping techniques used in hydraulic model development and calibration are described in Bales and others (2007). Bales and others (2007) compared simulated water-surface elevations to USGS stage-discharge rating curves and HWM from floods. For this study, the water-surface elevations simulated from the hydraulic model were compared by the USGS to the water-surface elevation from the current stage-discharge relation (rating number 28, effective January 5, 2011) for the streamgage at the Coast Fork Willamette River near Goshen, Oregon, at State Highway 58 (table 3). Differences were equal to or less than 0.70 ft. The results demonstrate that the model is capable of simulating accurate water elevations over a wide range of flows in the basin.

Table 3. Water-surface elevations from flow rating table and U.S. Army Corps of Engineers hydraulic model for the streamgage at the Coast Fork Willamette River near Goshen, Oregon (14157500).

[NAVD 88, North American Vertical Datum of 1988; ft, feet]

Stage, in feet above streamgage datum	Water-surface elevation (in feet above NAVD 88)		Elevation difference (ft)
	Rating table	Modeled	
11.8	489.3	490.00	-0.70
13.2	490.7	490.69	0.01
15.1	492.6	492.10	0.50
16.3	493.8	493.22	0.58
17.2	494.7	494.15	0.55
17.9	495.4	494.87	0.53
18.6	496.1	495.63	0.47
19.8	497.3	497.26	0.04

Development of Flood-Inundation Maps

Flood-inundation maps for the Middle and Coast Forks Willamette provided by USACE were clipped to the 9.1-mile reach of Coast Fork Willamette River near Goshen for this study.

Inundated areas that were detached from the main channel were examined using aerial photography to identify subsurface connections with the main river, such as through culverts under roadways. Where such connections existed, the mapped inundated areas were retained in the flood maps; otherwise, the erroneously delineated parts of the flood extent polygons were deleted or clipped. Bridge decks and culverts simulated in the model are shown as inundated only when the flood stage is equal to or higher than the deck elevation. For stages simulated, the stream elevation is below the deck elevations of the State Highway 58 and Cloverdale Road bridges spanning the Coast Fork Willamette River, and maps show these bridges as not inundated. At the highest stage of 19.8 ft, the stream elevation at the State Highway 58 Bridge is simulated below the bridge deck and approximately 4 ft below the bottom of the bridge. For the Cloverdale Road Bridge, the stream elevation is simulated below the bridge deck and approximately at the base of the bridge structure at stages of 18.6 and 19.8 ft. At other stages, the stream elevation is below the bottom of the Cloverdale Road Bridge.

Inundated areas of other bridge decks were removed in the final maps at stream stages where the deck appeared inundated because the lidar topography represented the stream channel elevation instead of the bridge deck elevation. At stages that inundated the bridge approaches and surrounding land, the maps show the bridge decks as inundated. Editing of inundated areas of the following bridges was performed:

- Seavey Loop Road bridge over Wild Hog Creek approximately 0.5 mi north of State Highway 58,
- A culvert on State Highway 58 between Hidden Lane and Seavey Loop Road,
- State Highway 58 bridge over an unnamed drainage approximately 0.5 mi northwest of the Coast Fork Willamette River,
- State Highway 58 bridge over an unnamed drainage approximately 0.25 mi southeast of the Coast Fork Willamette River,
- Dale Kuni Road bridge over an unnamed creek approximately 1.2 mi north of Cloverdale Road,
- Dale Kuni Road bridge over Hill Creek approximately 0.8 mi north of Cloverdale Road,
- Melton Road bridge over Hill Creek, and
- Cloverdale Road bridge over Hill Creek.

The flood inundations maps provided by USACE contain uncertainty where the Coast Fork Willamette River has many side channels that make simulation of flow complex. From river mile 5.5 to 3.5, flood inundation has uncertainty that is greater than in upstream reaches. For the hydraulic model and resulting flood inundation areas, the channels are complex between the main channel and sloughs due to braiding, agricultural modification, lateral structures, and natural levees. The USACE HECRAS model delineates the flow division between channels in this area slightly differently at each stage. On the flood inundation maps, the area with greater uncertainty is shaded green.

Coast Fork Willamette River, Oregon, Flood-Inundation Maps on the Internet

A Flood Inundation Mapping Science Web portal (http://water.usgs.gov/osw/flood_inundation/) provides USGS flood-inundation study information to the public. The portal has a link (http://wim.usgs.gov/FIMI/FloodInundationMapper.html) to an interactive map, from which a flood-inundation mapping study for a stream reach can be selected. At the Web page for the Coast Fork Willamette River study, graphs of the current stage and streamflow at the streamgage Coast Fork Willamette River near Goshen, Oregon, to which the inundation maps are referenced can be viewed. A link to the NWS AHPS Web site (http://water.weather.gov/ahps2/hydrograph.php?wfo=pqr&gage=goso3 (National Weather Service, 2015) allows the user to access information on Coast Fork Willamette River forecasted peak stage. The extent of flooding is displayed in sufficient detail for emergency personnel to efficiently prepare for flooding and make decisions for emergency responses. However, buildings that are shaded do not reflect inundation but denote that bare-earth surfaces in the vicinity are inundated. When the water depth (as indicated in the Web mapping application by holding the cursor over an inundated area) adjacent to the building of interest exceeds that building's height, the structure can be considered fully submerged.

Disclaimer for Flood-Inundation Maps

Inundation areas shown should not be used for navigation, regulatory, permitting, or other legal purposes. The USGS provides these maps "as-is" for a quick reference, emergency planning tool but assumes no legal liability or responsibility resulting from the use of this information.

Uncertainties and Limitations for Flood-Inundation Maps

Although the flood-inundation maps represent the boundaries of inundated areas with a distinct line, some uncertainty is associated with these maps. The flood boundaries shown were estimated based on water stages and streamflows at selected USGS streamgages. Water-surface elevations along the stream reaches were estimated by steady-state hydraulic modeling, assuming unobstructed flow, and using streamflows and hydrologic conditions anticipated at the USGS streamgage(s). The hydraulic model reflects the land-cover characteristics and any bridge, dam, levee, or other hydraulic structures existing as of 2011. Unique meteorological factors (timing and distribution of precipitation) may cause actual streamflows along the modeled reach to vary from those assumed during a flood, which may lead to deviations in the water-surface elevations and inundation boundaries shown. Additional areas may be flooded due to unanticipated conditions: such as changes in the streambed elevation or roughness, backwater into major tributaries along a main stem river, or backwater from localized debris or ice jams. The accuracy of the floodwater extent portrayed on these maps will vary with the accuracy of the digital elevation model used to simulate the land surface. Additional uncertainties and limitations pertinent to this study may be described elsewhere in this report.

If this series of flood-inundation maps will be used in conjunction with National Weather Service (NWS) river forecasts, the user should be aware of additional uncertainties that may be inherent or factored into NWS forecast procedures. The NWS uses forecast models to estimate the quantity and timing of water flowing through selected stream reaches in the United States. These forecast models (1) estimate the amount of runoff generated by precipitation and snowmelt, (2) simulate the movement of floodwater as it proceeds downstream, and (3) predict the flow and stage (water-surface elevation) for the stream at a given location (AHPS forecast point) throughout the forecast period (every 6 hours and 3 to 5 days out in many locations). For more information on AHPS forecasts, see http://water.weather.gov/ahps/pcpn_and_river_forecasting.pdf.

Most of the flood inundation maps developed for stages at the streamgage at Goshen fall within the USGS extended rating curve, which has a highest discharge of 60,000 ft^3/s. The flood inundation map for a stage of 19.8 ft, which is associated with a discharge of 68,200 ft^3/s, represents an area of less certainty because the flow exceeds the flows in the extended rating curve.

An assessment of the relative accuracy of the flood-inundation maps can be ascertained by using two methods. Differences between high-water marks and simulated elevations for the model calibrated to 2006 high-water marks in the study reach were within 0.98 ft (table 2). Differences between stages from the rating curve and modeled stages similar flow at the streamgage were equal to or less than 0.70 ft (table 3). Using the maximum error from these two methods, the flood-inundation map accuracy is approximately ±1 ft (0.98 ft). The inundated areas between river mile 5.5 and 3.5 are associated with larger uncertainty than the rest of the study area because of a complex network of side channels and flowpaths.

Summary

Estimated flood-inundation maps were developed in cooperation with the U.S. Army Corps of Engineers for a 9.1-mile reach of the Coast Fork Willamette River from the City of Creswell at Cloverdale Road to 3.0 miles downstream of the Goshen streamgage. The maps were developed using the U.S. Army Corps of Engineers' HEC–RAS and HEC–GeoRAS programs to compute water-surface profiles and to delineate estimated flood-inundation areas. The maps show estimated flood-inundation areas of the study area for stream stages between 11.8 and 19.8 ft for the streamgage at the Coast Fork Willamette River near Goshen, Oregon. The estimated accuracy of the flood-inundation maps is ±1 ft.

These maps, in conjunction with the real-time stage data from the U.S. Geological Survey streamgage at Coast Fork Willamette River near Goshen, Oregon, and National Weather Service flood-stage forecasts, will help to guide the general public in taking individual safety precautions and will provide emergency management officials with a tool to efficiently manage emergency flood operations and flood mitigation efforts.

Acknowledgments

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