State of Oregon
Oregon Department of Geology and Mineral Industries
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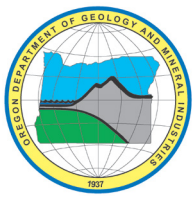
BASE FLOOD ELEVATION DETERMINATION BF-13-01

BASE FLOOD ELEVATION DETERMINATION FOR REACHES OF LAKE LABISH DITCH AND LITTLE PUDDING RIVER, MARION COUNTY, OREGON

by Jed T. Roberts[1] and Daniel E. Coe[1]



2013

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The Oregon Department of Geology and Mineral Industries is not liable for any claimed damage from the use of this information. The Federal Emergency Management Agency may, at any time in the future, revise the Base Flood Elevations for this study area. This study and Base Flood Elevation determination does not supersede any existing or future detailed analyses or determination performed by a licensed professional engineer. This analysis and mapping does not necessarily identify all areas subject to flooding, particularly from local drainage sources of small size.

Oregon Department of Geology and Mineral Industries Base Flood Elevation Determination BF-13-01
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STUDY BACKGROUND

This study was conducted under a Base Flood Elevation Determination Service agreement dated August 12, 2013, between the Oregon Department of Geology and Mineral Industries (DOGAMI) and AKS Forestry and Engineering. The purpose of this study was to develop 1% annual chance (100-year) water surface elevations, also known as Base Flood Elevations (BFEs), for reaches of Lake Labish Ditch and the Little Pudding River in Marion County, Oregon.

BFEs are determined primarily for administration of the National Flood Insurance Program (NFIP). The Federal Emergency Management Agency (FEMA) oversees the NFIP and issues Flood Insurance Rate Maps (FIRMs) that depict Special Flood Hazard Areas (SFHAs) within which flood insurance for structures is typically required. SFHAs are mapped by detailed or approximate methods. A detailed analysis produces BFEs that are mapped onto best available topographic data to define the boundaries of SFHAs designated as Zone AE, Zone AO, or Zone AH. Detailed analyses are commonly performed for streams in urban or suburban settings. An approximate analysis does not produce BFEs; instead, this method has historically involved engineering judgment to map SFHAs onto best available topographic data, often U.S. Geological Survey (USGS) topographic sheets. Approximate analyses are commonly performed for streams in rural areas, and SFHAs mapped with this approach are designated as Zone A. The approximate analysis approach was used to map SFHAs that are shown on the currently effective FIRM for Lake Labish Ditch and the Little Pudding River (Figure 1).

DOGAMI has partnered with FEMA through its Cooperating Technical Partner program to improve FIRMs by introducing high-resolution lidar (light detection and ranging) topographic data. As part of this effort DOGAMI has developed a FEMA-approved computer model-based approach to produce BFEs with lidar and revise Zone A SFHAs. This same approach was applied for the current study to produce BFEs in an area where FEMA has not yet funded a lidar-based FIRM revision.

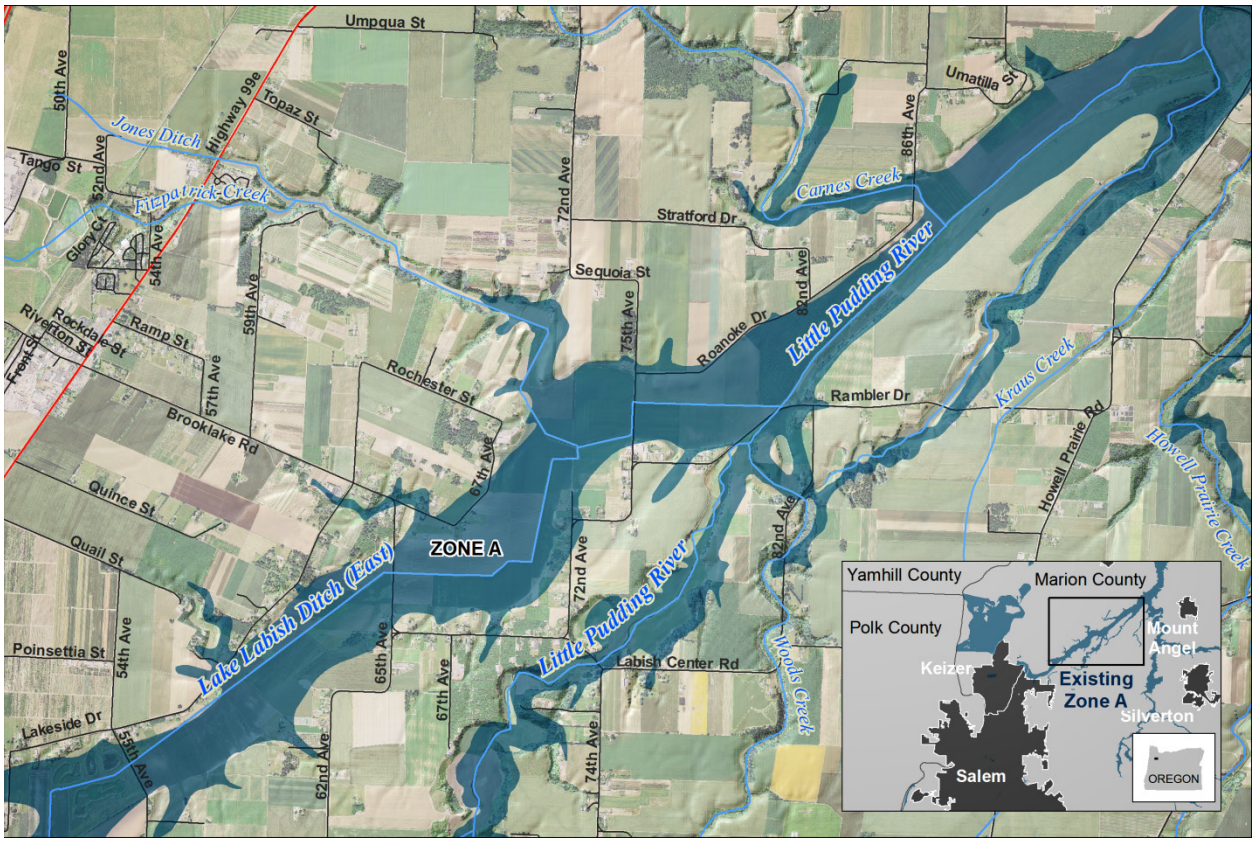

Figure 1. Zone A Special Flood Hazard Area Mapped by FEMA in 2003.

PHYSICAL SETTING

Lake Labish Ditch is a channel that was excavated in the late 1800s to drain Lake Labish for agricultural use. Due to a slight topographic divide in the middle of the historic lake, two main ditches comprise the Lake Labish Ditch system (FEMA, 2003). The west ditch drains into Claggett Creek, a tributary to the Willamette River. The east ditch drains into Little Pudding River. The east ditch has its confluence with the Little Pudding River just upstream of the Little Pudding River's confluence with the Pudding River. The east ditch and the reach of the Little Pudding River between its aforementioned confluences are the focus of this study (Figure 2).

Prior to 1950, flood events on the Pudding River caused water to back up on the Little Pudding River and flood the Lake Labish Ditch valley. In the 1950s the Natural Resources Conservation Service constructed the Parkersville dam and pump station on the Little Pudding River to prevent flooding in the Lake Labish Ditch valley due to flood events on the Pudding River (FEMA, 2003).

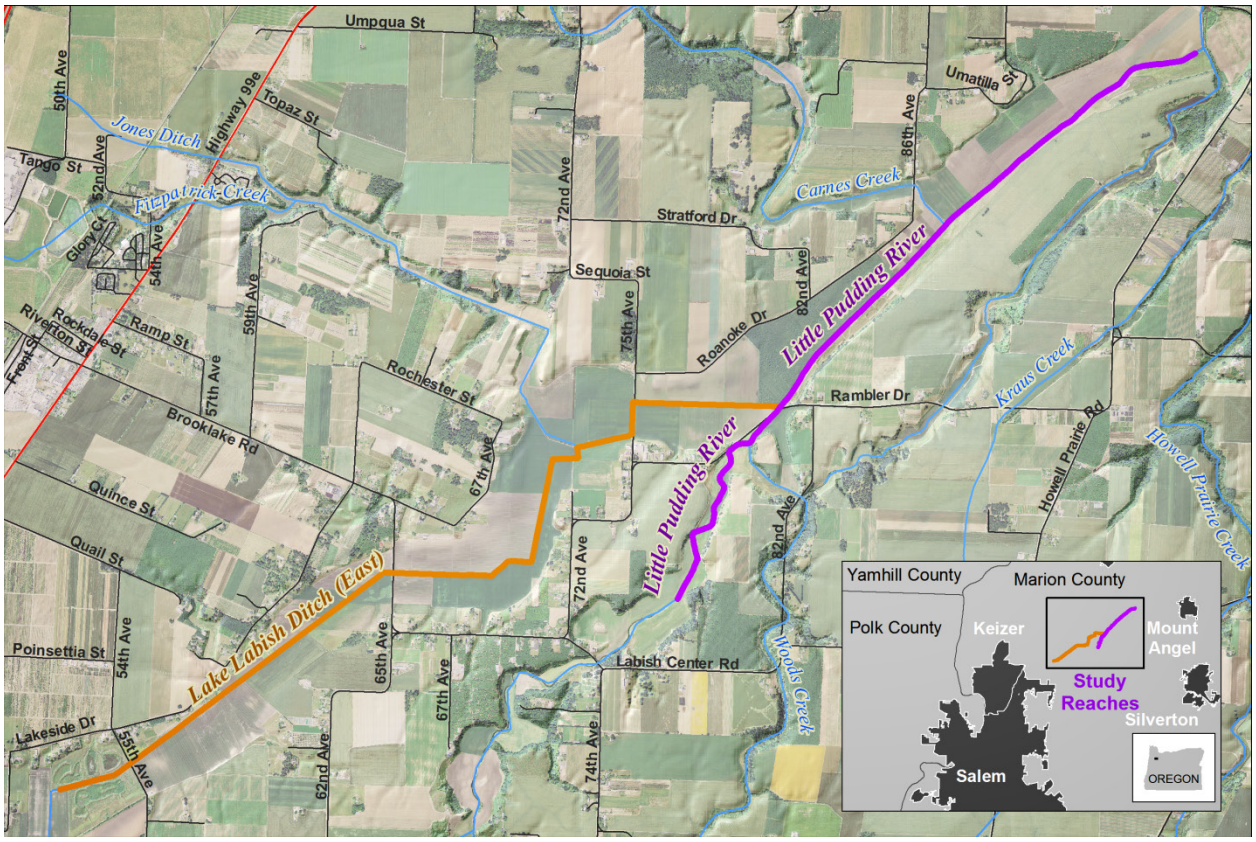

Figure 2. Location of Study Reaches.

HYDROLOGIC ANALYSIS METHODS

Two discharge locations were identified for this study. Because the area of interest is along Lake Labish Ditch, one discharge location was identified at the mouth of Lake Labish Ditch, just upstream of Little Pudding River. To account for backwater effects, a second discharge location was identified on Little Pudding River just upstream of Howell Prairie Road (Figure 3). Backwater effects from the Pudding River were not considered due to the presence of the Parkersville dam at Howell Prairie Road.

100-year peak discharges were calculated using a regional regression equation developed by the Oregon Water Resource Department (OWRD) and the USGS (Cooper, 2005). OWRD and USGS divided western Oregon into three hydrologic regions with separate regression equations. The watersheds upstream of the discharge locations both fall completely within Region 2B. For these ungaged locations the 100-year peak discharge is given by the equation

$$Q_{100} = 31.85\ Area^{0.9114}\ Slope^{0.4501}\ I24\text{-}2^{0.6252}$$

where

Q_{100} = the 100-year (1% annual chance) peak discharge, in cubic feet per second,
Area = the drainage area of the watershed, in square miles,
Slope = the mean watershed slope, in degrees, and
$I24\text{-}2$ = the 2-year (50% annual chance) 24-hour precipitation intensity, in inches.

Basin characteristics were determined using the USGS StreamStats for Oregon web tool (USGS, 2013). The resulting 100-year peak discharges are listed in Table 1.

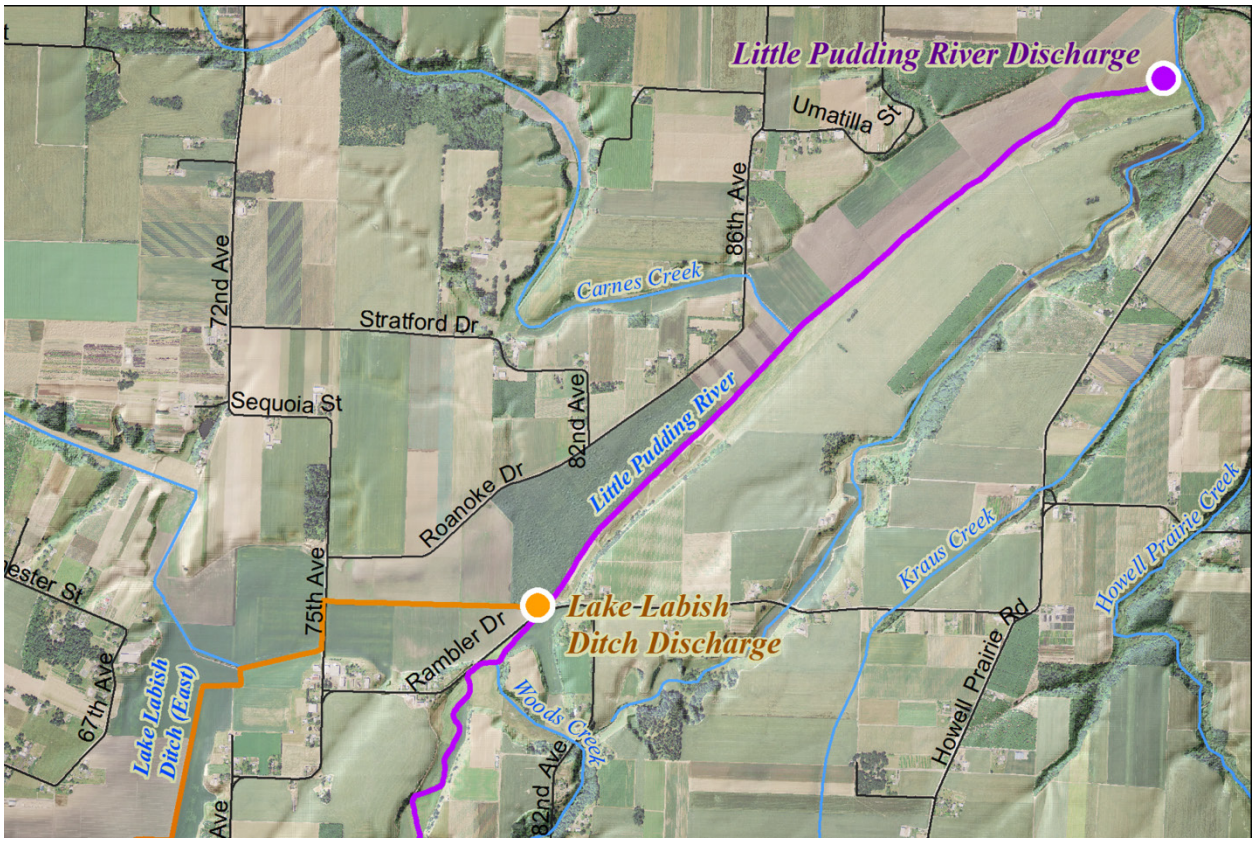

Figure 3. Discharge Locations.

Table 1. Summary of 100-Year Flood Discharges.

Discharge Location	Drainage Area (sq. mi.)	Mean Watershed Slope (deg.)	2-year 24-hour Precipitation Intensity (in.)	100-Year Peak Discharge (cfs)
Lake Labish Ditch, upstream of confluence with Little Pudding River	14.6	0.76	1.87	479
Little Pudding River, upstream of Howell Prairie Road	61.7	1.4	1.94	2,400

HYDRAULIC ANALYSIS METHODS

Steady flow hydraulic models were developed using the Hydrologic Engineering Center River Analysis System (HEC-RAS 4.1) provided by the U.S. Army Corps of Engineers (Brunner, 2010). Geometric input data were developed using the Esri ArcGIS© for Desktop Advanced 10.1 software package, the Esri 3D Analyst™ and Spatial Analyst™ extensions, and the HEC-GeoRAS 10.1 add-on provided by USACE (Ackerman, 2011).

Geometric data layers, including stream centerline, flowpaths, cross-sections, and bridges, were digitized from a hillshade raster derived from a 3-foot resolution lidar digital elevation model (DEM). The lidar DEM was derived from ground classified points with an average density of 0.15 per square foot. The vertical accuracy for the lidar acquisition area is ± 0.13 feet. Lidar acquisition for the study area took place in October 2008 (DOGAMI, 2011).

Cross-sections were placed at least every 500 feet perpendicular to the stream centerline. Opening widths for road crossings were assumed to be 10 feet unless a larger width was determined by measuring the channel widths nearest the crossing. An assumed deck thickness of 3.5 feet was applied to all road crossings. Ineffective flow was applied to off-channel areas of inundation. A normal depth reach boundary condition was determined by calculating the slope of a uniform gradient for the downstream section of the study reach. A Manning's roughness coefficient of 0.04 was applied globally.

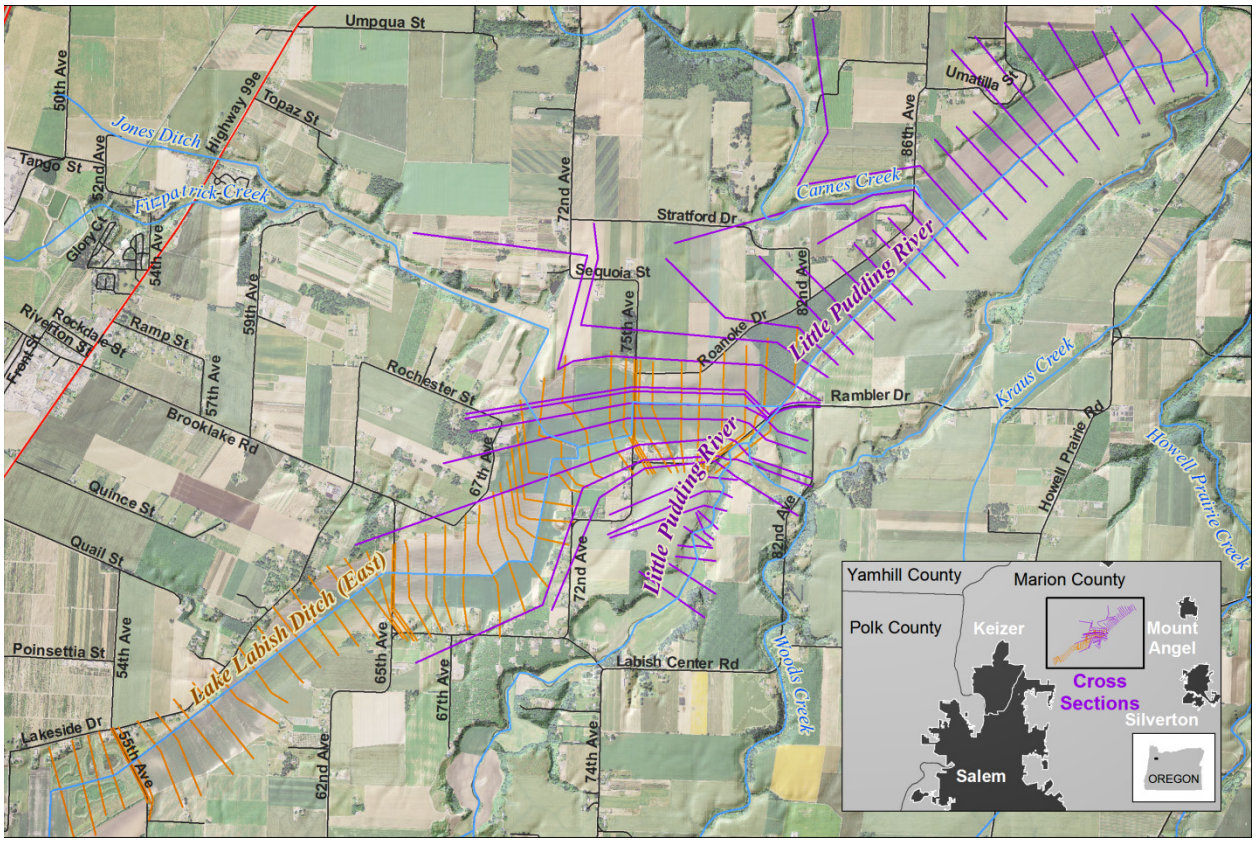

Figure 4. Location of Cross-Sections Used for Hydraulic Analysis.

SUMMARY OF RESULTS

The results of hydraulic modeling show that BFEs range from 134.2 feet (NAVD88) at the downstream terminus of the study reach to 142.2 feet (NAVD88) at the upstream terminus. Backwater flooding from the Little Pudding River controls BFEs on Lake Labish Ditch to 65th Avenue. Table 2 shows BFEs at select cross-sections throughout the study reach.

Table 2. Summary of 100-Year Flood Elevations.

Reference Cross-Section[1]	Location Description	BFE (ft. NAVD88[2])
LPR-1	Little Pudding River, 1,275 feet upstream of Howell Prairie Road	134.2
LPR-2	Little Pudding River, 1 mile upstream of Howell Prairie Road	134.5
LPR-3	Little Pudding River, 770 feet downstream of Rambler Drive	134.6
LPR-4	Little Pudding River, 1,210 feet upstream of Rambler Drive	134.7
LPR-5	Little Pudding River, 1,640 feet upstream of Rambler Drive	134.7
LPR-6	Little Pudding River, 3,770 feet upstream of Rambler Drive	135.0
LPR-7	Little Pudding River, 2,360 feet downstream of Labish Center Road	135.2
LLD-1	Lake Labish Ditch, just upstream of 65th Avenue	135.1
LLD-2	Lake Labish Ditch, 3,160 feet upstream of 65th Avenue	135.4
LLD-3	Lake Labish Ditch, 2,760 feet downstream of 55th Avenue	136.9
LLD-4	Lake Labish Ditch, just downstream of 55th Avenue	138.0
LLD-5	Lake Labish Ditch, just upstream of 55th Avenue	141.1
LLD-6	Lake Labish Ditch, 1,690 feet upstream of 55th Avenue	142.2

[1]See Appendix A for map of reference cross-sections.

[2]North American Vertical Datum of 1988.

RECOMMENDATIONS

The pump station at the Parkersville dam only operates during the summer growing season (FEMA, 2003). Because most flood events are likely to occur during the winter months, there is potential for the flood control structure to trap water upstream and exacerbate flood conditions on the Little Pudding River and Lake Labish Ditch. In 1996 this was the case when floodwaters backed up into Lake Labish Ditch and flooded approximately 15 homes in the City of Keizer (FEMA, 2003).

Photographs, provided to DOGAMI, showing high water on Lake Labish Ditch during the 1996 flood event, demonstrate that flood elevations in the east ditch reached at least 143 feet (NAVD88). This is approximately 6 feet higher than the BFE calculated at the same location for this study.

DOGAMI performed an alternative hydraulic analysis to reflect an extreme flood event without the Parkersville dam pump station operating. The results showed it is possible for floodwaters on Lake Labish Ditch and the Little Pudding River to reach 152 feet (NAVD88) before overtopping Howell Prairie Road.

The BFEs produced from this study represent the 100-year flood event under natural flow conditions. However, given observed impacts resulting from the operation of the Parkersville dam, it is strongly recommended that a factor of safety (up to an elevation of 152 feet NAVD88) be applied when considering purchase of flood insurance or development near the floodplain.

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APPENDIX A: MAP OF HYDRAULIC ANALYSIS RESULTS

Attached to this report is a map depicting the hydraulic analysis results of a 100-year flood event under natural flow conditions for reaches of Lake Labish Ditch and the Little Pudding River.

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BASE FLOOD ELEVATION DETERMINATION REPORT BF-13-01

Lake Labish Ditch and Portions of Little Pudding River, Marion County, Oregon

By Jed T. Roberts and Daniel E. Coe

(See accompanying report.)

Modeled 1% Chance Flood Depths

- 0–2 feet
- 2–4 feet
- 4–6 feet
- 6–8 feet
- 8 feet and above

- 134.7 LPR1 — Reference Cross-Section with Water Surface Elevation in Feet (NAVD88)
- Limit of Study
- Study Reach
- Stream
- Highway
- Road
- Township and Range Boundary
- Taxlot Boundary

Parkersville Dam

Howell Prairie Rd

Umatilla St

LPR1 LPR2 LPR3 LPR4 LPR5 LPR6 LPR7

LLD1 LLD2 LLD3 LLD4 LLD5 LLD6

Little Pudding River

Lake Labish Ditch (East)

Township 6 South Range 2 West

Township 6 South Range 1 West

Highway 219

I-5

Pacific Highway East 99E

Stratford Dr

Sequoia St

Roanoke Dr

Rambler Dr

Saratoga Dr

Brooklake Rd

Rochester St

Quince St

Ramp St

Lakeside Dr

Perkins St

Labish Center Rd

Nevada St

Barbara Way

Webb Ave

Peachtree St

Edith Ave

Nutmeg St

52nd Ave

54th Ave

57th Ave

59th Ave

62nd Ave

65th Ave

67th Ave

72nd Ave

74th Ave

75th Ave

82nd Ave

86th Ave

Howell Prairie Rd

Hallelujah Dr

Yamhill County
Marion County
Polk County
STUDY AREA
Mount Angel
Silverton
Keizer
Salem
OREGON

0 0.5 1 2 Miles

APPENDIX B: HYDRAULIC ANALYSIS DATA PACKAGE

Attached to this report is a data package containing the input and output datasets used to perform this study. It includes:

- HEC-RAS 4.1 models
- HEC-GeoRAS 10.1 input geometry data in GIS format
    - Cross-sections
    - Stream centerlines
    - Flowpaths
    - Bridges
- HEC-GeoRAS 10.1 output data in GIS format
    - 100-year flood zone
    - 100-year water surface elevation grid
    - 100-year depth grid
    - Cross-sections with computed 100-year water surface elevations
- 3-foot resolution lidar DEMs in GIS format
- Composites of Lake Labish Ditch and Little Pudding River output data in GIS format
    - 100-year flood zone
    - 100-year water surface elevation grid
    - 100-year depth grid