City of Salem | April 2018

# FLOODPLAIN MANAGEMENT PLAN



City of Salem Floodplain Management Plan

Adopted ?? Revised April 2018

Prepared by



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Floodplain Management Plan

# SPECIAL THANKS AND ACKNOWLEDGMENTS

The City of Salem developed this document through a community-wide planning process using plan templates provided by the Federal Emergency Management Agency. This project was completed through the work of two dedicated committees—the Floodplain Management Advisory Committee made up of citizens that provided input regarding needs of the community, and the Staff Technical Advisory Committee that coordinated the technical elements of the planning process. The City of Salem gratefully acknowledges the help of the following:

# Floodplain Management Advisory Committee

Corey Benson Rick Day Kathleen Dewoina Mike Erdmann Mark Grenz Ashley Howard Jeff Leach John Shepard Steve Ward Mark Weiprecht

# **Project Planning Team**

Glenn Davis (Project Manager), City of Salem Public Works, Chief Development Engineer, Floodplain Administrator

Robin Dalke, City of Salem Public Works, Floodplain Management

# Staff Technical Advisory Committee

Olivia Glantz, Community Development Urban Planning Patricia Farrell, Public Works Natural Resources and Parks Planning Heather Dimke, Public Works Public Information Officer Kenny Larson, Community Engagement Manager Justin Boyington, Flow Monitoring Analyst, Public Works Stormwater Operations Claude Kennedy, Community Development, Building and Safety Megan Furdson, Public Works Geographic Information System Mapping Roger Stevenson, Fire Department, Emergency Manager

# **EXECUTIVE SUMMARY**

#### Purpose

The *City of Salem Natural Hazard Mitigation Plan* prepares the City for the long term effects resulting from a variety of natural hazards. A natural hazard mitigation plan is required by the Federal Emergency Management Agency in order to receive federal funds for disaster projects. Flood Action Item #1 from the *City of Salem Natural Hazard Mitigation Plan* recommends creation of a floodplain management plan. This *Floodplain Management Plan* identifies flood-related hazards and establishes an action plan for how to mitigate those hazards.

## Development of the Plan

The *Floodplain Management Plan* is the result of extensive collaboration by a citizen advisory committee, City staff, multiple public agencies, non-profit organizations, and other community groups. The plan development was led by a 10-member citizen advisory committee, which included representatives of a wide range of community interests. The citizen committee was assisted by a technical committee of City staff representing various divisions within the Public Works, Community Development, and Fire Departments.

## Plan Goals

The goals of the *Natural Hazard Mitigation Plan* are also the goals that guided the overall direction of the *Floodplain Management Plan*; these goals are as follows:

Goal 1: Develop and implement mitigation activities to protect human life.

*Goal 2:* Protect existing buildings and infrastructure as well as future development from the impacts of natural hazards.

*Goal 3:* Strengthen communication and coordination of public and private partnerships and emergency services among local, county, and regional governments and the private sector.

Goal 4: Enhance economic resilience to reduce the impact on the local economy.

*Goal 5:* Preserve and rehabilitate natural systems to serve natural hazard mitigation functions and protect natural resources.

# Action Items

The *Floodplain Management Plan* establishes 43 action items in six floodplain management categories: preventive activities, property protection activities, natural resource protection activities, emergency services measures, structural projects, and public information activities. (See **Appendix G**.) Through a wide variety of activities, these action items implement the plan's goals in order to mitigate flood-related hazards.

## **Plan Implementation**

The plan implementation section details the process for ongoing implementation, evaluation, and modification of the *Floodplain Management Plan*. The City's Public Works Department is responsible for overseeing the annual review process with assistance from an advisory committee. The *Floodplain Management Plan* is scheduled for a complete update every five years.

# INTRODUCTION

## Purpose

Salem is home to an extensive system of natural waterways. As a result, Salem is susceptible to major flood events that pose threats to life and safety and that cause significant property damage. Though a number of government agencies and community groups attempt to mitigate flood hazards, a floodplain management plan integrates the community's efforts into one comprehensive program of activities. A floodplain management plan serves the following beneficial purposes for the Salem community:

- Identify existing and future flood related hazards and their causes.
- Ensure that a comprehensive review of all possible activities and mitigation measures are considered so that the most appropriate solutions will be implemented to address the hazard.
- Ensure that the recommended activities meet the goals and objectives of the community, are in coordination with land-use and comprehensive planning, do not create conflicts with other activities, and are coordinated to reduce the costs of implementing individual activities.
- Ensure criteria used in community land-use and development programs account for the hazards faced by existing and new development.
- Educate residents and property owners about hazards, loss reduction measures, and the natural and beneficial functions of floodplains.
- Build community support for activities and projects that prevent new problems, reduce losses, and protect the natural and beneficial functions of floodplains.

# **Regulatory Context**

#### **Natural Hazards Mitigation Plan**

Federal regulations require that jurisdictions maintain an approved natural hazard mitigation plan in order to receive federal funds for mitigation projects. Local and federal approval of such a plan ensures that the local jurisdictions remain eligible for pre- and post-disaster mitigation project grants. A primary goal of a natural hazards mitigation plan is to reduce future loss of life and damage to property resulting from natural hazards.

The 2017 *City of Salem Natural Hazard Mitigation Plan* (NHMP) indicates that Salem is highly vulnerable to flood hazards. The NHMP identifies two action items related specifically to flood hazards:

- FL1. Update, Maintain, and implement flood actions via a floodplain management plan with FEMA's Community Rating System guidelines.
- FL2. Improve the City of Salem's National Flood Insurance Program (NFIP) CRS rating class to reduce NFIP premiums.

The primary regulatory function of this *Floodplain Management Plan* is to implement Flood Action Item FL#1 of the NHMP. This *Floodplain Management Plan* also serves as a guide for implementation of Flood Action Item FL#2, and it will direct the City's floodplain management activities to better address flood-related hazards throughout many areas of Salem and the surrounding community. Further details about the CRS are included below.

#### **Community Rating System**

FEMA's Community Rating System program reduces flood insurance premiums for communities that implement floodplain management activities in excess of the minimum federal standards. Salem reached a CRS rating of Class 5 in 2015. By preparing a floodplain management plan, Salem will be eligible to earn additional CRS credits and will benefit from an action plan that will guide further improvement of its CRS rating.

## **Initial Planning Process**

The *Floodplain Management Plan* was initially adopted on June 10, 2013. In order to remain eligible for CRS credit, FEMA requires that the plan must be updated at least every five years. The timing of this Plan Update follows the Natural Hazards Mitigation Plan update, which was approved by FEMA on January 5, 2018.

Salem's CRS cycle verification visit by the Insurance Services Office is scheduled for April 26, 2018, and this Plan Update is an integral part of the verification process. The format of this Plan Update follows the process described in activity 510, "Floodplain Management Planning," in the 2017 CRS Coordinator's Manual.

# THE PLANNING PROCESS



Figure 1: Ten Steps in the Planning Process

# Organization of Plan

The organization of this plan document is based on FEMA's 10-step planning process:

Floodplain Management Plan Section	Planning Step	
Introduction	1	Organize
Public Involvement	2	Involve the Public
Coordination	3	Coordinate
Hazard Assessment	4	Assess the Hazard
Problem Evaluation	5	Assess the Problem
Setting Goals	6	Set Goals
Review of Possible Activities	7	Review Possible Activities
Action Plan	8	Draft an Action Plan
	9	Adopt the Plan
	10	Implement, Evaluate, and Revise

Table 1: FEMA's 10-Step Planning Process

# **PUBLIC INVOLVEMENT**

# Solicitation for Committee Members

In January 2018, a notice of solicitation for committee members was delivered to key stakeholders who have been involved in floodplain management, stormwater, and emergency management-related committees in recent years. Solicitation for committee members continued through February 2018.

# Floodplain Management Advisory Committee

The members of the Floodplain Management Advisory Committee are given in **Table 2** on page 6. The Project Manager served as the Committee Chair throughout the planning process.

#### Floodplain Management Plan

Member	Personal/Professional Affiliation
Glenn Davis, P.E., C.F.M.	City of Salem Public Works Chief Development Engineer, Community Rating System Coordinator, Project Manager, and Committee Chair
Rick Day	Business Owner, Old Castle Precast, Advantage
Corey Benson	Local Insurance Agent, Farmers
Mike Erdmann	CEO, Home Builder's Association of Marion and Polk Counties
Kathleen Dewoina	Real Estate Broker, Berkshire Hathaway, West Salem Neighborhood Association
Jeff Leach	Member, Southeast Salem Neighborhood Association Board
John Shepard	Resident, Business Owner
Ashley Howard	Real Estate Broker, Legacy Real Estate
Mark Grenz	Owner, MultiTech Engineering
Steve Ward, P.E.	Owner, Westech Engineering, Engineer
Mark Wieprecht	Member, Southeast Salem Neighborhood Association Owner of Flood-Damaged Property, Retired Architect

Table 2: Floodplain Management Advisory Committee Members

# **City Staff Participation**

The Plan Update Committee included representatives from various departments as shown in Table 3.

Committee Member	Representing
Robin Dalke	Public Works Floodplain Management
Olivia Glantz	Urban Planning
Patricia Farrell	Natural Resources Planning
Heather Dimke	Public Information Officer
Kenny Larson	City Manager's Office
Claude Kennedy	Building and Safety
Justin Boyington	Public Works Stormwater Operations
Megan Furdson	GIS/Mapping
Roger Stevenson	Emergency Management

 Table 3: Floodplain Management Plan Update Committee Members

# Advisory Committee Meetings

The project planning team contacted FEMA and confirmed that three committee meetings were sufficient for completing this Plan Update, according to FEMA guidelines. Committee meetings followed the 10-step planning process recommended by FEMA for floodplain management planning, along with separate planning processes recommended each for the Flood Information and Outreach Plan and for the Flood Insurance Plan. Each meeting focused primarily on two or more specific steps of FEMA's planning process. Agendas were provided to committee members before each meeting. Agendas were posted to the City's floodplain management website, and notices of upcoming meetings were posted on the City's calendar of events web page.

Appendix C includes all meeting agendas, sign-in sheets, handouts, and minutes. Committee meeting dates and topics are summarized in Table 4.

Date	Main Subjects
February 2, 2018	Organization Public Involvement Coordination Hazard Assessment Problem Assessment
February 26, 2018	Setting Goals Review Possible Activities
March 12, 2018	Review Scored Activities Draft Action Plan Recommendation to Council

Table 4: Committee Meeting Topics

# Public Meetings and Outreach

At the beginning of the planning process, the project manager met with the South Gateway Neighborhood Association to obtain public input on flooding concerns and possible solutions in key floodplain areas of South Salem. This group was selected because of recent flooding in the Battle Creek basin. A presentation was held at a public meeting on January 11, 2018, and follow-up discussions were coordinated with the project planning team.

A web page update with information explaining the planning process, meeting times, agendas, and the draft Plan Update was posted to the City of Salem City Committees web page.

The draft *Floodplain Management Plan* was completed in April 2018, and was submitted as an information report at the City Council's public meeting on April 9,

2018. Prior to the meeting, City staff mailed public notices to interested stakeholders (listed in **Appendix A**) and published the draft Plan Update on the City's website.

# COORDINATION

## Other Agencies and Organization

The Project Planning Team generated a list of affected jurisdictions and organizations based on FEMA guidelines and local notification lists on file with City staff. An outreach letter was sent to affected jurisdictions in February, 2018. The outreach letter and mailing list are included in **Appendix E**. No comments were received from these jurisdictions during the comment period.

# **Review Of Existing Reports**

#### City of Salem Natural Hazard Mitigation Plan

FEMA approved the City of Salem Natural Hazard Mitigation Plan as adopted on December 11, 2017, under City Resolution 2017-48. The work was performed in cooperation with Oregon Partnership for Disaster Resilience at the University of Oregon's Community Service Center.

A natural hazards mitigation plan provides communities with a set of goals, action items, and resources designed to reduce risk from future natural disaster events. With re-adoption of the plan, the City of Salem maintains its eligibility to apply for federal funding for natural hazards mitigation projects. The local planning process involved a wide range of representatives from city governments, fire departments, and Salem Hospital, among others.

The NHMP identifies Salem to be highly vulnerable to flood hazard risks. It also documents flooding of Salem and surrounding communities on several occasions in the past that warranted federal disaster declarations—most recently in January 2012, February 2014, and December 2015.

The 2012 NHMP recommends two flood-related action items:

- FL1. Update, maintain, and implement flood actions via a floodplain management plan in accordance with FEMA's Community Rating System guidelines.
- FL2. Improve the City of Salem's National Flood Insurance Program (NFIP) CRS rating class to reduce NFIP premiums.

#### Marion County Natural Hazards Mitigation Plan

Relevant hazard mitigation elements of the *Marion County, Oregon, Multi-Jurisdictional Natural Hazards Mitigation Plan*, dated June 2016, were incorporated into the Salem NHMP. Page 2-16 of the Marion County plan includes additional details regarding flood damage resulting from recent floods.

#### Salem Area Comprehensive Plan

The *Salem Area Comprehensive Plan*, November 2015, is the long-range plan for guiding development in the Salem-Keizer urban area for the next 20 years. The Natural Resource goal of the *Salem Area Comprehensive Plan* is "To conserve open space, protect natural, historic, cultural and scenic resources, and to protect life and property from natural disasters and hazards" (page 46).

Regarding flood hazards, the Salem Area Comprehensive Plan specifies:

Development in the floodplain shall be regulated to preserve and maintain the capability of the floodplain to convey the flood water discharges and to minimize danger to life and property (page 47).

#### Stormwater Master Plan

The Salem *Stormwater Master Plan* was adopted by City Council in September 2000 as a detailed part of the *Salem Area Comprehensive Plan*. The plan includes three major elements: (1) descriptions of the drainage basin for each major creek system; (2) a Drainage System Improvement Plan; and (3) a Stormwater Management Program Plan.

As the *Stormwater Master Plan* indicates, several of Salem's major creek systems are located in multiple jurisdictions. The drainage basins for most creek systems within Salem originate in rural areas outside the Urban Growth Boundary (UGB) including Battle, Croisan, Glenn-Gibson, Little Pudding, Mill, and Pettijohn-Laurel. Most Salem creeks discharge into the Willamette River within the Salem-Keizer UGB. However, a few creek systems can affect downstream communities not located along the Willamette River: Battle Creek discharges into Mill Creek near the City of Turner; Claggett Creek discharges near the City of Keizer; and Little Pudding River discharges into the Willamette River near Canby.

A component of the *Stormwater Master Plan*, the "Drainage System Improvement Plan," recommends construction projects to improve storm drains, culverts, open channels, streams, detention storage, and water quality facilities. This element of the plan identifies the need for 289 construction projects at a cost of \$217 million (year 2000 dollars). The majority of these projects had not been constructed as of 2012, mostly due to lack of funding.

The "Stormwater Management Program Plan," also a component of the *Stormwater Master Plan,* included the broad elements needed for a successful stormwater management program, which evaluates financial needs, information gaps, adequate

levels of operation and maintenance, public involvement, specific stormwater problems, and cost/benefit analyses. This plan component emphasizes environmental stewardship, stormwater planning, long-term vision, cost-effective solutions, implementation, and financial planning. The Stormwater Management Program Plan includes a policy plan for specific topics of quantity, quality, policies, operations, education, and financing.

Salem is currently undergoing a process to update its Stormwater Master Plan. One key issue affecting the plan's policies relates to how flood inundation data may be used for floodplain management. In 2017, the Salem City Council directed a task force be convened to consider whether and how the City should use improved data and modeling methods to update Salem's floodplain maps. The Task Force included subject matter experts; representatives from municipal agencies; leaders from the engineering, development, and business communities; and representatives from potentially affected watersheds and neighborhood associations. The Task Force held three meetings (December 8, 2017, December 20, 2017, and January 29, 2018), all of which were open to the public.

#### Salem Transportation System Plan

The Salem *Transportation System Plan* (TSP), dated February 2016, provides a framework of goals, objectives, and policies that guides Salem's transportation system. The TSP recommends how Salem invest its resources in future transportation programs and infrastructure to meet anticipated travel demands.

Pursuant to an Action Item in the 2013 Floodplain Management Plan, the TSP added the following paragraph related to critical routes:

The City's arterial street system connects people to critical facilities as well as providing emergency response and evacuation routes in the event of natural hazards. Planning for and maintaining a robust network of critical routes supports the health and safety of the community. Identification of transportation improvement projects for both existing and new facilities should take into consideration the function of the street as a critical route for emergency management purposes. Data available to support this analysis includes identification of street segments that are prone to flooding and information gained through bridge inspection reports. Future transportation projects should consider opportunities to reduce the potential for critical routes to be blocked during major floods or other hazards.

#### Stormwater Management Program Plan

The Stormwater Management Program Plan (SWMP) was originally prepared in 1996 as part of the process for Salem to obtain its initial Municipal Separate Storm Sewer System (MS4) permit from the Oregon Department of Environmental Quality (DEQ) in December 1997. The City's SWMP has been reviewed and updated on several occasions in conjunction with applications for renewal of the MS4 Permit. The most recent update of the SWMP is dated April 2011, which incorporates the most recent MS4 permit requirements.

The main purpose of the SWMP is to address four basic elements of the MS4 permit:

- 1. Structural and source control Best Management Practices to reduce pollutants from residential and commercial areas
- 2. Program to detect and remove illicit discharges and improper disposal into the storm sewer system
- 3. Program to monitor and control pollutants from industrial facilities
- 4. Program to reduce pollutants in stormwater discharges from construction sites

The SWMP includes detailed tasks, goals, and tracking measures for accomplishing each of the four basic elements of the MS4 permit. A number of these tasks were incorporated into Action Items within this *Floodplain Management Plan*.

#### Pringle Creek Watershed Management Plan

In June 2008, the City of Salem completed the *Pringle Creek Watershed Management Plan* (PCWMP). This plan initiated an overall watershed planning program for Salem's urban watersheds with the goal of developing a framework for improving the city's urban watershed health and for fostering community support and ownership of watershed protection and restoration.

The goals for the pilot *Pringle Creek Watershed Management Plan* included promoting community-wide support for funding urban watershed improvements, creating short-term and long-term visions for a healthy urban watershed, restoring watershed functions in an urban environment, and assessing what resources are needed to implement restoration and protection actions.

This plan includes a comprehensive list of recommendations with the aim of guiding City departments to meet the City's long-term vision for watershed health. This plan also recommends detailed tasks for implementation based on priority, organizational responsibility, cost, and funding sources.

#### **Flood Insurance Study**

The primary source for flooding patterns and flood elevation data in Salem is FEMA's *Flood Insurance Study: Marion County, Oregon, and Incorporated Areas* (FIS), dated January 2003. The FIS includes detailed flood profiles for all major waterways in Salem, including Mill Creek, Shelton Ditch, Pringle Creek and its forks, Battle Creek, Powell Creek, Claggett Creek, Croisan Creek, Gibson Creek, and Glen Creek.

The FIS includes a description of each community within Marion County and their respective flood history, risks, and protection measures. The study identifies Salem's

primary flood risks to be in December and January, caused by large storms moving inland from the Pacific Ocean. Salem is protected by two diversion structures: one diverting Mill Creek flows into Shelton Ditch, and a second diverting flows from West Fork Pringle Creek to Middle Fork Pringle Creek. The FIS is comprehensive of all major waterways in Salem; significant additional study is not warranted.

#### **TMDL Implementation Plan**

Salem (City) is a Designated Management Agency (DMA) under the 2006 Willamette Basin Total Maximum Daily Load (TMDL) and the 2008 Molalla-Pudding TMDL and is responsible for development and implementation of strategies to minimize and address the discharge of TMDL pollutants. As a DMA, the City developed an updated 2016 TMDL Implementation Plan (TMDL Plan) to address requirements of the Willamette Basin TMDL. This plan includes strategies and activities that the City is proposing to continue compliance with the TMDLs in accordance with DEQ's 2006 guidance document and Oregon Administrative Rule (OAR) 340-042-0080.

The TMDL Plan includes the following: (1) a regulatory background and summary related to the designation and definition of point and nonpoint sources in TMDLs; (2) the City's management strategies for bacteria, total suspended solids (TSS), and mercury as point source pollutants addressed under the City's NPDES Municipal Separate Storm Sewer System (MS4) permit; and (3) management strategies, implementation time frames, and performance monitoring specific for temperature (as a nonpoint source pollutant not otherwise addressed by NPDES MS4 permits).

The management strategies for point and nonpoint sources were reviewed and incorporated into the Review of Possible Activities as appropriate.

# HAZARD ASSESSMENT

### Overview

An assessment of all natural hazards is included in the Salem NHMP. A detailed description of Salem's flood-related hazards is provided below.

The City of Salem features the Willamette River, smaller tributaries, and streams that are susceptible to annual flooding events that pose threats to life and safety and cause significant property damage. The streams include Battle Creek, Cinnamon Creek, Claggett Creek, Clark Creek, Croisan Creek, Davidson Creek, Gibson Creek, Glenn Creek, Golf Creek, Jory Creek, Laurel Creek, Little Pudding, Mill Creek, Mill Race, Pettijohn Creek, Powell Creek, Pringle Creek, Scotch Creek, Shelton Ditch, Waln Creek, and Winslow Creek. Salem's flood events often occur when warm weather and heavy rains melt snow at higher elevations which flood local streams.

## **Historic Flood Events**

The largest flood of the Willamette River on record occurred in 1861; the next significant flood occurred in 1890. In more recent times, many residents may remember the Christmas flood of 1964, which was rated "approximately a 100-year flood" by FEMA and may be the most damaging in Oregon's history. The Christmas flood of 1964 caused \$157 million in damage, and 20 Oregonians lost their lives.

The Christmas flood occurred as a result of two storms, one on December 19, 1964, and the other on January 31, 1965. These storms brought record-breaking rainfall, and the resultant flooding was exacerbated by near-record early season snow depths. The Willamette River crested nearly ten feet above flood stage, and many other streams in Salem overflowed their banks. The floodwaters rendered the sewage treatment plant inoperable, causing raw sewage to be channeled directly into the Willamette River. One hundred and twenty-one patients were evacuated from Salem Memorial Hospital, and 15 families in the Turner and Salem areas were evacuated from their homes.

Since 1964, major storm events occurred in January 1974, February 1986, February 1996, November 1996, and January 2012. In February 1996, the Salem area saw nearly 100-year flood levels, causing flooding in both rural and urban areas. Damages to city businesses, residences, and infrastructure were tremendous, and most of the city's residents were affected by the substantial impact on the transportation system, the loss of potable water, and the damage to personal property. Claims filed under

FEMA's National Flood Insurance Program from Salem residences and businesses accounted for almost one-third of the claims filed for Marion County in 1996.

During the most recent event in January 2012, some areas of south Salem received over 9 inches of rain within a 5-day period. Heavy rainfall combined with melting snow caused substantial flooding in the Battle Creek, Mill Creek, Pringle Creek, and Croisan Creek basins. Approximately 300 people were evacuated from their homes, and 64 city streets were closed due to high water.

## Causes of Flooding in Salem

Flooding occurs when climate (or weather patterns), geology, and hydrology combine to create conditions where river and stream waters flow outside of their usual course and overflow their banks. In Salem, the combination of these factors, augmented by ongoing development, create chronic seasonal flooding conditions.

Flooding is most common from November through March when storms from the Pacific Ocean, 60 miles away, bring intense rainfall to the area. Salem receives approximately 38 inches of rain on average each year. Larger floods result from heavy rains that continue over the course of several days, worsened by snow melt, at a time when the soil is near saturation from previous rains. Frozen topsoil also contributes to flooding.

Riverine flooding and urban flooding are the two types of flooding that primarily affect Salem. Riverine flooding is the over-bank flooding of rivers and streams, a natural process which adds sediment and nutrients to fertile floodplain areas. Urban flooding results from the conversion of land from fields or woodlands to parking lots and roads, through which the land loses its ability to absorb rainfall.

#### Characteristics

The principal types of floods that occur in Salem include riverine, shallow area, and urban floods. Riverine flooding is the most common type of flooding in Salem; it typically occurs on large rivers, such as the Willamette River, and usually results from large storms or prolonged wet periods. Portions of Salem that are located along water bodies have the potential to experience riverine flooding after spring rains, heavy thunderstorms, or rapid runoff from snow melt. Riverine floods can be slow- or fast-rising, but usually develop over a period of days. The danger of riverine flooding occurs mainly during the winter months, with the onset of persistent, heavy rainfall, and during spring, with melting of snow in the Coast Range. Shallow area floods are a special type of riverine flooding. FEMA defines a shallow area flood hazard as an area that is inundated by a 100-year flood with a flood depth of 1 to 3 feet. Such areas are generally flooded by low-velocity sheet flows of water.

Urban flooding occurs where land has been converted from open space to areas consisting of homes, parking lots, and commercial, industrial, and public buildings and structures. In such areas the previous ability of water to filter into the ground is often prevented by the extensive impervious surfaces associated with urban development. During periods of urban flooding, streets can rapidly become swift moving rivers, and basements and backyards can quickly fill with water. Storm drains and smaller creeks can back up due to yard waste and debris. Clogged storm drainage systems often lead to further localized flooding.

#### Location/Extent

Salem has more than 4,000 acres of floodplain and approximately 3,000 individual parcels that are partially or entirely located within the floodplain. The most significant of the FEMA-determined floodplains and floodways either surround the southern side of the Willamette River west of Salem, or are within the greater Mill Creek/Pringle Creek watershed.

Properties in and near the floodplains in Salem are subject to frequent flooding events. Since flooding is such a pervasive problem throughout the city, many residents have purchased flood insurance to help recover from losses incurred from flooding events. (See **Map 1** on page XX.)

## Other Areas of Flooding

#### **Repetitive Loss Areas**

Salem has five repetitive loss properties in four distinct geographic areas (see Maps 2 and 3 on page XX). Repetitive loss properties are those properties for which two or more claims of more than \$1,000 have been paid by the NFIP within any 10-year period.

**Salem Industrial Drive**–Flooding hazards in the repetitive loss area of Salem Industrial Drive NE were mitigated in 2007 with the construction of Bill Frey Drive NE and channel improvements to Claggett Creek. This repetitive loss area is near a City-owned natural area along Claggett Creek, which was formerly operated as a gravel pit before being acquired by the City for natural and beneficial use.

**Bellevue Street**–This area experienced repetitive losses because of two structures within Shelton Ditch. One structure was a footbridge that experienced damage during the 1996 flood, which has been replaced at a higher elevation that does not obstruct flood flows. The second structure is the Winter Street Bridge, which is has been replaced.

**State Street**–This RLA was added in 2016 based on two claims in the area from flood events in 2012 and 2015. This area has a number of pre-FIRM structures located in or near the floodway boundary. Based on discussions with operations staff, it appears the damage to this building has been limited to crawlspace flooding.

**Marstone Court**–This RLA was added in 2016 based on two claims in the area from flood events in 2012 and 2015. Flooding concerns have been attributed to an undersized culvert on the portion of Waln Creek that flows under Woodside Drive and









# U Legend 1996 Flood City Limits Water/Waterways This product is provided as is, without warranty. In no event is the City of Salem liable for damages from the use of this product. This product is subject to license and copyright limitations and further distribution or resale is prohibited. Major Streets

# Map 3: Flood Inundation 1996

capacity limitations from an above-ground detention system that was designed in the cul-de-sac of Marstone Ct. A culvert upgrade project was completed in 2015 by the City.

#### **Flood Inundation Maps**

Subsequent to the flood event of 1996, City staff documented flood inundation areas and generated flood inundation maps (see Map 3 on page 19) on the City's Geological Information System (GIS). The data from the 1996 flood inundation maps were used by FEMA to generate new Flood Insurance Rate Maps (FIRMs) in 2000.

## Other Flood Hazards

#### **Inventory of Levees**

The Keizer River Wall protects the City of Keizer from Willamette River flooding. This wall was inspected by the US Army Corps of Engineers in 2010, as described in an inspection report titled *Keizer River Wall, Flood Damage Reduction Project, Periodic Inspection No. 1.* Because this flood wall is located sufficiently downstream of Salem to prevent backwater effects, this flood protection measure does not appear to affect the flood hazards within the city limits of Salem.

The FIS describes that an earthen berm protects the Sun Retirement Center along West Fork Pringle Creek at 12th Street SE. This berm appears to restrict localized flooding for one property along 12th Street Cutoff SE.

#### **Inventory of Dams**

The *Marion County, Oregon, Multi-Jurisdictional Natural Hazard Mitigation Plan* identifies two dams with high hazard potential—Big Cliff Dam and Detroit Dam—that are located on the North Santiam River, which ultimately discharges into the Willamette River upstream of Salem.

Dams play a crucial role in power generation and water control mechanisms for the region. Dam failures can occur rapidly and with little warning. Fortunately most failures result in minor damage and pose little or no risk to life safety. However, the potential for severe damage still exists. The Oregon Water and Resources Department has inventoried all dams located across Marion County and Salem. The "hazard level" estimates the amount of damage that could occur in the event of dam failure.

Marion County has over 56 dams, and two are ranked at a high hazard level: Detroit Dam and Big Cliff Dam. Detroit and Big Cliff are hydroelectric dams that control the flow of water on the Santiam River, providing a major boating and recreational area. However, both dams are considered a major hazard for the large population downstream that would be at risk in the event of a dam failure, including populations in Salem. Besides the Detroit and Big Cliff dams, other major dams surrounding the Salem area include Waconda and Silverton (Salem Natural Hazard Mitigation Plan, 2017, p. C-32).

## Potential for Increased Flooding

#### **Changes in Floodplain Development**

Goal N (Scenic And Historic Areas, Natural Resources And Hazards) of the *Salem Area Comprehensive Plan* is "to conserve open space, protect natural, historic, cultural and scenic resources, and to protect life and property from natural disasters and hazards." Referencing Goal N: Flood Hazards, the *Salem Area Comprehensive Plan* also states, "Development in the floodplain shall be regulated to preserve and maintain the capability of the floodplain to convey the flood water discharges and to minimize danger to life and property."

Economic and residential demands for vacant land are analyzed in the *Salem Economic Opportunities Analysis, Table 7,* and the *Salem Housing Needs Analysis, Table 12.* These demands show that there is a potential shortage of multi-family residential and commercial land, and a potential surplus of industrial and single family residential land. Therefore, flood-prone areas in multi-family and industrial areas will be more likely to encroach into floodplain areas because of the deficiency of available land. These studies do not suggest that development patterns within the floodplain will vary significantly in the future from past trends.

The *Pringle Creek Watershed Management Plan* addresses the impacts of future development in the Pringle Creek watershed and provides a reasonable summary for other watersheds in Salem:

Encroachment on and Expansion in the Floodplain – The fertile soil and scenic location frequently make floodplains popular locations for development. However, streams are not static and it is often necessary to modify the floodplain to protect buildings and infrastructure. The most common protection mechanism is to fill the floodplain, raising the building elevation to beyond the reach of frequent flooding events. This solves the local flooding issue but the fill reduces the capacity of the floodplain and intensifies downstream problems. Other flood control measures such as levees, armoring, and channelization can all produce the same effect, as well as undersized culverts and bridges.

Pringle Creek contributes stormwater to the Willamette River just upstream of downtown Salem. On-site detention is already required of new development. However, additional flow controls including additional regional detention facilities could create a more natural hydrograph pattern for Pringle Creek and reduce backwater effects from the storm-swollen Pringle Creek flows trying to outfall into an equally swollen Willamette River. The City is not currently prioritizing regional detention facilities based on the findings from the Regional Detention Facilities Study; however the most recent Stormwater Management Plan states that regional facilities would be considered as opportunities arise (HDR Engineering Inc. and Barney and Worth, Inc., Pringle Creek Watershed Management Plan, 2008, Section 3.3.6, page 3-17).

Floodplain development may be affected significantly by federal changes being proposed to the National Flood Insurance Program to mitigate impacts to endangered species in Oregon. The Oregon Department of Land Conservation and Development's website states the following regarding the federal process:

On April 14, 2016 the National Marine Fisheries Service (NMFS) delivered to the Federal Emergency Management Agency (FEMA) a jeopardy biological opinion (BiOp) on implementation of the National Flood Insurance Program (NFIP) in Oregon. The BiOp includes a set of recommendations for reducing the impact of NFIP related development on salmon.

A BiOp is a scientific judgment about the potential effects of a federal action on an ESA listed species. Although the document is called an "opinion," it has the force of a decision document. FEMA must respond to the findings in the BiOp. This BiOp is a "jeopardy opinion" to which NMFS has attached a set of recommendations, or "reasonable and prudent alternatives" (RPAs) to FEMA's February 2013 proposal for reducing the impacts of the NFIP on salmon. Essentially, NMFS has concluded that development in floodplains displaces important habitat, which salmon utilize during flood events, and contributes to instream water quality and hydrologic conditions that are unfavorable for fish....

Ultimately, NFIP communities in the 31 counties with ESA listed salmonids will need to increase habitat protections. Development that degrades floodplain functions includes: clearing of native riparian vegetation; increases in impervious surface; displacement or reduction of flood storage via fill or structures; interruption of habitat forming process; increases of pollutant loading in receiving water bodies; and increases in stormwater. The new expectations will be described by FEMA guidance, which will be drafted over the next several months. (http://www.oregon.gov/LCD)

#### **Development in the Watersheds**

The *Salem-Keizer Housing Needs Analysis*, dated December 2014, estimates a population increase within the Salem-Keizer UGB will grow from 210,035 people in 2015 to 269,274 people in 2035, adding 59,239 people over the 20-year period (page 15). The analysis shows that Salem has approximately 5,300 acres of buildable residential land, where approximately 1,700 acres is considered surplus land.

Similarly, the *Salem Economic Opportunities Analysis* also estimates that a majority of the buildable nonresidential land in the Salem UGB will be developed by 2032.

The *Stormwater Master Plan* describes the size of each drainage basin within Salem, the portion located within the UGB, and its potential for development (based on development patterns and urban/rural land use) as indicated in **Table 5.** 

Watershed	Size (Sq Miles)	Ratio within UGB	Development Potential
Battle Creek	10.0	33%	High
Croisan Creek	4.9	50%	High
East Bank	2.0	100%	Low
Glenn Gibson	10.4	50%	High
Little Pudding	9.1	Not specified	Medium
Lower Claggett	1.5	Not specified	Low
Mill Creek	110	8%	Medium
Pettijohn Laurel	2.6	Less than 50%	Low
Pringle Creek	13.3	100%	Medium
Upper Claggett	7.4	100%	Low
West Bank	2.3	Nearly 100%	Medium
Willamette Slough	4.8	Not specified	Low

Table 5: Watershed Potential for Development

The *Stormwater Master Plan* analyzed stormwater flows based on anticipated flows within 20 years of creation of the plan. However, 100-year inundation maps were not created as part of the 2000 plan. The updated Stormwater Master Plan is anticipated to include inundation maps, first for the Battle Creek Basin, then subsequently for the Mill and Pringle Creek basins.

#### **Climate Change**

*The Third Oregon Climate Assessment Report*, dated January 2017, by the Oregon Climate Change Research Institute summarizes recent literature on climate change science and impacts as it relates to the state of Oregon. Precipitation projections vary based on the excerpts below:

Annual precipitation is projected to increase slightly, although climate scientists have less confidence in precipitation projections than temperature projections. Summers are expected to warm more than the annual average and are likely to become drier. Extreme heat and extreme precipitation events are expected to become more frequent. In many respects, 2015 was a notable year in its record warmth and snowpack drought that resembles what climate model projections indicate would be normal conditions by middle of this century (page 4).

Likewise, averaged over the Pacific Northwest, there was no significant trend in annual precipitation from 1901–2012, although a positive trend was noted for spring. Interannual-to-decadal variability dominated any long-term signal in precipitation. Future precipitation trends are expected to continue to be dominated by large natural variability (fig. 2.3). Still, annual precipitation in Oregon is projected to increase on average by 1.9% by the 2050s, and 3.4% by the 2080s under the low emissions pathway. Under the high emissions pathway, increases in annual precipitation are a bit larger for each time period: 2.7%, and 6.3%, respectively. However, the range of responses from individual global climate models surrounds zero (table 2.3). Larger changes are projected for seasonal precipitation. Oregon's already dry summers are projected to become drier while winter, spring, and fall are projected to become wetter, albeit some models project increases and others project decreases in each season (page 9).

#### **Other Natural Hazards**

The *City of Salem Natural Hazard Mitigation Plan* (NHMP), dated December 11, 2017, describes all natural hazards that affect Salem in addition to flooding. The NHMP includes detailed descriptions of the severity of each hazard, history of past events, and the probability of future events in the Risk Assessment portion of the plan. The following hazards are addressed in the plan:

- Drought
- Earthquake
- Extreme heat
- Flood
- Landslide
- Wildfire
- Volcano
- Windstorm
- Winter storm
- Hazardous materials incident

For the Plan Updated purposes, the committee recommends referencing Section 2: Risk Assessment of the adopted NHMP for more detailed information on each hazard.

# **PROBLEM EVALUATION**

Vulnerability to all hazards is addressed in the NHMP, which assesses Salem to be highly vulnerable to and highly probable of experiencing flood hazards. This chapter evaluates flooding problems related to life safety, public health, critical facilities and infrastructure, economy and major employers, damage to buildings and natural areas, land development impacts, and potential for increased flooding.

## Life Safety

The most immediate threats to life safety are flash floods on Salem's smaller waterways, especially the Battle Creek and Glen-Gibson Creek systems. These waterways can reach flood stage in a matter of hours, so immediate warning systems and prompt evacuation procedures are critical to life safety. Flood-prone properties along Battle Creek, Gibson Creek, and the upper reaches of Pringle and Glen Creeks have mostly residential uses. Land along lower reaches of Glen Creek are primarily commercial developments; properties at the lower reaches of Pringle Creek have a variety of land uses.

The Mill Creek system (including Shelton Ditch) poses the greatest flood hazard citywide, encompassing a significant portion of central and southeast Salem. Because of the size of Mill Creek's watershed, flash flooding is not a significant hazard. Water levels rise gradually, providing adequate response time for flood warning systems and evacuation. However, floods along Mill Creek have a longer duration, which cause additional impacts to life safety and property damage.

Through a FEMA-funded grant awarded after the 2012 floods, new monitoring infrastructure in the Mill Creek watershed was installed and completed in the fall of 2014. The expansion and upgrades to the existing gauging network were critical to the development of an automated alerting system and hydrologic forecasting model. The development of a new Flood Warning System for Salem provides operational response staff and emergency managers with valuable information to aid in the warning and evacuation of residents and visitors. Warning and evacuation measures have been updated and detailed in the adopted *Salem Emergency Management Plan* and *Salem Flood Warning and Response Plan*.

Life safety is a vital concern when flood events interrupt a number of critical transportation corridors throughout Salem. Emergency vehicles can be delayed because of restricted mobility in flooded areas. Major streets that may likely be closed during flood events include those indicated in **Table 6**.

Classification	Street Names
Parkway	Mission Street SE
Major Arterial	Center Street NE State Street Capitol Street NE/SE 12th Street NE/SE Hawthorne Avenue NE/SE Summer Street NE Madrona Avenue SE 25th Street SE McGilchrist Avenue SE River Road
Minor Arterial	17th Street NE/SE Airport Road SE Broadway Street NE Glen Creek Road NW Orchard Heights Road NW Fairview Industrial Drive SE Turner Road SE
Collector	Airway Drive SE Croisan Creek Road S D Street NE Fairway Avenue SE Oxford Street SE Hines Street SE 22nd Street NE/SE Rural Street SE Cross Street SE

Table 6: Critical Transportation Corridors Affected by Flooding

# Public Health

The Centers for Disease Control and Prevention warn that floodwaters pose a variety of health risks, including exposure to infectious diseases, chemical hazards, and injuries. Flood waters can become contaminated with bacteria and hazardous chemicals which pose risk of disease through physical contact, ingestion, or open wounds. Floodwaters pose risk of physical injury from floating objects and damaged electrical power lines. Floodwaters, especially when rapidly moving, also pose risk of drowning.

Floodwaters can also cause indirect health risks. Animals can be displaced during flooding and pose a risk to public health. Standing water during and after a flood

can increase insect populations, posing an additional risk to insect-borne diseases. If clean-up efforts are delayed after flood events, water-damaged buildings can collect mold, which is a significant health concern to building occupants. Many of these indirect public health concerns can be reduced after flood events by expediting repair of water-damaged buildings and other cleanup efforts.

# Critical Facilities and Infrastructure

The City of Salem Natural Hazard Mitigation Plan states:

Critical facilities (i.e. police, fire, and government facilities), housing supply and physical infrastructure are vital during a disaster and are essential for proper functioning and response. The lack or poor condition of infrastructure can negatively affect a community's ability to cope, respond and recover from a natural disaster. Following a disaster, communities may experience isolation from surrounding cities and counties due to infrastructure failure. These conditions force communities to rely on local and immediately available resources (page 2-62).

Virtually all state and city roads and bridges in Salem are vulnerable to multiple hazards including flood, landslide, and earthquake. Impacts to the transportation system can result in the isolation of vulnerable populations, limit access to critical facilities such as hospitals and adversely impact local commerce, employment, and economic activity (page 2-63).

Fourteen critical facilities are located within the regulatory floodplain, totaling approximately \$930 million in improvement value. Salem Hospital is a critical facility that can be substantially impacted during flood events, since vehicular access to the facility can be limited by street closures surrounding the hospital. Salem has also identified approximately 200 essential facilities (i.e. schools, residential care facilities, daycares, record retention facilities, hazardous waste storage, etc.) in the regulatory floodplain. City staff coordinates contact and flood response planning efforts with both critical and essential facilities. A critical and essential facilities database is maintained in the Salem Emergency Operations Center Situational Awareness Framework for Events (SAFE) system.

In the January 2012 flood event, City public infrastructure damage was estimated at approximately \$10 million. The majority of damage, \$7.5 million, was to vehicular bridges; other damage included City-owned parks, buildings, streets, and water, wastewater, and stormwater facilities. The January 2012 event was somewhat localized to the Battle Creek and Mill Creek basins; however, the potential damage to critical facilities and infrastructure city-wide is significant.

# Economy and Major Employers

A number of employment centers are located within the regulatory floodplain. The Pringle Creek floodplain area includes industrial employment areas in the vicinity of McGilchrist Street SE and Salem Memorial Hospital, one of Salem's largest employers. Mill Creek can overflow into Salem Airport, which would potentially restrict air traffic, and the overflow can continue through industrial employment areas west of 25th Street SE, including the City Operations Complex. In West Salem, the Willamette River causes flooding in commercial areas along Wallace Road NW and Edgewater Street NW.

Transportation impacts during flood events can cause significant economic impacts. Major transportation corridors can be closed by high water, restricting commercial traffic. The most significant transportation impacts involve the potential closure of arterial streets, including the Wallace/Edgewater intersection, Mission Street SE, Center Street NE/SE, State Street, and River Road S.

# Types of Affected Buildings

Approximately 3,190 buildings are located within the City's regulatory floodplain. **Table 7** shows the zoning designation and the number of structures in the regulatory floodplain.

Zoning Designation	Number of Structures
Critical Facilities (All Zones)	14
Commercial	274
Industrial	364
Public	120
Residential	2,417
Mixed Use	1

Table 7: Improvement Values of Buildings Within the Floodplain

As shown in Table 7, buildings zoned residential comprise approximately 70 percent of buildings in the floodplain. In addition to structural and life-safety impacts, flooding in residential areas can also result in the need for temporary shelters to house displaced residents.

All City-owned buildings are protected by flood insurance policies, whether or not they are located within the floodplain. Among the publicly-owned properties, the City of Salem owns approximately 114 buildings that are located in the regulatory floodplain. The general uses of those buildings are tabulated in **Table 8**.

Use of City-Owned Building	Number of Buildings
Airport	14
Fire	10
General	13
Housing Authority	21
Library	1
Parks	23
Transportation	14
Utility	18

Table 8: City-Owned Buildings

# Flood Insurance Claims

FEMA records show that 197 flood insurance claims in the Salem community have been filed prior to 2011, totaling nearly \$3.4 million. The claim payments paid for significant flood damages are tabulated in **Table 9**.

Date of Flood Damage Total Claims			
February 1996	\$901,000		
November 1996	\$587,000		
November 1998	\$101,000		
June 2000	\$92,000		
January 2012	\$1,589,000		
December 2015	\$59,000		

Table 9: Claim Payments

Of those claims listed above, approximately \$325,000 in claims were paid to owners of properties in the Salem Industrial Drive NE area. No claims have been paid in the Salem Industrial Drive NE area since 2003, so the improvements in the vicinity of Claggett Creek in 2007 may have mitigated the potential for further flood damage.

Approximately \$382,000 in claims have been paid to owners of properties in the Bellevue Street SE area; the latest claim was filed in 2012. Improvements made in 2015 to the Winter Street Bridge along Shelton Ditch may have mitigated the flooding concerns in this repetitive loss area.

There are two new areas of repetitive loss claims that have been identified since the original adoption of the Floodplain Management Plan. These areas, including State Street and Marstone Court SE, have been paid claims of approximately \$142,000 due to flood damage caused by the January 2012 and December 2015 flood events. These areas were recently identified in 2016 data provided to the City, and will be assessed for possible mitigation projects.

## Natural Areas

The City of Salem Natural Hazard Mitigation Plan states:

The capacity of the natural environment is essential in sustaining all forms of life including human life, yet it often plays an underrepresented role in community resiliency to natural hazards. The natural environment includes land, air, water, and other natural resources that support and provide space to live, work and recreate. Natural capital such as wetlands and forested hill slopes play significant roles in protecting communities and the environment from weather-related hazards, such as flooding and landslides. When natural systems are impacted or depleted by human activities, those activities can adversely affect community resilience to natural hazard events....

The primary river that flows through Salem is the Willamette River; other important streams that pass through are Mill Creek, the Mill Race, Pringle Creek, and the Shelton Ditch. Smaller streams in the eastern part of the city include Clark Creek, Jory Creek, Battle Creek, Croisan Creek and Claggett Creek, while Glen Creek and Brush Creek flow through West Salem. These streams frequently flood, and while this can provide natural benefits, flooding can inflict personal injury and property damage. (Oregon Partnership for Disaster Resilience, City of Salem Natural Hazards Mitigation Plan, University of Oregon's Community Service Center, Eugene, Oregon, 2012, pages 4-28–4-29.)

(See Map 4 on page 31.)

A detailed study of natural areas in the Pringle Creek basin is included in the *Pringle Creek Watershed Management Plan*, and this analysis provides a reasonable summary for much of the Salem community.

Wetlands and Floodplains – Riparian areas, adjacent wetlands and local floodplains are important drainage features in a watershed because they decrease flood volumes and rates of flow. Well-vegetated riparian areas may also store floodwaters, thereby reducing associated flood damage downstream. Furthermore, the natural capacity of a watershed to manage flood events is reduced when channelization occurs, impervious surfaces increase and wetlands are filled in. (HDR Engineering Inc. and



# Map 4: Open Spaces in Floodplain

*Barney and Worth, Inc.,* Pringle Creek Watershed Management Plan, 2008, Section 4.1.3, page 4-3.)

# Impacts of Land Development

Based on hazard assessment information, three creek systems appear to be most vulnerable to future development: Battle Creek, Pringle Creek, and Croisan Creek:

- Battle Creek has a high potential for development and has experienced significant impacts from major flood events in both 1996 and 2012. Impacts of urbanization are limited because two-thirds of the watershed is located outside the UGB. Flood impacts within the basin affect mostly residential properties.
- Pringle Creek has a medium potential for development and has high impacts from urbanization because 100 percent of the watershed is located within the UGB. The *Pringle Creek Watershed Management Plan, Section 3.1* states, "Estimates of current imperviousness in the Pringle Creek watershed range from 19 to 25 percent according to the City of Salem's Impervious Surface Report. With over 20 percent of the watershed already covered with impervious surface, Pringle Creek ranks as an 'impacted stream' according to the index proposed by Schueler (1994). Future development will easily push this stream into the 'non-supporting' category. Imperviousness is projected to ultimately increase to approximately 52 percent." These changes in imperviousness could have a considerable impact on future flood flows.
- Croisan Creek has a high potential for development with 50 percent of the watershed located within the UGB. Existing commercial and residential developments along River Road S are the most likely properties to be impacted by development within the basin, though those impacts will not be known until further study.

Other creek systems have a low potential for impact and are not expected to see significant changes as a result of future development.

# Potential for Increased Flooding

The hazard assessment identified three potential sources of increased flooding: (1) changes in floodplain development; (2) development in the watersheds; and (3) climate change. Potential impacts from these sources of increased flooding are as follows:

#### **Changes in Floodplain Development**

The development requirements within floodplains are contained in *Salem Revised Code Chapter 601*, Floodplain Overlay Zones. The current ordinance restricts most development in floodways unless an engineered analysis demonstrates no increase in flood levels. Development within floodplains is allowed as long as buildings are constructed to minimize flood damage.

Based on past development patterns and the current floodplain overlay ordinance, development in the future will reduce available flood storage as fill is placed in floodplains. Ultimately, this development will not increase flood elevations more than one foot. New buildings are required to be elevated a minimum of one-foot above base flood elevation, so new buildings are not at measurably increased risk of flooding because of development in floodplains. However, existing buildings constructed under earlier regulations may experience additional flood hazards over time as floodplains are filled and developed. These impacts are not known until further study.

#### **Development in the Watersheds**

The Developable Land Analysis in the Hazard Assessment Chapter showed that three creek systems—Battle Creek, Pringle Creek, and Croisan Creek—are most vulnerable to potential impacts of future development within the watershed. These impacts are anticipated to be addressed in the future update to the *Stormwater Master Plan*. As a result, the impacts of development upon each watershed and future inundation areas are expected to be identified in the future *Stormwater Master Plan* update.

#### **Climate Change**

The Third Oregon Climate Assessment Report, dated January 2017, by the Oregon Climate Change Research Institute summarizes the flood-related impacts from climate change as follows: "Annual precipitation is projected to increase slightly, although climate scientists have less confidence in precipitation projections than temperature projections."

Additional study is needed to determine how potential climate changes could be factored into flood studies to identify changes in base flood elevations.

# **SETTING GOALS**

The Floodplain Management Advisory Committee was presented with two options for setting goals: (1) adopt distinct goals for the Plan Update; or (2) adopt the same goals as the *City of Salem Natural Hazard Mitigation Plan*. The committee elected to adopt the NHMP goals for the Plan Update. The goals are listed in **Table 10** below.

Goal Number	Description
1	Develop and implement mitigation activities to protect human life.
2	Protect existing buildings and infrastructure as well as future development from the impacts of natural hazards.
3	Strengthen communication and coordination of public and private partnerships and emergency services among local, county, and regional governments and the private sector.
4	Enhance economic resilience to reduce the impact on the local economy.
5	Preserve and rehabilitate natural systems to serve natural hazard mitigation functions and protect natural resources.

Table 10: Floodplain Management Plan Goals

**Table 11** on page 35 illustrates which plan goals address the issues identified in the chapter titled "Problem Evaluation."

Flood-Related Problem	Goal 1	Goal 2	Goal 3	Goal 4	Goal 5
Life Safety	Х				
Public Health	Х				
Critical Facilities and Infrastructure	Х	Х	Х		
Economy and Major Employers		Х		Х	
Buildings		Х			
Natural Functions			Х		Х
Impacts of Land Development		Х	Х		
Potential for Increased Flooding		Х	Х		Х

Table 11: Flood-Related Problems

# REVIEW OF POSSIBLE ACTIVITIES

# **Effectiveness of Existing Regulations**

Existing regulations were analyzed as part of selecting potential activities. Analysis of regulatory codes and plans is as follows:

- Comprehensive Plan–The goals of this Plan are consistent with the policies in the comprehensive plan related to Section N. "Scenic and Historic Areas, Natural Resources and Hazards." No activities were proposed that relate to changes to the Comprehensive Plan.
- Building Code–Activity 21 (protect new buildings from shallow flooding) was selected because building code provisions are not sufficient to attain maximum CRS local drainage protection credits. Activity 81 (Equipment freeboard) was proposed because building code provisions do not meet CRS Class 4 prerequisites.
- Zoning Code–Parks and open space are allowed uses in many zoning classifications. Planned Unit Development criteria in SRC 210.025(d)(2)(D) includes provision for "Common open space that will preserve significant natural or cultural features." The South Waterfront Zone includes building setbacks from Pringle Creek. Activity 41 (Riparian setback) was proposed to modify riparian buffer requirements.
- Subdivision Ordinance–SRC 205.045 includes special standards for conservation lots or parcels. Subdivision approval criteria requires compliance with floodplain development standards. No activities were proposed that relate to changes to the subdivision code.
- Floodplain Overlay Zone–Ordinance Bill 17-15 was adopted by Council in 2015, amending the floodplain overlay zone to prohibit first-floor enclosures. Activity 11 (Oregon model ordinance) was proposed to ensure statewide consistency in floodplain ordinances. Activity 80 (Compensatory storage) was proposed as an ordinance change to limit fill in flood prone areas. Activity 81 (Equipment freeboard) was proposed because the floodplain overlay zone does not meet CRS Class 4 prerequisites.

 Stormwater Ordinance–Ordinance Bill 28-13 was adopted by Council in 2013, creating a new Salem Revised Code Chapter 71 dedicated solely to stormwater management. Activity 83 (Design Storms) was proposed because the stormwater ordinance does not meet CRS Class 4 prerequisites.

The overall floodplain management program—with its regulations, standards, and procedures—has succeeded in earning the City a class 5 CRS rating. Major adjustments are not warranted in order to address issues raised in the Problem Assessment chapter. The criteria described below provide a numerical basis for determining the benefit-to-cost ratio to make minor program improvements and maximize reduction of future flood losses.

#### **Current and Future Conditions**

The Stormwater Ordinance requires the use of low-impact development techniques through installation of green stormwater infrastructure. These techniques reduce the potential for additional runoff resulting from future development conditions. The existing Stormwater Master Plan addresses current and future conditions, but is out of date and in the process of being updated. Once the Stormwater Master Plan Update is complete, additional information will be available regarding current and future conditions. Future plan updates will likely consider new activities as identified in the updated Stormwater Master Plan.

#### **Activity Selection Criteria**

**Appendix F** includes the original 78 activities that were considered by the Floodplain Management Advisory Committee to prevent or reduce flood-related problems. These activities included a variety of floodplain management categories: regulatory standards, preventive activities (PA), property protection (PP) activities, natural resource (NR) protection activities, emergency services (ES) measures, structural projects (SP), and public information (PI) activities. The activities were selected from Appendix F of the 2013 Floodplain Management Plan along with additional activities recommended by the advisory committee. The activities that are included in the action plan for the Plan Update are described in Appendix G.

Criteria were adopted to aid the committee in ranking the effectiveness of each activity. The criteria included a scoring system for anticipated costs and potential benefits. Costs included available funds, available staff resources, and negative impacts to key stakeholders in the community. Potential benefits included activities that were already required or adopted in another plan, reduced cost or liability, enhanced livability, improved safety and CRS-creditable activities.

The additional criteria resulted in a numerical scoring system that ranked all potential activities. The committee then reviewed all activities to confirm that the numerical ranking was appropriate. The advisory committee generally recommended or rejected potential activities based on their benefit-to-cost ratio. This selection process ensures that funding is available or achievable for selected activities.

# **ACTION PLAN**

# **Review of Prior Action Plan Items**

The 2013 Floodplain Management Plan included 30 action items. Of those activities, five were one-time endeavors that have been completed and have not been considered in this Plan Update. Seventeen of the Action Plan items were activities that were partially or fully completed, but have been selected in this Plan Update. The remaining eight Action Items were not completed. Six of those eight remaining activities have been selected in this Plan Update. The explained below:

- The activity titled "Investigate FEMA's Cooperating Technical Partnership program" was completed, but resulted in a decision not to enroll in the program. This decision was based on the results of the Council subcommittee that analyzed flood mapping options based on Stormwater Master Plan technical data.
- The activity titled "Implement Riparian Action Plan" was deemed obsolete because it was based on an informal report adopted by City Council in 2009.

# Updated Action Plan Items

A detailed description of each Action Plan item is included in **Appendix G** as tabulated below in **Table 12**. Item numbers reflect the general floodplain management category of each activity: preventive activities (PA), property protection activities (PP), natural resource protection activities (NR), emergency services measures (ES), structural projects (SP), and public information activities (PI). The prioritization of each action plan item depicted in the "Time Line" column, which varies in implementation from zero to five years. Responsibility for implementation and availability of funding is included in Appendix G.

lton #	Description	Time Line	Goals					
item #	Description		1	2	3	4	5	
PA1	Maintain benchmark data	Ongoing		Х	Х			
PA2	Inspect and clean streams and stormwater facilities annually	Ongoing		х			х	
PA3	Establish Stormwater Master Plan policies to reduce peak flows during 100-year flood events	0–2 years	х	х				
PA4	Promote low impact development practices in development and redevelopment projects	Ongoing				х	х	
PA5	Create 100-year inundation maps using data from Stormwater Master Plan	0–2 years		х			х	
PA6	Adopt Oregon model floodplain management ordinance	0–2 years			х			
PA7	Provide additional staff training in administering regulations	0–2 years		х	х	х		
PA8	Coordinate stormwater and flood management regulations with communities and organizations that share Salem's watersheds	Ongoing			Х			
PA9	Improve program for periodic site inspections of existing development within the floodplain	Ongoing	х	х				
PA10	Modify floodplain ordinance to require 1-foot freeboard for equipment servicing buildings	0–2 years		х		х		
PA11	Update stormwater ordinance to manage runoff from all storms up to and including the 100-year event	0–2 years	х	х	х	х		
PA12	Protect buildings from shallow flooding	3–5 years		Х		Х		

Table 12a: Action Plan Items

	Description	Time Line	Goals						
Item #			1	2	3	4	5		
PP1	Improve floodplain protection assistance program	Ongoing		х		х			
PP2	Implement Flood Insurance Plan	Ongoing		Х		Х			
PP3	Acquire easements for public and private stormwater facilities	Ongoing		х					
PP4	Investigate financial assistance program for Elevation Certificates and Letter of Map changes	0–2 years		х		х			
PP5	Analyze repetitive loss areas	0–2 years		Х		Х			
NR1	Provide grant funding for restoration projects in riparian areas	Ongoing					х		
NR2	Amend <i>Salem Revised Code</i> to implement provisions of the <i>Endangered Species Act</i> as they relate to floodplain development	0–2 years			х		х		
NR3	Enhance natural functions for City-owned properties in the floodplain	Ongoing					х		
NR4	Form Watershed Planning Committee	3–5 years			Х	Х	Х		
NR5	Develop and maintain watershed management plans	0–2 years			х		х		
NR6	Streamline process to accept land donations to City for natural areas	3–5 years					х		
NR7	Increase quality and quantity of vegetative cover	Ongoing					Х		
ES1	Implement emergency response plans for critical facilities	Ongoing	Х		х				
ES2	Create post-flood procedures for gathering flood data	3–5 years	Х	х	х				
ES3	Improve flood warning and response	Ongoing	Х		Х				
ES4	Investigate dam failure threat to Salem and prepare plan	0–2 years	Х	Х	х				
ES5	Create a levee inventory	0–2 years	Х	Х					
ES6	Modify questionnaires that are used during flood events to improve data	3–5 years		Х					
ES7	Investigate development of incentives for critical facilities and industries in the floodplain to develop flood warning and response plans	3–5 years	х	х					
ES8	Implement post-disaster mitigation policies from the Emergency Management Plan		х	х	х				
SP1	Construct stormwater capital improvement projects	Ongoing	х	х					
SP2	Include damage assessments from Natural Hazard Mitigation Plan as a criteria for prioritizing CIP projects	0–2 years		х		Х			

ltem #	Description	Time Line	Goals					
			1	2	3	4	5	
SP3	Construct capital improvement projects to improve stream banks	Ongoing		Х			х	
SP4	Update Stormwater SDC methodology consistent with Stormwater Master Plan to provide funding for capital projects	0–2 years	х	х		x		
PI1	Require hazard disclosure in real-estate transactions	0–2 years				Х		
PI2	Create and implement a Program for Public Information	2–5 years		Х	х			
P13	Improve information on City website regarding floodplain management as needed to improve CRS rating	Ongoing		х		х		
P14	Coordinate floodplain management outreach efforts with the City's stormwater program implementation activities	0–2 years			х			
P15	Compile and improve outreach materials to guide property owners in planting and habitat restoration of flood-prone properties	3–5 years		х			х	
P16	Improve information on City website regarding planting and habitat restoration along waterways	3–5 years		х			х	
P17	Improve information on City website regarding protection of tree canopy for reducing stormwater runoff	3–5 years		х			х	

Table 12b: Action Plan Items

# Adoption

Prior to the public comment period, a draft version of the Plan Update was included as an information item on the City Council agenda for April 9, 2018. Upon incorporating comments into the draft document, the final Plan Update was adopted by City Council under Resolution 20XX-XX on April XX, 2018.

# Plan Evaluation and Update

In order to be implemented effectively, the *Floodplain Management Plan* will be regularly monitored and evaluated. The Public Works Director will oversee the implementation and evaluation of the *Floodplain Management Plan* with assistance the Floodplain Management Plan advisory committee or equivalent. The advisory committee will hold annual meetings at a minimum but may meet more frequently, as warranted, to effectively monitor progress of the plan implementation. An annual evaluation report will be submitted as an information report to City Council, made available to the media, and posted on the City's website.