

COMPREHENSIVE PLANNING FOR FLOOD HAZARD MANAGEMENT: A GUIDEBOOK



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A guidebook prepared by the Department of Ecology for local governments preparing comprehensive flood control management plans under Chapter 86.26 RCW and Chapter 173-158 WAC.

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The cover photo shows an aerial view of the Skagit River. The photo is licensed under a [Creative Commons license](#).

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ACRONYMS AND ABBREVIATIONS

1D	One dimensional
2D	Two dimensional
ADA	Americans with Disabilities Act
BCA	Benefit-Cost Analysis
BCR	Benefit-Cost Ratio
BiOp	Biological Opinion
BRIC	Building Resilient Infrastructure and Communities
CEQ	Council on Environmental Quality
CFCMP	Comprehensive Flood Control Management Plan
CFHMP	Comprehensive Flood Hazard Management Plan
CFM	Certified Floodplain Manager
CFR	Code of Federal Regulations
cfs	cubic feet per second
CIG	University of Washington Climate Impacts Group
CMZ	Channel Migration Zone
Corps	U.S. Army Corps of Engineers
CRS	Community Rating System
DEM	Digital Elevation Model
EA	Environmental Assessment
Ecology	Washington State Department of Ecology
EHP	Environmental and Historic Preservation
EIS	Environmental Impact Statement
EMD	Washington Emergency Management Division
EPA	U.S. Environmental Protection Agency
ERS	Environmental Review Section
ESA	Endangered Species Act
FbD	Floodplains by Design
FCAAP	Flood Control Assistance Account Program
FCZD	Flood Control Zone District
FEMA	Federal Emergency Management Agency
FIRM	Flood Insurance Rate Map
FIS	Flood Insurance Study
FMA	Flood Mitigation Assistance
FONSI	Finding of No Significant Impact
FY	Fiscal Year
GMA	Growth Management Act

HEAL	Healthy Environment for All
HMGP	Hazard Mitigation Grant Program
HPA	Hydraulic Project Approval
HSPF	Hydrologic Simulation Program-Fortran
IFM	Integrated Floodplain Management
LID	Local Improvement District
LiDAR	Light Detection and Ranging
LOMR	Letter of Map Revision
LOS	level of service
NEPA	National Environmental Policy Act
NFIP	National Flood Insurance Program
NMFS	National Marine Fisheries Service
NOAA	National Oceanic & Atmospheric Administration
NOFO	Notice of Funding Opportunity
NORFMA	Northwest Regional Floodplain Management Association
NPDES	National Pollutant Discharge Elimination System
NPS	National Park Service
NWIFC	Northwest Indian Fisheries Commission
OHWM	Ordinary High Water Mark
PAS	Planning Assistance to States
PL	Public Law
RCW	Revised Code of Washington
Risk MAP	Risk Mapping, Assessment, and Planning
RPA	Reasonable and Prudent Alternative
SBC	State Building Code
SEPA	State Environmental Policy Act
SFHA	special flood hazard area
SMA	Shoreline Management Act
SMP	Shoreline Master Program
SWIF	System Wide Improvement Framework
TMDL	Total Maximum Daily Load
U.S.C.	United States Code
UBC	Uniform Building Code
USFWS	United States Fish and Wildlife Service
USGS	United States Geological Survey
WAC	Washington Administrative Code
WDFW	Washington Department of Fish and Wildlife
WRIA	Water Resource Inventory Area
WWHM	Western Washington Hydrologic Model

CHAPTER 1: COMPREHENSIVE FLOOD HAZARD MANAGEMENT PLANNING PRINCIPLES AND LEGISLATIVE OVERVIEW

1.1 Purpose

The purpose of this guidebook is to assist local governments in preparing Comprehensive Flood Hazard Management Plans (CFHMPs) that address flood hazard management needs, comply with state laws, and enable communities to compete for project grants. It is designed for use by planning and public works departments or other local officials to develop CFHMPs for cities, towns, counties, Tribes, conservation districts, or special purpose districts (such as flood control districts).

The Washington State Department of Ecology (Ecology) first developed guidance for comprehensive flood planning in 1991, which local jurisdictions used to develop CFHMPs with funding from the Flood Control Assistance Account Program (FCAAP) from 1991 to 2009 (Ecology, 1991). This 2021 guidance document builds on the information included in the 1991 document. While many of the principles and steps for comprehensive flood planning in the 1991 document remain relevant, the many changes in flood hazard planning since it was written require consideration and integration into successful comprehensive flood hazard management planning. Those changes include:

- The listing of salmon species under the Endangered Species Act (ESA).
- Increased understanding of tribal rights, including treaty rights.
- Increased understanding of the projected impacts of climate change on flood hazards, including increases in sea level, winter streamflows, heavy precipitation events, and sediment transport, all of which will require a more resilient flood hazard management system.
- Increased focus on environmental justice, diversity, equity, and inclusion, inscribed into state law with the passage of the Healthy Environment for All (HEAL) Act as Senate Bill 5141 in 2021.
- The failure of traditional structural flood control approaches, which have degraded habitat and disrupted natural processes while failing to curb ever-increasing flood damages.
- The broader application of the Integrated Floodplain Management approach.

Section 1.4 of this guidebook describes 14 key principles of comprehensive flood hazard management to guide the development of CFHMPs that address flood safety as well as the factors listed above. As described in Section 1.4, comprehensive flood hazard management requires a **focus on non-structural alternatives and ecological restoration** to be successful in addressing flood safety and meeting other requirements and needs facing communities in Washington State. Non-structural measures are those that “adjust human activities to accommodate nature’s flooding in an effort to reduce flood damages to human built infrastructure” (ASFP, 2003). Non-structural measures include acquisition, relocation, elevation, floodproofing, land use, and zoning regulations, floodplain mapping, emergency action plans, and flood warning.

This guidebook is organized into eight chapters and two appendices.

- **Chapter 1** introduces this guidebook and identifies the major principles of comprehensive flood hazard management planning. It describes the Washington State Legislative framework for flood planning and recommends a schedule for periodic updates of this guidebook.

- **Chapter 2** describes the procedures for initiating a Comprehensive Flood Hazard Management Plan.
- **Chapter 3** describes the contents of a Comprehensive Flood Hazard Management Plan, including two CFHMP table of contents examples.
- **Chapter 4** defines Integrated Floodplain Management (IFM), provides an IFM checklist, and discusses scalable approaches to IFM.
- **Chapter 5** outlines related programs and grants.
- **Chapter 6** discusses tribal rights, including treaty rights, and their relationship to flood hazard management and flood planning.
- **Chapter 7** provides a process to guide the reader through preparing a comprehensive CFHMP and is broken up into 14 separate steps.
- **Chapter 8** lists the references and source material used to prepare this guidebook.
- **Appendix A: Regulatory Programs** describes regulatory programs that relate to flood hazard management and that should be considered when developing a CFHMP.
- **Appendix B: Resources for Flood and Ecological Restoration Information** includes a set of links to resources that can support the development of a CFHMP.

1.2 Flooding in Washington State

In 1991, in [Engrossed Substitute Senate Bill 5411](#), the Washington State Legislature found that:

(a) Floods pose threats to public health and safety including loss or endangerment to human life; damage to homes; damage to public roads, highways, bridges, and utilities; interruption of travel, communication, and commerce; damage to private and public property; degradation of water quality; damage to fisheries, fish hatcheries, and fish habitat; harm to livestock; destruction or degradation of environmentally sensitive areas; erosion of soil, stream banks, and beds; and harmful accumulation of soil and debris in the beds of streams or other bodies of water and on public and private lands;

(b) Alleviation of flood damage to property and to public health and safety is a matter of public concern;

(c) Many land uses alter the pattern of runoff by decreasing the ability of upstream lands to store waters, thus increasing the rate of runoff and attendant downstream impacts; and

(d) Prevention of flood damage requires a comprehensive approach, incorporating stormwater management and basin-wide flood damage protection planning.

Flooding is one of the top causes of damage in Washington State, with nearly 30 Presidential Disaster Declarations for flooding since 1953. In Washington, the costs of flooding exceed all other natural hazards (EMD, 2018). There is over an 80% chance that 10 or more flood events will happen in any given year in the state, and the frequency of events will increase as the climate changes (Ecology, 2021). Several types of floods occur across the state's diverse geography. In Western Washington, floods typically result from prolonged winter rains. In Eastern Washington and in the

Cascades, spring snowmelt and rain-on-snow events are the primary causes of flooding. Coastal storm surges, king tides, overwhelmed storm drains, flash floods, ice jam and debris blockages, and channel migration are also potential sources of damage. Cleaning up after a flood costs more than taking measures to prevent flood damage (Ecology, 2021).

Washington Rivers and coastal areas and their floodplains deliver a wealth of economic, natural, and cultural benefits to our communities. Yet flood hazard management has not kept pace as our communities have grown and floodplains areas have continued to be developed. People are living in the path of floodwaters, our water quality is on the decline, and habitat needed for salmon populations to spawn and rear is disappearing. Conflicts between floodplain land uses have challenged floodplain managers' ability to address these interrelated issues. Comprehensive flood hazard management is critical to addressing the delicate balance between flood risk reduction, resource protection and restoration, existing and potential land use, and equity.

Historically, flood hazard management focused on flood control: containing flow within river channels and rapidly clearing floodwaters. This manifested as large flood control dams and channel alteration projects that disconnected rivers from their natural floodplains and watersheds. The earliest flood hazard management strategies were implemented in the late nineteenth and early twentieth centuries and commonly involved massive physical alteration to river corridors. Measures included re-channelization or straightening river alignments as well as removing snags (large woody material) from river channels. These strategies focused on improving flood conveyance and drainage efficiency but were often accompanied by a severe loss of riparian habitat and adverse impacts on natural geomorphic processes. As the region developed, more structural flood hazard management strategies were implemented by various local, state, and federal agencies, including the construction of levee systems and flood control dams as well as periodic dredging of river channels. Again, these strategies were often implemented at a cost to both habitat and interruption of natural river processes, which were not well understood at the time.

The cumulative damage from past flood hazard management strategies has been correlated to degraded habitat and is most evident in the ESA listing of several salmonid species and populations throughout the state. Further, a 2008 Biological Opinion on the National Flood Insurance Program (NFIP) from the National Marine Fisheries Service (NMFS) directly linked traditional flood damage reduction approaches in the Puget Sound watersheds to these ESA listings and required floodplain managers to address impacts through their flood damage reduction programs. These conditions have spurred a reassessment of flood hazard strategies and resulted in changes to regional Federal Emergency Management Agency (FEMA) floodplain management regulations and procedures (see Appendix A).

In recent decades, flood hazard management has shifted toward a more holistic approach, considering multiple objectives and thinking in terms of flood management strategies that work with natural processes (including floodplain storage and channel migration) to limit flood damage while protecting ecological functions. This represents a philosophical evolution from viewing floods as a hazard to contain and defend against, to viewing them as an important natural process that can be accommodated by giving the river space (within a defined corridor) and providing protections for necessary human infrastructure in affected areas. Best practices now consider the latter perspective to be the most cost effective in the long term and to be the best approach to build community resiliency for uncertainties around future climate impacts.

Floodplain managers, elected officials, and members of the public across the state are increasingly aware of the importance of having an integrated approach to managing flood hazards, stormwater, natural resources, and land use. Washingtonians have a shared responsibility to manage the effects of our actions on our watersheds and mitigate the impacts of flooding on our people, our property, and our natural resources.

1.3 Key Terminology

The term "flood hazard management" encompasses "floodplain management," which involves managing floodplain areas in a manner that balances resource protection, environmental enhancement, flood risk reduction, and current and future land use. Floodplain management is an important planning and growth management tool because it focuses on the opportunities and constraints of floodplain areas. The guidebook utilizes the term "flood hazard management" rather than "floodplain management" because flood hazard management activities, including forestry practices and stormwater management, can extend beyond the designated 1%-annual-chance-floodplain, whereas "floodplain management" could be construed as only being applicable to activities occurring within the regulatory floodplain.

Terminology is important because the terms "floodplain management" and "flood control management" are used in different interrelated Washington State statutes. For example, Chapter 86.26 of the Revised Code of Washington (RCW) sets requirements for "comprehensive flood control management plan(s)," while Chapter 86.16 RCW sets floodplain management regulations. For the purpose of this guidebook, the term "flood hazard management" includes both flood control management and floodplain management. A CFHMP includes the state's requirements for both "Comprehensive Flood Control Management Plans" and "Floodplain Management Plans." This guidebook primarily refers to CFHMPs, but does refer to Comprehensive Flood Control Management Plans (or CFCMPs) when quoting legislation that uses that term.

1.4 Principles of Comprehensive Flood Hazard Management

The concept of flood hazard management embraces several fundamental values, principles, and techniques. This section describes 14 key principles to consider when developing a CFHMP.

Principle 1: Focus on Non-Structural Alternatives and Ecological Restoration

As noted above in Section 1.2, the traditional approach of structural flood control has degraded habitats and disrupted natural processes. The traditional approach also has not been successful in eliminating flood hazards, which continue to threaten health, safety, homes, businesses, and infrastructure in Washington's floodplains. While structural measures may still be, appropriate in some areas and for some hazards, comprehensive flood hazard management must shift to focus on *non-structural alternatives* and on *ecological restoration*. This approach is required by:

- Washington Administrative Code (WAC) 173-145-040, which requires CFHMPs to consider fish resources (especially ESA-listed species and others of particular importance to tribal rights) and wildlife resources.
- The Endangered Species Act. Sixteen populations of salmonid species in Washington State are listed as either endangered or threatened, and floodplains are critical habitat for salmonids. Compliance with the ESA requires ecological restoration of floodplain areas and a reduction in structural flood control infrastructure. See Appendix A for more information.
- Tribal rights, including treaty rights. Floodplain habitat recovery and restoration are critically important for salmon management in order to support a robust harvest guaranteed to Tribes through their treaty rights. See Chapter 6 for more information.

Principle 2: Respect for Rivers' Natural Processes

Rivers are dynamic systems and flooding, erosion, stream braiding, sediment deposits, and channel migration can result from natural processes. *"The ecological integrity of river ecosystems depends on their natural dynamic character"* (Poff et al., 1997). Whereas flood control seeks to overcome or control these processes, flood hazard management recognizes that it may be more cost-effective and environmentally sound to work with a river's natural processes. In some cases, constructing levees or other structural flood protection may be appropriate, but in many cases, letting the river take its natural course within a defined corridor is more effective for flood hazard management. Letting the river take its natural course includes overbank flow, a natural event critical to the maintenance of fish and wildlife habitat. Restricting adjacent development, setting back levees, preserving and restoring riparian forest buffers, and using bioengineering solutions such as wetland storage areas may be more cost-effective than structural solutions aimed at containing river processes to the channel. Flood hazard management emphasizes minimum impact on natural processes because experience has shown that fighting a river's natural tendencies is often more costly and results in other problems upstream, downstream, and on the other side of the river.

Principle 3: Focus on the Cause of Flood Damage

Traditionally, flood control focused on preventing flood hazard by treating its symptoms. If a river flooded a town, then the answer was to build up the flood walls to channel the higher water levels without addressing the land use practices upstream or in the flooded area that were exacerbating the flooding in the first place. Contemporary flood hazard management practices recognize the need to treat the causes as well as the symptoms of problem flooding.

Principle 4: Integrated Floodplain Management

Integrated Floodplain Management (IFM) is an approach to floodplain management that leverages collaboration based on shared values in order to adopt new approaches to reduce flood damages, increase salmon runs, and preserve farms and open spaces that enrich our lives and create a resilient future (Ecology, 2019). As described in Section 1.3, comprehensive flood hazard management is about managing flood hazards both within and outside the floodplain; IFM is about managing the floodplain for a broader set of community interests. IFM embraces a holistic and collaborative approach to decision-making that brings together multiple interests to find common agreement on local floodplain visions, strategies, and actions that achieve multiple benefits. IFM is typically a long-term planning and implementation process, while development of a CFHMP must take place within 3 years; therefore, development of a CFHMP should be informed by and should inform IFM efforts but should be considered a discrete process within the broader IFM effort. In Washington, IFM is often known by the phrase Floodplains by Design, which is the name for both an Ecology grant program and an ambitious public-private partnership dedicated to advancing IFM principles (Floodplains by Design, 2018).

Principle 5: Consideration of the Entire Watershed, Not Just Local Conditions

Conditions across an entire watershed can affect flooding. Issues in one part of the watershed can result in flooding problems in another. For example, poor forestry, agricultural, or development practices upstream can cause additional water runoff to peak, surge, or accumulate downstream. Consequently, comprehensive flood hazard management encompasses the following: flooding in rural, suburban, and urban environments; flooding associated with major river systems and small urban streams; and the range of solutions needed to address flooding associated with a variety of conditions, causes, and landscapes. These can range from on-site stormwater management development standards in King County's rapidly urbanizing areas, to the removal of wrecking yards located within the floodplain of the Yakima River in Yakima County. Since watersheds typically cross-city and county jurisdictions, state lines, and possibly federally owned or tribal lands, interjurisdictional cooperation is essential. The complexity of the natural systems, as well as the

jurisdictional overlap that often occurs, points to the importance of comprehensive flood hazard management at the level of the entire watershed. Where possible, a CFHMP should consider the entire Water Resource Inventory Area (WRIA). Note that salmon recovery plans and watershed management plans, which should be considered in development of a CFHMP, are developed at the WRIA scale.

Principle 6: Public Participation and Diversity, Equity, and Inclusion

When people and infrastructure are located within the floodplain, flooding can have direct and sometimes catastrophic effects on a community. Therefore, decisions about how to manage flood hazards must reflect the ideas, opinions, and perspectives of the affected community. Public participation is essential to consider community concerns and to educate local residents on the fundamentals of responsible, effective flood hazard management. As with many hazards, flooding disproportionately affects vulnerable populations. For example, lower income individuals are not only more likely to live in neighborhoods that are susceptible to flooding; they are also significantly disadvantaged in recovering from flood damage (Sherwin, 2019). Therefore, it is important to consider diversity, equity, and inclusion when developing a flood plan. The public participation process needs to be proactive and include vulnerable and underrepresented communities to ensure that their voices are heard in the development of the flood plan and in the implementation of flood hazard reduction actions.

Principle 7: Coordination among Public Works, Planning, and Building Departments and Other Department Activities

Flood hazard management touches many departments within a jurisdiction, and too often, activities are not interdepartmentally coordinated. One common mistake is not including a planning department in a key role in the development of a CFHMP and thereby missing opportunities to address flood hazards through regulatory or policy changes (for example, through updates to the Flood Hazard Management Ordinance, Shoreline Master Program, and/or Critical Areas Ordinance). Therefore, improving interagency and interdepartmental coordination should be part of a CFHMP process. In many jurisdictions, public works departments' responsibilities include the construction and maintenance of structural flood hazard management measures; building departments review new construction proposals to implement NFIP standards; planning departments regulate shoreline activities; and parks and recreation departments coordinate and plan for recreation and public access features. Ideally, comprehensive flood hazard management planning brings all interested parties together so that one department's efforts support the others.

Principle 8: Interagency and Stakeholder Coordination

Many organizations should have a voice in defining the goals and parameters of Comprehensive Flood Hazard Management Plans, including local governmental agencies; state departments, including the Washington Department of Fish and Wildlife (WDFW), Ecology, Washington Department of Natural Resources, and Department of Parks and Recreation; federal agencies such as FEMA, the U.S. Army Corps of Engineers (Corps), U.S. Geological Survey (USGS), and National Park Service (NPS); forestry and agricultural interests; affected Tribal governments; diking, drainage, and flood control districts; interest groups focused on environmental, social, and economic issues; and neighborhood associations. Because of their significance to the topic, tribal rights (including treaty rights) are described in more detail in Chapter 6. Comprehensive flood hazard management planning must be a team effort that integrates community development regulations and environmental enhancement activities.

Principle 9: Planning Process-oriented Examination of Issues

Comprehensive Flood Hazard Management Plans should provide a planning process for examining the causes of flooding and evaluating alternative non-structural and structural solutions that are based on short- and long-term goals, objectives, and solutions, including:

- Technical feasibility and certainty to address the problem.
- Construction and maintenance costs.
- Legal and regulatory constraints.
- Environmental impacts, both site-specific and cumulative.
- Funding capabilities.
- Tribal, stakeholder, and public acceptance.
- Recommended solutions prioritized.

The planning process offers broader perspective by reexamining current flood maintenance activities as they relate to established and understood goals and objectives. An open planning process will help government officials balance the impacts of specific flood hazard management measures against benefits. For example, benefits to individual property owners from diking projects should be weighed against the monetary and environmental costs borne by the general public and the impacts on other communities upstream, downstream, and across the river.

Principle 10: Consideration of Future Conditions

Floodplains are dynamic systems that change over time and are influenced by a broad range of factors. Flood hazard conditions will not be the same as they are now in 10, 20, 50, or 100 years. The factors that influence future flood hazard conditions vary by community, but two of the key factors that should be considered are climate change and development. Climate change is expected to reduce snowpack, increase winter streamflow, increase riverine flood risk, raise sea levels, and increase sediment transport in the winter and spring (Mauger et al., 2015). Together with climate change, population changes and the accompanying development are anticipated to lead to substantial increases in flood damage (Swain et al., 2020). Without adequate consideration of future conditions, the solutions in a flood plan will not be durable, leading to increased costs in the future – not to mention increased flood hazard.

Principle 11: Consideration of Tribal Rights

While it has not always been acknowledged by floodplain managers, floodplain management activities affect tribal rights, including treaty rights, due to the link between floodplain habitat, salmon productivity, and salmon harvests. *“Floodplains play a critical ecological role in salmon recovery and creating healthy functioning habitat. Floodplains are essential to maintaining the hydrological function of streams and providing off-channel salmon habitat”* (NWIFC, 2020). The management of natural resources through the existing federal, state, and local regulatory frameworks has not sufficiently protected tribal resources, including treaty resources and specifically including salmon. *“A consistent trend...is that key habitat features, such as riparian vegetation, habitat connectivity, and streamflows, continue to be imperiled by human activities. This extensive loss and degradation of habitat, changing climate, and ocean conditions threaten salmon, tribal cultures and tribal treaty-reserved rights...”* (NWIFC, 2020). The existing flood control infrastructure (such as dams, levees, flood gates, and bank protection) causes daily harm to salmon populations by blocking fish passage and cutting rivers off from important habitat areas (NWIFC, 2020). Improved floodplain management by jurisdictions is one critical way to protect tribal resources. Tribal rights are discussed further in Chapter 6.

Principle 12: Consideration of Environmental Justice

In 2021, the Washington State Legislature passed the Healthy Environment for All (HEAL) Act, which defines environmental justice as:

The fair treatment and meaningful involvement of all people regardless of race, color, national origin, or income with respect to the development, implementation, and enforcement of environmental laws, rules, and policies. Environmental justice includes addressing disproportionate environmental and health impacts in all laws, rules, and policies with environmental impacts by prioritizing vulnerable populations and overburdened communities, the equitable distribution of resources and benefits, and eliminating harm.

To adequately and equitably address flood hazards, CFHMPs must consider environmental justice while characterizing conditions, identifying hazards, and identifying and selecting strategies and measures. Impacts of flooding on these communities are long lasting. For example, Sherwin (2019) reported that a year following Hurricane Harvey in Houston, Texas, 27% of Hispanic Texans whose homes were damaged reported that the homes were still unsafe to live in compared to 20% of blacks and 11% of the white population. Similarly, in the same survey, 50% of lower-income residents reported that they were not receiving the help that they needed, as compared to 32% of those earning higher incomes. Recognizing diversity, making equitable decisions, and including the local community (as discussed in Principle 6 above) not only enhance public involvement and local accountability, but also can inform CFHMP development to lift communities out of their current state of susceptibility to environmental justice impacts from flooding.

Principle 13: Integration with Other Flood Hazard Management Programs and Grants

Jurisdictions navigate a complicated web of hazard mitigation regulations and programs. Programs include the NFIP, FEMA Hazard Mitigation Grants, the Community Rating System, the Corps' System-Wide Improvement Framework, the Flood Control Assistance Account Program, and Ecology's Floodplains by Design grant program. Successful comprehensive flood planning should help a community meet multiple needs and qualify for multiple funding sources.

Principle 14: Incorporation of Comprehensive Planning Solutions

Human use of rivers and floodplains encompasses a broad range of environmental, public, and private objectives. Flood hazard management incorporates the full range of comprehensive planning tools to achieve those objectives, including the following.

- Land use planning that both allows for land uses that benefit from a floodplain location (such as agriculture, water-dependent uses, or recreation) and that direct non-floodplain land uses to safer locations.
- Land use zoning and site development standards that prevent or reduce flood hazards, such as the requirement for on-site detention/retention systems.
- Infrastructure development standards that minimize encroachments in floodplains, and design standards that maximize resiliency from flood damage and are compatible with floodplain-dependent land uses, including ecological restoration.
- The acquisition of flood-sensitive areas for open space, habitat, and/or compatible land use, such as seasonal and/or low impact recreation.
- Forestry management practices that reduce runoff, attenuate peak flows, and enable groundwater recharge.
- Shoreline Master Program regulations that restrict inappropriate development and encourage compatible land uses.
- Growth Management Act (Critical Area) regulations to promote flood safety based on Best Available Science.

- National Flood Insurance Program related regulations that require all development in the FEMA-identified Special Flood Hazard Area to comply with FEMA floodplain development standards.
- The use of existing dikes and levees for recreational trails and public access to water as part of park and recreation plans.
- Removal or setback of existing dikes and levees to allow reconnection and flood storage.
- Designing transportation facilities to reduce their impact on the watershed.
- Protection and creation of habitat areas that provide natural functions, such as wetlands for stormwater storage and biofiltration, or upland beaver habitat for storage capacity.
- Stormwater management planning that requires individual or cooperative retention/detention systems.
- Carefully designed structural flood projects that reduce as much as possible, negative impacts on other public objectives and, where possible, incorporate other public objectives.
- Bioengineering, such as installation of engineered log jams.
- Retrofitting/floodproofing of existing structures.
- Carefully designing water-related infrastructure such as irrigation diversions or wastewater and drainage returns.

Flood hazard management planning provides an excellent framework to systematically address those elements of other planning activities normally carried out by local governments. A Comprehensive Flood Hazard Management Plan can:

- Provide a flexible, equitable, and cost-effective program of steps to reduce flood damage.
- Address the issue of cumulative environmental impacts that arise in reviewing development permit applications.
- Fulfill some of the requirements for comprehensive land use planning set by the Washington State Growth Management Act (GMA) and Shoreline Management Act, especially in the areas of critical area protection and intergovernmental coordination.
- Fulfill some of the requirements for participation in the NFIP and examine the possibility for more stringent requirements that are cost-effective in terms of a reduction in flood insurance rates and increased flood protection.
- Add impetus to lands acquisition and assist in comprehensive recreational planning.
- Support stormwater management, salmon recovery, and streamflow/climate planning.

1.5 Washington State Statutes Governing Comprehensive Flood Hazard Management Activities

There are three principal interrelated Washington statutes that, along with their administrative guidelines, address flood hazard management activities. **Chapter 86.12 RCW - Flood Control by Counties** authorizes county governments the power to levy taxes, condemn properties, and undertake flood control activities directed toward a public purpose. **Chapter 86.16 RCW - Floodplain**

Management finds that prevention of flood damage is a matter of statewide public concern and places regulatory control within the responsibilities of Ecology. **Chapter 86.26 RCW - State Participation in Flood Control Maintenance** establishes the Flood Control Assistance Account Program to provide funding for local flood hazard management efforts and sets criteria for the use of FCAAP funds.

The important provisions for each of the three statutes are summarized below as an introduction to flood hazard management planning. Local engineers, planners, and administrators dealing with flood hazard management activities are strongly advised to refer to the current RCW and WAC during the planning process.

Chapter 86.12 RCW-Flood Control by Counties

Chapter 86.12 RCW authorizes county governments the power to levy taxes, exercise eminent domain, and take action to control and prevent flood damage. RCW 86.12.200 authorizes counties to adopt CFHMPs¹ "for any drainage basin that is located wholly or partially within the county." RCW 86.12.200 further states that the plan shall include the following elements:

- (1) *Designation of areas that are susceptible to periodic flooding, from inundation by bodies of water or surface water runoff, or both, including the river's meander belt or floodway,*
- (2) *Establishment of a comprehensive scheme of flood control protection and improvements for the areas that are subject to such periodic flooding, that includes:*
 - (a) *Determining the need for, and desirable location of, flood control improvements to protect or preclude flood damage to structures, works, and improvements, based upon a cost/benefit ratio² between the expense of providing and maintaining these improvements.*
 - (b) *establishing the level of flood protection that each portion of the system of flood control improvements will be permitted,*
 - (c) *identifying alternatives to in-stream flood control work,*
 - (d) *identifying areas where flood waters could be directed during a flood to avoid damage to buildings and other structures; and*
 - (e) *identifying sources of revenue that will be sufficient to finance the comprehensive scheme of flood control protection and improvements;*
- (3) *Establishing land use regulations that preclude the location of structures, works, or improvements in critical portions of such areas subject to periodic flooding, including a river's meander belt or floodway, and permitting only flood-compatible land uses in such areas;*
- (4) *Establishing restrictions on construction activities in areas subject to periodic floods that require the flood proofing of those structures that are permitted to be constructed or remodeled; and*

¹ RCW 86.12.200 uses the term "Comprehensive Flood Control Management Plan (CFCMP)." See Section 1.3.

² Note that benefit-cost evaluations can have environmental justice implications, focusing flood hazard mitigation projects in areas with higher property values (that thereby show a higher economic benefit to providing flood protection). It is recommended that benefit-cost evaluations not be used unless necessary.

- (5) *Establishing restrictions on land clearing activities and development practices that exacerbate flood problems by increasing the flow or accumulation of floodwaters, or the intensity of drainage on low-lying areas. Land clearing activities do not include forest practices as defined in chapter 76.09 RCW.*

RCW 86.12.200 goes on to say that: *The comprehensive flood control management plan shall be subject to the minimum requirements for participation in the national flood insurance program, requirements exceeding the minimum national flood insurance program that have been adopted by the department of ecology for a specific floodplain pursuant to RCW 86.16.031, and rules adopted by the department of ecology pursuant to RCW 86.26.050 relating to floodplain management activities.*

The language in this section contains several key points. Item (2a) calls for evaluating the need for flood control measures based on a cost/benefit ratio between expenses and public benefits. This recognizes that structural approaches should not be undertaken without determining that real benefits (in terms of economic productivity and resource management) outweigh project costs. Also, it acknowledges that restricting development within flood-prone areas is often more cost-effective than structural improvements.

Item (2c) calls for identifying alternatives to instream flood control work. This statement, along with items (3), (4), and (5) listed above, places emphasis on alternatives to structural flood control projects such as land use planning, floodproofing, and resource management. RCW 86.12.200 emphasizes county authority to prepare plans for drainage basins lying wholly or partially within respective jurisdictions, recognizing that effective flood hazard management should be undertaken on a watershed-wide basis.

RCW 86.12.210 outlines a process whereby city and county governments work together in preparing CFHMPs and establishes the authority of such adopted plans, stating:

A comprehensive flood control management plan that includes an area within which a city or town, or a special district subject to chapter 85.38 RCW, is located shall be developed by the county with the full participation of officials from the city, town, or special district, including conservation districts, and appropriate state and federal agencies. Where a comprehensive flood control management plan is being prepared for a river basin that is part of the common boundary between two counties, the county legislative authority of the county preparing the plan may allow participation by officials of the adjacently located county.

Following adoption by the county, city, or town, a comprehensive flood control management plan shall be binding on each jurisdiction and special district that is located within an area included in the plan. If within one hundred twenty days of the county's adoption, a city or town does not adopt the comprehensive flood control management plan, the city or county shall request arbitration on the issue or issues in dispute. If parties cannot agree to the selection of an arbitrator, the arbitrator shall be selected according to the process described in RCW 7.04.0.50. The cost of the arbitrator shall be shared equally by the participating parties and the arbitrator's decision shall be binding. Any land use regulations and restrictions on construction activities contained in a comprehensive flood control management plan applicable to a city or town shall be minimum standards that the city or town may exceed. A city or town undertaking flood or storm water control activities consistent with the comprehensive flood control management plan shall retain authority over such activities.

RCW 86.12.220 encourages counties to establish advisory committees that include representatives from affected jurisdictions, districts, and agencies as well as "other interested persons."

Chapter 86.16 RCW - Floodplain Management

In enacting Chapter 86.16 RCW - Floodplain Management, the state of Washington assumed a strong regulatory role over the waters in the state for the purposes of alleviating recurring flood damage and promoting public health and safety. Ecology was given the responsibility for coordinating floodplain management regulation aspects of the NFIP. Under Chapter 86.16 RCW, counties and incorporated cities are required to adopt floodplain management ordinances that comply with the minimum standards of the NFIP and Chapter 86.16 RCW. Floodplain management ordinances are typically aimed at reducing the risk of flood damage by restricting development in floodways and requiring flood resistant or floodproofed buildings in flood-prone areas. Chapter 173-158 WAC Floodplain Management outlines the administrative rules for implementing Chapter 86.16 RCW. It adopts the standards in 44 Code of Federal Regulations (CFR) parts 59 and 60 in the NFIP and sets additional standards dealing with construction in the floodway. WAC 173-158-080 suggests that communities avoid negative impacts on wetlands because of their biological productivity and role in hydrological stabilization.

Chapter 86.26 RCW - State Participation in Flood Control Maintenance

In 1984, the Washington State Legislature enacted Chapter 86.26 RCW - State Participation in Flood Control Maintenance and established the Flood Control Assistance Account Program to assist local jurisdictions in comprehensive planning and flood control maintenance efforts. Ecology administers the program and distributes matching grants out of the FCAAP account to cities, towns, counties, federally recognized Tribes, conservation districts, and other special districts such as flood control districts. These funds, coupled with other state funds (such as Centennial Clean Water Funds, Coastal Zone Management Funding, Department of Transportation, and other local funding sources) increase available dollars for plans and projects.

1.6 Schedule for Periodic Updates of Guidance

This guidebook is the first update of the Comprehensive Planning for Flood Hazard Management document, completed 30 years after the document was originally written. Ideally, future updates will be made on a more frequent basis. Conditions for flood planning change regularly as regulations are updated, the Community Rating System (CRS) manual is updated (every 3 to 5 years on average), the Floodplains by Design Funding Guidelines are updated (every 2 years), and floodplain managers across the state continue to innovate new approaches to managing flood hazards.

Because the FCAAP program will be funding flood-planning efforts in the 2021–2023 biennium for the first time in over a decade, this guidebook should be updated in 2024 or 2025 to benefit from lessons learned from the first biennium of flood planning with the updated guidance document. Following that update, the document should be reviewed regularly at least every 5 years to determine if an update is needed. If the document is reviewed and updated frequently on this recommended schedule, each review and update will not require a large investment of effort or funding.

The next update of the document could also incorporate the findings and recommendations from the State/Tribal Riparian Protection and Restoration Workgroup, which is currently evaluating how to integrate consideration of riparian forest buffers of at least 1 Site Potential Tree Height in width into various state programs. Comprehensive Flood Hazard Management Plans are not regulatory documents that establish riparian buffers and setbacks. While the plans include regulatory overview sections that put the plan into context, riparian buffers are found in regulatory ordinances such as Critical Areas Ordinances and Shoreline Master Programs. That said, riparian buffers are important to natural floodplain functions and can help address flood hazards. Once the Work Group has

released more guidance on the outcome of their work, it can be incorporated into future revisions of this guidebook.

When this guidebook is being updated, there will likely be CFHMP projects in process in some jurisdictions in the state. Updates to the guidebook could add new minimum requirements for CFHMPs, which could impact any ongoing CFHMP process that may have already passed that step without completing the new minimum requirements. This potential impact should be carefully considered and avoided in each update. If a change is made to minimum requirements, it should not apply to plans currently in process.

CHAPTER 2: INITIATING A COMPREHENSIVE FLOOD HAZARD MANAGEMENT PLAN

2.1 Introduction

This section includes guidance for initiating a CFHMP, including answers to common questions, guidance on funding a CFHMP, and a description of how to use this guidebook. Starting a comprehensive flood hazard management planning process can be a daunting prospect because of the complexity of technical issues, the myriad of regulatory programs surrounding flood hazard and resource management, the volatility of flood control and land use issues, and the expense of the planning activities. However, the economic and environmental benefits are great. Moreover, future funding sources may be dependent upon having such a plan.

2.2 Common Questions

Q: Where can I get the funds for comprehensive flood hazard management planning?

A: The Flood Control Assistance Account Program (FCAAP) program will pay for up to 75% of the cost of a Comprehensive Flood Hazard Management Plan (CFHMP) prepared to the FCAAP standards, which are outlined in this guidebook. Match can be shown in the form of other grant funds, value of land previously acquired as long as the land is used for implementation of the project, time spent working on a project, and in-kind costs. Some jurisdictions have also used funds from Centennial Clean Water Funds and/or local funds to develop a CFHMP. One of the primary sources of local funding for preparing CFHMPs has been flood control zone districts. More information on funding sources is included in Section 2.3. Grant funding sources can also fund CFHMPs. More information on grant programs is included in Chapter 5.

Q: How much does a local government have to pay for a CFHMP?

A: The cost varies with the size of the planning area, the special needs of the planning activity, the ability of the local jurisdiction to provide match, the amount of current information available vs. the need to gather new information, etc. CFHMPs typically cost between \$150,000 and \$1 million. WAC 173-145-090(4) requires that the amount of FCAAP funds available for all nonemergency projects and CFHMPs in any county may not exceed \$500,000 per biennium.

Q: How big an area should be included in the plan?

A: Ideally, the plan should include the whole WRIA because the hydrology and land use of the watershed as a system can be affected by changes in any part of it. WAC 173-145-040(4) states that the area shall include at least the 1%-annual-chance floodplain within a reach of the watershed of sufficient length to ensure that a comprehensive evaluation can be made of the flood problems for a specific reach of the watershed. While the plan may only apply to a given reach or reaches, in many cases the entire watershed will need to be characterized to understand the riverine processes that are relevant to that reach. Often, the study area must extend beyond the jurisdictional boundaries of the local government. Jurisdictions that include multiple watersheds (such as some counties) will often develop a plan that covers the entire jurisdiction and therefore all of the watersheds in the jurisdiction. Another common option is for a jurisdiction to take the lead in planning for the watersheds that lie primarily within their boundaries, and coordinate with neighbor jurisdictions to participate in their planning efforts.

Q: What can a local planner do if the planning area extends beyond the local government's jurisdiction?

A: The best solution is to coordinate with the neighboring government or agency and develop a plan that covers both or multiple jurisdictions.

Q: What is the required minimum level of detail for technical analyses for tasks such as problem identification, hydrological analysis, impact evaluation, and cost/benefit projection?

A: There is no specific minimum level of detail for technical analyses, as long as sufficient information is available to characterize the flood risk and the need for flood hazard management strategies and measures, and to develop and analyze a set of strategies and measures. The scope of work for a flood plan should be based on available funding, existing background information, the severity of the problem, and the complexity of planning issues involved. Guidance on technical analyses is included in Chapter 7, Step 4.

Q: The Comprehensive Flood Hazard Management Plan is subject to Ecology review. What are the criteria for approval?

A: A CFHMP is subject to Ecology review if it has been developed using FCAAP funding. WAC-173-145-040 outlines what must be in a plan at a minimum (see Section 3.2 of this guidebook), and this guidebook provides further guidance in preparing plans. Ecology's approval process includes a review of the minimum requirements of WAC 173-145-040; the tasks outlined in the FCAAP grant agreements' scopes of work, and Ecology's consultation with WDFW. Ecology can review a CFHMP for approval upon request even if it was not funded with FCAAP funding. See Chapter 7, Step 12 for a description of the approval process.

Q: How long does a plan usually take?

A: The process outlined in this guidebook generally takes about 2 to 3 years, but it can take longer depending on the scope of the plan, the number of technical analyses being conducted to inform the plan, the level of community involved, and whether the plan is an update of an existing plan. During the first year, the process is established, background information compiled, and the need for floodplain management measures substantiated. During the second year, the planning team can identify and evaluate alternative flood control measures and prepare a draft and final plan. The time it takes Ecology to review and approve the submitted draft and final plan in consultation with WDFW can vary widely depending on the complexity of the plan and the amount of coordination during review.

Q: What are the most common difficulties in preparing Comprehensive Flood Hazard Management Plans?

A: In past years, the most common shortcoming of the plans submitted for review has been the emphasis on short-term structural measures at the expense of long-term non-structural solutions such as restricting and managing development, wetland storage, and runoff management. Another common difficulty has been sorting out the web of overlapping agency regulations, resource protection programs, and planning requirements. Appendix A of this guidebook describes how these regulatory programs affect flood hazard planning and management. Additionally, past CFHMPs did not always include the identification and consideration of potential impacts of instream flood control work on various resources, including fisheries. Also, our advice is to include WDFW, Tribes, other entities who manage for ESA-listed species, and other relevant stakeholders on your plan's advisory committee early in the planning process so that their concerns and suggestions are proactively considered as part of the plan. Another difficulty arises from the complexity of the watershed itself. Chapter 7, Step 4 includes guidance on approaches to an inventory and analysis of the conditions within a watershed relevant to flood hazard management.

Q: Do I need to do a SEPA environmental checklist (checklist) or environmental impact statement (EIS)?

A: Generally speaking, we recommend that the environmental assessment in the form of a State Environmental Policy Act (SEPA) checklist or environmental impact statement (EIS) be integrated into the planning process by evaluating the impacts of proposed alternative flood control measures within SEPA guidelines so that work is not duplicated. The SEPA checklist or EIS should reflect an analysis of alternative flood hazard management solutions should the plan be implemented as a whole; impacts caused by individual solutions as well as cumulative impacts should be described even if the document is a "programmatic" SEPA checklist or EIS.

Q: Can FCAAP funds be used for SEPA documentation?

A: Yes.

Q: How does this effort relate to the Growth Management Act?

A: Under the Growth Management Act (GMA), cities and counties must provide for the protection of groundwater quality and quantity and, where applicable, plan for needed drainage, flooding, and surface water runoff control measures. Local governments must designate flood-prone, frequently flooded and geologically hazardous areas and wetlands as critical areas. Development regulations for critical areas must be adopted to prevent incompatible land uses. The GMA also requires that local governments coordinate with neighboring jurisdictions to solve planning issues of common concern; an aspect of flood hazard management planning that is mandated by WAC 173-145-040. Therefore, GMA and CFHMP requirements share common goals. The GMA should facilitate preparing a CFHMP in at least three ways:

1. Population forecasts and development projections can be used in predicting increased stormwater runoff and flooding problems.
2. The critical areas inventory required by the GMA will provide important floodplain data.
3. The GMA requires that capital improvements be coordinated and funded to adequately service new growth. Flood hazard management improvements, as part of a capital improvement program, must observe the same requirements.

Local communities should adopt a joint approach to growth and flood hazard management. Exchanging technical information and developing regulations and improvements tailored to comply with GMA and CFHMP requirements will reduce costs and expedite the planning process. CFHMPs can also be incorporated into Comprehensive Plans under the GMA as part of the natural hazards element.

Q: How does flood hazard management relate to stormwater management?

A: In one sense, flood hazard management and stormwater management are one and the same. Both manage surface water through a variety of structural and non-structural techniques in an attempt to prevent the damage (human and environmental) caused by flooding. Stormwater management is characterized by an emphasis on local drainage issues associated with urbanized or urbanizing areas. Flood hazard management is characterized by an emphasis on major rivers, their tributaries, and catastrophic flooding events. Local public works departments may have separate stormwater and flood hazard management programs within a larger "surface water management" department. For the purposes of this guidebook, flood hazard management includes the principles and techniques of stormwater management.

Q: My community already participates in the National Flood Insurance Program (NFIP). Why should we have to do more planning?

A: The NFIP mandates that local communities regulate development through a permitting system using the mapped 1%-annual-chance FEMA floodplain. Development of a CFHMP provides an opportunity to consider higher regulatory standards to provide increased protection as well as capital projects to address flood hazards. In addition, communities with CFHMPs are better prepared to successfully compete for capital grant funds for flood hazard management projects.

Q: What are the benefits of preparing a Comprehensive Flood Hazard Management Plan?

A: A CFHMP provides a forum for addressing numerous interrelated issues. We have learned that floodplains are laden with complex planning issues, ranging from biological resource protection, geohydrological engineering, land use development, aesthetics, open space, and recreation objectives. It makes sense to address these issues comprehensively, and a plan provides the impetus and funding to do so. Most importantly, it offers the opportunity for differing interest groups and parties to sit down and resolve their often-conflicting objectives. In this way, the planning process is a forum for conflict resolution regarding planning and resource protection issues based on community needs. Conflict mediation theory recommends that a mutually agreeable solution be sought through outlining goals and identifying options to produce solutions that optimize all participant objectives. This is just the type of process that is recommended for flood hazard management planning. If the CFHMP development process includes thoughtful and effective public engagement that informs the selection and sequencing of strategies and measures, the CFHMP can also provide public support for the selected measures.

The plan also provides the technical foundation for future flood hazard management recommendations. For example, following a flood that destroys levees or bridges, the plan will provide insight as to whether that infrastructure should be rebuilt to pre-flooding conditions or if it should be lowered, modified (by being set back, for example), or eliminated altogether. A CFHMP can also provide support for accessing grant funding to complete flood hazard management measures. Information on grant programs that can help fund flood hazard management, such as Floodplains by Design and various FEMA grant programs, is included in Chapter 5.

Q: Who normally leads the planning effort?

A: Traditionally, flood hazard management has been the responsibility of local public works or engineering departments. Depending on the level of your community's emphasis on resource protection, growth management, non-structural flood protection measures, and intergovernmental coordination, it may be more appropriate that the local planning department take the lead role. The important thing is that the two departmental functions work closely together and with all interested parties during the planning process. If possible, consider a joint-led effort across planning, public works, and natural resources staff. Otherwise, the formation of a multi-disciplinary steering team to lead the plan is strongly recommended; the steering team should include representatives from additional departments and Tribes.

2.3 Funding a Flood Plan

Tribal, local, and regional governments are typically underfunded for major planning efforts such as developing a CFHMP. Because the federal and state government flood programs recognize the importance of robust, comprehensive planning as a foundation for implementing flood damage reduction actions, several grant programs are available. This section describes the potential funding sources for flood planning, including local, state, and federal funding mechanisms.

Chapter 86.26 RCW - State Participation in Flood Control Maintenance

In 1984, the Washington State legislature enacted Chapter 86.26 RCW - State Participation in Flood Control Maintenance and established the Flood Control Assistance Account Program (FCAAP) to aid local jurisdictions in comprehensive planning and flood control maintenance efforts. Ecology administers the program and distributes matching grants out of the FCAAP account to cities, counties, and other special districts that are responsible for flood control. These funds are complemented by other state funds, such as Floodplains by Design, Centennial Clean Water Funds (available through Ecology's Water Quality Combined Funding Program), Department of Transportation, and other local funding sources, which provide funding for projects.

Flood Control Assistance Account Program (FCAAP)

The FCAAP funds grants and program administration statewide. RCW 86.26.007 states that the program will be funded at \$4 million per biennium. However, from 2009 to 2021, FCAAP funds were reduced. Funding was restored by the 2021 Legislature.

FCAAP Grants

Matching grants are available on a reimbursable basis for two kinds of activities:

- 1) *Comprehensive Flood Hazard Management Plans*³—Grants up to 75% of total cost are available to assist local jurisdictions in preparing a comprehensive plan for an appropriate planning area. A plan must include a determination of the need for flood control work, a thorough assessment of alternatives, a thorough analysis of environmental impacts on resources, an evaluation of problems and proposed solutions, and prioritized recommendations. To remain eligible for FCAAP grants for maintenance work, the final CFHMP must be adopted by the local jurisdiction after it has been approved by Ecology in consultation with WDFW. In addition, the Emergency Management Division must certify that an acceptable local emergency management plan is being administered.
- 2) *Emergency Flood Control Projects*—Grants up to 80% are available to respond to unusual, unforeseen, and emergent flood conditions for the preservation of life and property. To release such funds, the appropriate authority must declare an emergency. Funds are available for both construction of emergency projects and flood fighting costs, with payment based on a first-come, first-served basis and not on a priority system. These funds are only available to projects that have been approved for matching funds by Ecology prior to construction.

FCAAP Project Funding Criteria

The priority given to projects by Ecology, the counties, and other eligible municipal corporations shall involve consideration of the following criteria:

1. The relationship of public benefits to total project costs.
2. The priority that has already been established by each county.
3. Intensity of local flood control management problems, including but not limited to their inter-relationships with:
 - a) Population affected

³ Chapter 173-145 WAC uses the term "Comprehensive Flood Control Management Plan (CFCMP)." See Section 1.3.

- b) Property and related development affected
 - c) Land management and zoning
 - d) Existing flood control management practices
4. Where the CFHMP is completed and adopted, the following will be considered:
- a) Consistency with the plan or plan recommendations
 - b) Priority of project as identified in the plan
 - c) Implementation of plan or plan recommendations
 - d) Potential impacts of instream uses and resources
5. Where a CFHMP is being developed or has not been initiated, the following will be considered:
- a) Evidence of multijurisdictional cooperation necessary for development of a comprehensive county or multicounty CFHMP
 - b) Availability of qualified personnel or resources for planning purposes
 - c) Availability of qualified personnel or resources for project construction purposes
 - d) Other planning efforts undertaken or proposed within the planning jurisdiction and their relationship to flood control management
 - e) Ability to make rapid progress toward development of a CFHMP
 - f) Existing and proposed participation of community groups, private industry, professional organizations, the general public, and others toward the development and implementation of the proposed CFHMP.

Flood Control Zone Districts

Several counties in Washington have chosen to form flood control zone districts (FCZDs) to fund flood hazard management activities. An FCZD is a special purpose district established by the action of a County Council or Board of County Commissioners. The purpose of an FCZD is *“undertaking, operating, or maintaining flood control projects or stormwater control projects or groups of projects that are of special benefit to specified areas of the county”* (RCW 86.15.020).

An FCZD has the authority to use various funding mechanisms, including:

- A regular levy requiring authorization by the supervisors. The maximum amount that can be levied is 50 cents per \$1,000 of assessed valuation (RCW 86.15.160).
- An excess levy as a property tax requiring annual voter approval (RCW 86.15.160).
- Assessments (RCW 86.15.160).
- Service charges, including public entities (RCW 86.15.176).
- Local improvement districts (LIDs) (RCW 86.15.160).
- Subzones, which are operated as flood control zones (RCW 86.15.025).
- Revenue and GO Bonds (RCW 86.15.178 and RCW 86.15.170 respectively).

- Stormwater fee charges, including public property (RCW 86.15.160).
- Voluntary assessments for flood or stormwater control (RCW 86.15.165).

RCW 86.15.110 states that, prior to an FCZD extending, enlarging, acquiring, or constructing any flood control improvements:

A comprehensive plan of development for flood control has been prepared for the stream or water course upon which the improvement will be enlarged, extended, acquired, or constructed, and that the improvement generally contributes to the objectives of the comprehensive plan of development: PROVIDED, That the plan shall be first submitted to the state department of ecology at least ninety days in advance of the beginning of any flood control project or improvement; and shall be subject to all the regulatory control provisions by the department of ecology as provided in chapter [86.16](#) RCW.

The following Washington State jurisdictions have formed countywide flood control zone districts: Chelan County, Columbia County (formed in cooperation with Dayton and Starbuck), King County, Kittitas County, Lewis County, Pacific County, Pierce County, Skagit County, Whatcom County, and Yakima County. Other flood control zone districts in the state include the Lexington Flood Control Zone District in Cowlitz County, three flood control zone districts in Jefferson County, the Newman Lake Flood Control Zone District in Spokane County, and the Walla Walla County Mill Creek Flood Control Zone District.

A CFHMP prepared under this guidebook could thereby serve as the comprehensive plan of development for an FCZD. Formation of an FCZD is a strong option both for funding a CFHMP and for funding the strategies and actions recommended in the CFHMP.

FEMA Funding Programs

FEMA grant programs can also fund development of CFHMPs. See Sections 5.2, 5.3, 5.4, and 5.5 for more information on FEMA grant programs.

2.4 Scaling the CFHMP Effort to Your Community

There is no limit to the effort your community can go to in developing a CFHMP. There are always opportunities to further refine models, develop new models, integrate additional interests, and conduct more outreach. However, financial resources, time, and staff and stakeholder capacity will limit your CFHMP process. Therefore, it will be necessary to scale the effort to your community's resources and capacity as well as to your priorities.

This guidebook was developed to allow for a scaled approach. The heart of the guidance for developing a CFHMP is included in Chapter 7, which has been developed with a modular, stepwise approach. For each step in the process, the guidance in Chapter 7 first outlines the minimum requirements, and then provides general guidance and advice for meeting those requirements. Additionally, each step includes modular guidance for coordinating your CFHMP with other relevant programs, for incorporating an IFM approach, and for incorporating considerations of climate change. If your community needs a CFHMP that will meet the requirements to receive CRS credit and that considers climate change, but you do not have the capacity for an IFM approach at this time, the structure of Chapter 7 should help you easily select those pathways. If your funding is very limited and you can only pursue the minimum at this time, Chapter 7 should also make that minimum clear. However, we recommend that you still review the other guidance; you may find helpful approaches that you can incorporate to strengthen your strategies and actions without outpacing your resources.

CHAPTER 3: CONTENTS OF A COMPREHENSIVE FLOOD HAZARD MANAGEMENT PLAN

3.1 Introduction

There are many possible approaches to determining the contents and organization of a CFHMP. Section 3.2 below lists the requirement elements of a CFHMP as established in WAC 173-145-040, and Sections 3.3 and 3.4 include example flood plan outlines from Pierce County and Yakima County. Each jurisdiction should develop an outline for its CFHMP that reflects the needs and interests of their community, while meeting the requirements in WAC 173-145-040 and in this guidebook.

3.2 Required Elements of a CFHMP

WAC 173-145-040 describes the required elements of a CFHMP.⁴ The required elements of a CFHMP as described in the WAC fall short of the principles of comprehensive flood hazard management as described in Section 1.4 and do not include consistency with local salmon recovery plans, consideration of future conditions, integrated floodplain management, environmental justice, watershed-scale planning, or many other recommended elements of flood planning described throughout this guidebook. Therefore, the requirements are quoted from the WAC in this section as reference and should not be considered sufficient to develop an effective CFHMP.

According to WAC 173-145-040, the plan must include:

- 1) Determination of the need for flood control work.⁵
 - a) Description of the watershed;
 - b) Identification of types of watershed flood problems;
 - c) Location and identification of specific problem areas;
 - d) Description of flood damage history;
 - e) Description of potential flood damages;
 - f) Short-term and long-term goals and objectives for the planning area;
 - g) Description of rules that apply within the watershed including, but not limited to, local shoreline management master programs, and zoning, subdivision, and flood hazard ordinances;
 - h) Determination that the instream flood control work is consistent with applicable policies and rules.
- 2) Alternative flood control work.
 - a) Description of potential measures of instream flood control work;
 - b) Description of alternatives to instream flood control work.

Guidance for achieving 1) a) through 1) e) and 1) g) is included in Step 4 in Chapter 7.

Guidance for 1) f) is included in Steps 3 and 5. Guidance for 1) h) is included in Step 8 in Chapter 7.

Guidance for achieving 2) is included in Step 7 in Chapter 7.

⁴ WAC 173-145-040 uses the term “Comprehensive Flood Control Management Plan (CFCMP).” See Section 1.3.

⁵ Note: While WAC 173-145-040 refers to “flood control work,” this guidebook interprets this to meet “flood hazard management.” See Section 1.3 (Key Terminology).

- 3) Identification and consideration of potential impacts of instream flood control work on the following instream uses and resources.
 - a) Fish resources, especially ESA-listed species and others of particular importance to tribal rights;
 - b) Wildlife resources;
 - c) Scenic, aesthetic, historic, and cultural resources, including access;
 - d) Navigation;
 - e) Water quality;
 - f) Hydrology;
 - g) Existing recreation;
 - h) Other impacts.

- 4) Area of coverage for the comprehensive plan shall include, as a minimum, the area of the 1% annual chance flood⁶ within a reach of the watershed of sufficient length to ensure that a comprehensive evaluation can be made of the flood problems for a specific reach of the watershed. The plan may or may not include an entire watershed. Comprehensive plans shall also include flood hazard areas not subject to riverine flooding, such as areas subject to coastal flooding, flash flooding, or flooding from inadequate drainage. Either the meander belt or floodway must be identified on aerial photographs or maps that will be included with the plan.

- 5) Conclusion and proposed solution(s). The CFHMP must be finalized by the following action from the appropriate local authority:
 - a) Evaluation of problems and needs;
 - b) Evaluation of alternative solutions;
 - c) Recommended corrective action with proposed impact resolution measures for resource losses; and
 - d) Corrective action priority.

- 6) A certification from the Emergency Management Division of the Washington State Military Department that the local emergency management organization is administering an acceptable comprehensive emergency operations plan.⁷

Guidance to achieve 3) is included in Steps 8, 9, and 11 in Chapter 7.

Guidance to achieve 4) is included in Step 4 in Chapter 7.

Guidance to achieve 5) a) is included in Step 6 in Chapter 7. Guidance for 5) b) is included in Steps 7 and 8. Guidance for 5) c) is included in Steps 8, 10, and 11. Guidance for 5) d) is included in Step 10. In Chapter 7.

3.3 Example Outline: Pierce County 2023 Flood Plan

Pierce County is currently in the middle of a 3-year process to develop a new CFHMP, which is scheduled to be completed in 2023 (Pierce County Planning and Public Works Surface Water Management, 2021). The current draft outline of the 2023 Pierce County Comprehensive Flood Management Plan is a useful example to consider because it is truly comprehensive. The plan will cover cities and county areas and look broadly at all flooding types within Pierce County: groundwater, riverine, urban, and coastal flooding. Additionally, the plan will address other considerations like climate change; diversity, equity, and

⁶ WAC 173-145-040 uses the term “one-hundred-year frequency floodplain.”

⁷ WAC 173-145-040 requires a certification from the State Department of Commerce; the relevant state authorities were transferred to the Emergency Management Division in 1995. When starting a CFHMP process, confirm with Ecology whether such a certification is required.

inclusion; and adaptive management pathways. The plan will also include a thorough implementation section that incorporates a funding strategy and financial rate study. This plan contains all of the elements required by WAC 173-145-040 and expands upon them to address new and emerging elements of comprehensive flood hazard management.

Chapter 1: Introduction

- Goals
- Objectives
- Guiding Principles
- Planning Processes
- 2013/2018 Accomplishments
- Basin Plan Incorporation
- Brief Overview of Each Plan/Study Being Done
- SEPA

Chapter 2, Part I: Needs and Drivers

- Pierce County River Systems
- Types of Flood-Related Hazards
- Effects of Sediment in the River
- Flooding and Future Trends
- Flood Damage Impacts
- Floodplain Management Policies

Chapter 2, Part II: Regulatory Commitments, Agreements, Drivers, and Other Considerations

- Total Maximum Daily Load (TMDL)
- Water Quality
- National Pollutant Discharge Elimination System (NPDES)
- Habitat Conservation Plan
- System Wide Improvement Framework (SWIF)
- Channel Migration Zone (CMZ)
- Inter-County River Improvement Commission
- Culverts
- Community Rating System (CRS)
- Pierce County Floodplain Regulations
- Orca Restoration Plan
- Salmon Restoration Plan
- Salmon Habitat
- Puget Sound Action Agenda
- Temperature/Shading
- Fish Habitat/Spawning
- 200-Foot Riparian Buffer

Chapter 3: Project Considerations

- Diversity, Equity, and Inclusion
- Climate Change
- Sustainability
- Adaptive Management/Pathways
- Sediment Management
- Floodplains for the Future
- Coordination with Cities and Counties
- Tribal Coordination

- SWIF
- Agriculture and Flood Easements
- Preservation and Maintenance
- Rights & Access to County Facility
- Sea Level Rise Impacts on Drainage

Chapter 4: Programmatic Recommendations

- Flood Risk
- Groundwater Flooding
- Riverine Flooding
- Urban Flooding, Streams, Creeks
- Coastal Flooding
- Habitat
- Water Quality
- Programmatic Recommendations
- Comprehensive and Strategic Plans
- Level of Service

Chapter 5: Hazard Breakdown

- Coastal Flooding: Overview
- Coastal Flooding: Pathways
- Groundwater Flooding: Overview
- Groundwater Flooding: Pathways
- Riverine Flooding: Overview
- Riverine Flooding: Projects
- Urban Flooding: Overview
- Urban Flooding: Pathways and Projects

Chapter 6: Plan Implementation

- Funding
- Financial Rate Study
- Plan Implementation
- Role of the County
- Who is Going to do the Work and When?

Appendices:

- Problem to Project Process, Evaluation Criteria
- Top Projects
- Five Shelf-Ready Projects
- Benefit-Cost Analysis (BCA) Work for Top-Ranked Projects
- General Investigation Projects
- Project Ranking Worksheets and Criteria
- Financial Rate Study
- Economic Analysis
- Groundwater Findings
- Floodplain Regulations
- Climate Change Technical Backups
- Full Levee Feasibility Study
- Problem Identification
- Habitat and Flood Capacity Creation Project Summary Report

3.4 Example Outline: Yakima County Naches River Flood Plan

Compared to the 2023 Pierce County Flood Plan outline, the 2003 Naches River Comprehensive Flood Hazard Management Plan outline sticks closer to the outline provided by WAC 173-145-040, while still being comprehensive in addressing the flood hazards in the study area (Yakima County, 2005). This plan outline is a useful example to consider because of its more traditional planning approach over a smaller geographic area. Specifically, the outline includes a robust alternative analysis that addresses a wide range of approaches including policy and regulatory changes, structure maintenance and protection, programmatic options, open space preservation, emergency management, and public outreach. Additionally, the outline includes an analysis of public education, individual behavior, and public perception of disaster assistance.

Executive Summary

- Approach
- Flood Issues
- Alternative Analysis
- Summary of Recommended Actions

Chapter 1: Introduction

- Background
- Plan Development Process
- Related Studies and Sources of Information
- Flood Control Assistance Account Program

Chapter 2: Study Area Characteristics

- General Description
- Physical Characteristics
- Socioeconomic Characteristics

Chapter 3: Previous Studies

- Lower Naches River Channel Migration Study, 2003
- Upper Yakima River Comprehensive Flood Hazard Management Plan, 1998
- Yakima County Flood Insurance Study, 1998
- Naches River Floodplain Information, 1972
- Yakima and Naches Rivers Floodplain Information, 1970

Chapter 4: Flood History Characteristics

- Factors Affecting Flooding
- Flood History and Damage
- Historical Flood Improvement Projects

Chapter 5: Flood Control Facilities and Programs

- Facilities Inventory
- Operation and Maintenance
- Special Districts
- Other Flood-Related Programs

Chapter 6: Regulatory Overview

- Summary of Existing Regulations
- Key Federal Regulations
- Key State Regulations
- Key County Regulations
- Key City of Naches Regulations
- Permitting Requirements

Chapter 7: Flood Problem Areas

- Problem Identification
- Scientific and Engineering Information Gaps
- Public Education
- Emergency Management
- Facilities and Existing Structures
- Regulatory
- Bank Erosion and Channel Migration
- Site-Specific Flood Issues

Chapter 8: Alternative Analysis Approach

- General Categories of Solutions
- Alternative Analysis and Selection

Chapter 9: Analysis of Flood Mitigation Alternatives

- Flood Hazard Reduction for New Development and Existing Structures
- Open Space Preservation/Habitat Preservation and Enhancement
- Flood Hazard Reduction for Public Facilities
- Emergency Management
- Mapping/Data Collection
- Public Education, Outreach, and Public Safety
- Implementation Funding

Chapter 10: Summary of Recommended Actions

References

Appendices

- Channel Migration Analysis Report
- Historic Floods Naches River Near Naches
- Inventory of Flood Control Structures
- Federal, State, and Local Regulations and Policies

CHAPTER 4: INTEGRATED FLOODPLAIN MANAGEMENT

4.1 Introduction

The previous version of this guidebook, published in 1991, included “Pursuit of Other Resource Protection Goals” as the sixth of eight Principles of Comprehensive Flood Hazard Management:

Dikes and levees traditionally used to control flooding destroy wildlife habitat, degrade a river's natural beauty, reduce water quality, diminish fisheries resources, and cause further downstream flooding and erosion. Flood hazard management, being comprehensive in approach, embraces these environmental conditions and considers them along with the prevention of flooding.

Shortly after the 1991 guidance was released, the listings of several salmon and steelhead populations across the state changed our approach to managing river, shoreline, and floodplain systems. The National Oceanic & Atmospheric Administration/National Marine Fisheries Service (NOAA-NMFS) listed Snake River fall Chinook salmon as Threatened in 1992, and several populations in the Columbia River and Puget Sound were listed shortly thereafter. In 1999, Washington State developed the state strategy known as “Extinction is Not an Option” to recover salmon and steelhead stocks, and recovery plans were drafted and adopted at the watershed and regional scales across the state; most if not all include floodplain habitat restoration as a focal strategy for salmon and steelhead recovery. Regional recovery organizations adaptively manage the approved recovery plans with co-managers (WDFW and Tribes) who also negotiate and manage harvest and hatchery aspects of the fisheries. The Governor’s Salmon Recovery Office is currently updating the 1999 strategy (see <https://rco.wa.gov/salmon-recovery/salmon-recovery-strategy-update/> for more information). The listings require a more integrated approach to managing floodplain areas.

Since 1991, integrating ecological restoration (to address ESA listings) and other resource protection goals (such as agriculture, water quality, and/or recreation) has become more central to floodplain management in Washington State, and the resource protection goals being considered have broadened. This approach has come to be known as Integrated Floodplain Management (IFM).

Since 2013, Ecology has been one of the leads of the Floodplains by Design (FbD) initiative, an ambitious public-private partnership focused on IFM by encouraging, funding, and supporting efforts to integrate and accelerate efforts to reduce flood risks and restore habitat across Washington State’s major river corridors. The initiative’s goal is to improve the resiliency of floodplains for the protection of human communities and the health of the ecosystem, while supporting values important in the region such as agriculture, clean water, a vibrant economy, and outdoor recreation.

Communities conducting comprehensive flood planning should strongly consider an IFM approach to their flood planning work, whether to help integrate across various departments and align the community’s goals, to help solve particularly thorny problems, or to simply be well positioned for a Floodplains by Design grant (see Section 5.2). To help communities interested in incorporating IFM into their CFHMP, this chapter includes a definition of IFM, an IFM checklist, a description of scalable approaches to IFM, and some specific IFM strategies. Additionally, for each step in the CFHMP process, Chapter 7 of this guidebook includes specific IFM guidance.

IFM is an overarching planning philosophy for managing floodplain areas, and IFM efforts tend to be ongoing. In contrast, a CFHMP is a document that captures a specific window in time. FCAAP funding requires that a CFHMP be completed within 3 years. Therefore, IFM is not an approach to developing a CFHMP. However, IFM is the recommended approach to floodplain management in Washington

State and should therefore be considered and incorporated into development of a CFHMP. There are several different approaches that can be effective:

- A watershed may have an IFM effort that has been ongoing prior to undertaking a CFHMP. In this case, a CFHMP could be developed as a flood hazard-focused plan that is informed by the ongoing IFM effort and integrates other planning priorities. The CFHMP would provide information and actions for flood hazard management that can then inform the IFM effort moving forward.
- Alternately, the CFHMP could be developed as an integrated plan based on the ongoing effort that considers habitat restoration and agricultural viability (for example) as equal priorities for the planning document. In this way, the CFHMP process can organize and advance the overall IFM effort, which would be expected to continue after the CFHMP is completed.
- For a watershed where an IFM effort has not yet started, development of a CFHMP—which requires the formation of an advisory committee, analysis of existing conditions, and development of non-structural flood hazard management and ecological restoration measures—can be an opportunity to start IFM. In this case, the information in Section 4.5 may be particularly helpful.

4.2 Definition of Integrated Floodplain Management

IFM is an approach to floodplain management that leverages collaboration based on shared values in order to adopt new approaches to reduce flood damages, increase salmon runs, and preserve farms and open spaces that enrich our lives and create a resilient future.

The goal of IFM is to improve the resiliency of floodplains for the protection of human communities and the health of ecosystems, while supporting values important in the region such as agriculture, clean water, a vibrant economy, and outdoor recreation. IFM solutions are locally driven and solve multiple floodplain management challenges. IFM aims to move past single-focus or “siloe” management efforts that can lead to unintended consequences, toward a holistic, collaborative model that works at a scale that matters to maximize benefits and reduce costs to people and nature. IFM embraces a holistic and collaborative approach to decision-making that brings together multiple interests to find common agreement on local floodplain visions, strategies, and actions that achieves multiple benefits. Multi-benefit outcomes can include (but are not limited to):

- Reduced flood risks for communities and commerce
- Healthy habitats for fish and wildlife
- Resilient communities and ecosystems
- Minimized flood damage
- Productive, viable agriculture
- Safe and sustainable development
- Jobs and sustainable livelihoods
- Sustainable supply of clean water
- Recreation and open space
- Tribal rights and access to rivers

Not all of these interests need to be included to be successful at IFM – not all areas will have agriculture present, for example. However, it is recommended that all be at least considered.

4.3 Integrated Floodplain Management Checklist

IFM is not necessarily sequential, and the process differs for each community. IFM is built in concentric stages and requires continuous support as efforts are managed to achieve identified goals and implement agreed-upon actions. It is important not to rush the process and to take the time to consider as much as possible. The following IFM checklist is adapted from “Advancing Integrated Floodplain Management at the Local Level” (Floodplains by Design, 2016 – available online at <http://www.floodplainsbydesign.org/work/>). While the checklist describes a list of steps that should be considered, and it is possible to follow them in order, the best approach is to tailor the sequence of steps to your community.

- Identify Participants** Identify participants that hold a legal right, management authority, or interest in the watershed and/or reach scales. Examples of participants include Tribes, agencies, agricultural interests, habitat restoration interests, landowners, recreation interests, business interests, and the public. Include consideration of upland land managers, such as the Washington Department of Natural Resources, the U.S. Forest Service, and private timber interests. It may be more important to start small with the most directly affected stakeholders, and build momentum at a realistic scale relative to the staff and leadership capacity. Starting small is acceptable and often the best option for building relationships and trust. As these processes often take multiple years, or even decades, participation may evolve and there may be a need to bring in new participants and help them come up to speed on the process.
- Lead** Leadership is essential and must ultimately serve as the bridge between the broader interests of the group and the authorizing environments of the communities or institutions of the representatives. Thus, it is important to identify who is not only willing to participate but those that are willing to lead or champion the process.
- Identify Interests** Identify the interests and values of the participants. Allowing participants to express their interests, needs, concerns, and fears can build understanding and pave the way for partnerships to form around mutually beneficial solutions. It is important that participants articulate specific and measurable goals, at both the watershed and reach scales, even if there are differing opinions within a specific interest area (e.g., flood risk reduction or salmon recovery). Technical work may be needed to support development of these goals and create a foundation for collaboration and compromises. That technical work may be focused on a single interest (e.g., an analysis of agricultural drainage) but designed to inform the broader integrated effort.
- Build Trust** Trust and mutual respect are a critical foundation to creative problem solving. Trust and mutual respect must be built between individuals representing the principal interests as well as decision-making bodies and local communities. Trust is built through structured conversations that give voice to the interests within each of the interest areas (e.g., fish, farming, and flood risk reduction).

In most situations, a neutral and highly skilled facilitator or staff coordinator is helpful in building trust and mutual respect. Building trust and mutual respect does not mean seeking “success” too early. Conflicts in floodplain areas are often deeply emotional and historically rooted. They can often indicate fundamental differences in values and aspirations. Poorly handled conflict can be damaging to the ability to move forward. The establishment and maintenance of clear roles of the facilitator and the ground rules is a critical part of the process. Often, staff charged with facilitating these efforts belong to an organization that is one of the interested participants and are often not formally trained in facilitating collaborative processes - increasing the challenge.

The willingness of all participants to actively listen to and consider the opinions and thoughts of other participants is key to building trust. Follow-through is another important element of building trust, especially if a flood event occurs during the process (which is very likely). How local agencies respond to the flood in the context of the information, strategies, and actions being developed as part of IFM is crucial.

Celebrate Success

Often IFM processes represent hard technical, emotional, and social work. Seemingly, small steps actually require tremendous investments of time, energy, and faith. These accomplishments should be identified, documented, and celebrated. This could include a few moments at the start of a meeting, shared food, and an email congratulating those who participated in a successful step, a phone call, or something more time intensive and formal. For some projects, it can take many years to reach construction. Successes along the way need to be celebrated to inspire continued work and leadership and to avoid a sense of depletion amongst staff and participants.

Commit to Shared Vision and Goals

Genuine commitment to a shared vision of the floodplain is a critical element. Depending on the situation, this could be across an entire floodplain area or at a reach scale. The shared vision and goals may be very general to very specific depending on the level of trust, the ability of an interest area to describe and agree upon their interests, and the ability of interest areas to understand and respect the needs of others. The importance of this step cannot be overstated and will likely be revisited many times over the years. The ability to move effectively from visioning to solutions and implementation is fundamentally rooted in:

- Level of trust and mutual respect
- Commitment to the group, the process, and the outcomes
- Effective linkages between interest area leaders, decision-makers and authorizing bodies, and on-the-ground affected parties
- Solid understanding in each of the interest areas

Formal written commitment (in the form of a signed charter, a Memorandum of Agreement, or letters) may be helpful.

Develop Actions

The next step is to develop a package of actions that achieve the shared vision and goals at a reach scale. This means that some actions may be more “integrated” than others may. Early in building trust, it may be important to get reciprocal support for high priority actions for each interest group with limited

integration as a critical trust-building step—essentially verifying that different interest groups understand the needs of others and will support those needs. As trust is built, it will become possible to brainstorm a list of more creative solutions that may better meet the vision and goals at a watershed, reach, and/or project scale. Solutions can be policy or on-the-ground actions. Given that past efforts have developed suites of single-purpose solutions, early solutions often include projects originally developed for just one purpose (such as projects in an existing flood plan). These are an excellent source of starting places, if they can truly be revisited in ways that expand possibilities and create projects that address a broader suite of interests. Many solutions should include policy actions if long-term results are to be achieved. Early success may be less innovative and not as integrated but is still a huge advancement if trust in the group is being built. If a group is building off of an earlier “salmon” or “flood” project, it is critical to ensure these projects are revisited in a manner that fully explores their potential to advance these and other needs. It is easy for other interest areas to feel that the addition of token “fish” elements to a “flood” project, for example, is disingenuous unless the project itself or the broader suite of projects truly addresses the needs of the given interest area.

Track Metrics

Develop simple and implementable metrics to help various interests ensure that their needs are being adequately addressed through the suite of projects and management actions that are being implemented. The metrics should be one means of helping the management effort refine its work to best achieve its goals. Pick 2–3 measurable indicators per interest area as a starting place to track the general trajectory of the collaboration. These indicators may represent a mix of policy and project outcomes (e.g., increase in fish habitat in Reach 1; fewer structures at high repetitive flood risk) and are developed by the group.

One example of a tracking program for IFM is the Puyallup Watershed Floodplains for the Future Shared Monitoring Program:

<https://floodplainsforthefuture.org/>.

Implement

Integrated management groups will have a variety of organizations seeking and implementing projects through both collaborative efforts (Floodplains by Design) and issue-specific processes (flood control zone district, salmon recovery funding, and streamflow grants). For example, the salmon recovery groups will continue to solicit and receive salmon-specific funding for salmon projects. The highest functioning integrated management program will see a continuity of investment that brings the collective vision to bear as both traditionally issue-specific and multi-benefit funds are deployed. Such programs will also seek to change and reform policies and programs within the various interest areas and authorizing institutions to ensure the collective vision is achieved over time. Integrated management must be a suite of policy and project actions. Leaders must truly be collectively committed to achieving the broader goals.

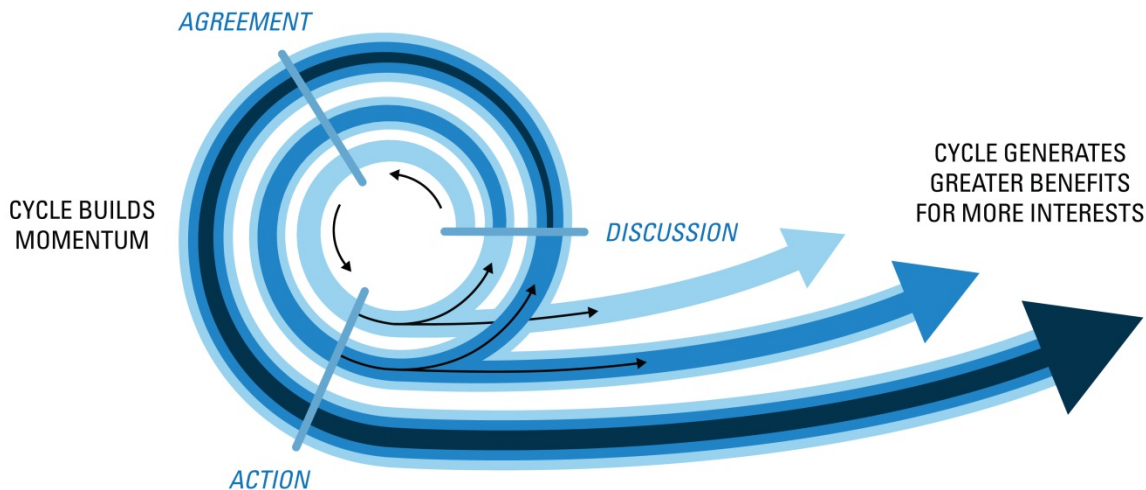
In addition to the process steps described in the checklist, it is necessary to consider the substantive elements that are required for successful IFM. The “How Integrated is our Floodplain Management?” infographic on the next page (developed by FbD) provides a tool to evaluate your level of integration and to determine the next best step to advance.

How Integrated is our Floodplain Management?

 <p>SHARED VISION</p> <ul style="list-style-type: none"> + No shared vision or very general shared vision ++ Multi-interest shared vision not yet tightly linked to actions +++ Multi-interest shared vision directly linked to actions 	 <p>GOALS</p> <ul style="list-style-type: none"> + Some interests have clearly articulated needs and goals, others may not ++ All interests have needs and goals that are known by other interests +++ All interests have needs and goals that are integrated and actively shared 	 <p>INSTITUTIONAL STRUCTURES</p> <ul style="list-style-type: none"> + Collaborative efforts are unstructured and ad-hoc ++ Efforts are staffed, structures are clear, and decision-making is defined +++ Collaboration is institutionalized with organizational support 	 <p>COLLABORATION</p> <ul style="list-style-type: none"> + Collaboration may result in mutual support for individual actions ++ Mutual support for actions coordinated on the landscape +++ Multi-benefit and individual interest actions coordinated on landscape 	 <p>PARTICIPANTS</p> <ul style="list-style-type: none"> + Actions are defined by one or two agencies with multiple interests in mind ++ A variety of stakeholders are at the table and participating +++ All people affected by the decision are participating
 <p>TECHNICAL STUDIES</p> <ul style="list-style-type: none"> + No understanding of the river system dynamics ++ Technical studies have been done but don't yet lead to integrated and prioritized actions +++ Technical studies have led to integrated actions and sequencing 	 <p>ACTIONS</p> <ul style="list-style-type: none"> + Package of site-specific individual interest actions; may or may not conflict ++ Package of individual interest actions that don't conflict +++ Package of single interest and multi-benefit actions that don't conflict 	 <p>SCALE</p> <ul style="list-style-type: none"> + Actions are coordinated at the site-scale only, at one or more discrete sites ++ Actions are coordinated at a large-site or small-reach scale +++ Actions are coordinated at a reach or watershed scale 	 <p>CLIMATE IMPACTS</p> <ul style="list-style-type: none"> + Watershed-specific climate impacts are not understood or addressed ++ Climate impacts may be addressed in individual project designs +++ Climate projections addressed through location, sequence, and design of durable projects 	 <p>MEASURING SUCCESS</p> <ul style="list-style-type: none"> + No tracking in place to assess change over time ++ Limited ability to measure success within certain interests, actions, or reaches +++ Sophisticated ability to measure success across landscape

As described above, IFM is complex and nonlinear. The figure below shows the cycle of Integrated Floodplain Management. IFM evolves as agreement and action build momentum, thus engaging either a broader set of stakeholders and interests or requiring a deepened and more specific discussion among already engaged parties. As participants build trust, they have more robust discussion, which leads to agreement and support for larger, more significant suites of actions over time. It is critical, however, for the parties involved in integrated management efforts to have the capacity to sustain and expand their efforts without becoming stretched too thin or diminishing. New interests should be incorporated over time to improve the overall results that are generated and/or to ensure that a path of implementation can be achieved.

The Cycle of Integrated Management Building Toward Greater Achievement



4.4 Strategies for Integrated Floodplain Planning

Strategies for incorporating IFM into your CFHMP are included throughout Chapter 7. This section describes some general strategies and lessons learned from staff work to support IFM at the watershed scale conducted by The Nature Conservancy as part of the Floodplains by Design initiative and is based on *Floodplains by Design: Toward a New Paradigm: Integrated Floodplain Management Status Report* (Floodplains by Design, 2018). Additional resources for IFM are listed in Appendix B.

Integration Involves Many Elements

Integrated Floodplain Management is complex and requires attention paid to many different elements. The “How Integrated is Our Floodplain Management?” figure included in Section 4.3 shows ten elements of IFM. Each element is important, but elements will likely be advanced on different time scales, and work on each element is not linear. Integration can occur within an organization (e.g., county government), within an interest area (e.g., integration within the farm community), or across interests and organizations. The list of elements in the figure can be used to assess the status of an IFM effort and to identify the next best strategic step.

Integrated Floodplain Management Requires Dedicated Staff Time

Each interest within an integrated planning effort needs staff capacity in order to define and articulate their needs and to seek and incorporate new information. An internal staff person can also lead projects that are prioritized by the group but that the group does not have capacity to lead. Integration across efforts also requires substantial staff time, so having dedicated staff who are neutral across interests and can coordinate the integrated floodplain collaboration effort is essential. In addition, dedicated staff needs to have the support of their leadership to engage in a long, complex, and time-consuming process with unpredictable outcomes. While consultant support can help provide specific skills (such as technical expertise, facilitation, or collaboration coaching), actual in-house staff capacity, especially at the implementing agency or lead agency, is critical.

Integrated Floodplain Management Requires a Wide Variety of Skills

Managing integrated floodplain efforts at the local level is much more complicated than may be assumed. In addition to staff time, a variety of capabilities and skills are needed. The needed skills are complex, nuanced, and need to be performed at a high level. For example, technical skills, project management skills, the ability to hold a vision, the ability to fit an effort within institutional structures, facilitation, storytelling, and grant writing are all needed skills for these efforts (although a full list of skills would be much longer). It is not possible for one person to have the entire skillset needed. Also, the emphasis of the skillset needed may change over time or suddenly if a crisis emerges. To be successful, a group working on integration needs to consciously increase its skillset through collaboration, training, peer-to-peer learning, and hiring outside expertise. Currently, training opportunities for IFM skills are ad hoc and an organized system is not in place.

Integrated Floodplain Management Works Best at a Bigger Scale and with More Voices Involved

The larger the scale (ideally a reach or watershed scale), the more possible it is to develop a package of projects to address a wide range of issues. Integrated management also works best when it involves a broad range of interests and voices. When floodplain interests are left out of the effort, they can present a barrier to implementation or fail to fully maximize the potential of a given site. It is also important to encourage specific interests (such as habitat recovery, or agriculture) to work together separately from the integrated group in order to make sure they represent their interests in a coordinated way that reflects their values. Then, integration efforts should focus on creating shared understandings across different interests. Continued outreach to ever-widening circles helps build support and understanding.

Early Actions Set Integrated Floodplain Management into Motion

Early actions can set IFM into motion. Even if early projects create friction or are imperfect, how they move forward can build trust as participants from different interests see each other working together to ultimately shape a shared project. Early projects at a smaller scale present a good opportunity to test integration and to build relationships. Fully integrated floodplain actions can take a long time, so pursuing early actions that support the diverse interests of the collaboration helps improve conditions on the ground in the meantime. It is not necessary to wait until everything is sorted out (such as having all scientific studies completed or all parties at the table) before acting on key early actions. Pursuing early actions and learning from them also helps an integration effort to be flexible and adaptable.

Sustained Integrated Floodplain Management Requires Tracking and Measurement of Progress

IFM by nature includes a range of goals, both interest-specific goals and shared goals. If participants do not see that progress is being made on the goals they find most important, it will be difficult to maintain both trust and momentum. In addition, being able to document success is key to bringing in new participants and seeking funding. Indicators of progress need to be both measurable and meaningful.

Data Management for Integrated Floodplain Management is Complex and Essential

Integrating efforts across governments, organizations, and partners requires transparency and the ability to see the sum total of a variety of efforts in one place. As collaborations get to scale and are working on a number of projects with different lead agencies and different funders, being able to track and see the work of the group easily and efficiently is essential. Most governments and organizations are largely set up to track their own work. Often, a separate dedicated effort is required to bring the various pieces together in a manner that multiple parties can access. Thoughtful management and dissemination of data will help ensure that science can provide a basis for discussion and agreement.

Storytelling Uses Empathy to Build Understanding and Respect

Empathy is at the core of what builds understanding and respect. Collaboration only works where there is understanding and respect for other interests and the needs of others. Storytelling skills can be used to evoke empathy from others by conveying in a very human way the importance of various aspects of IFM to the storyteller.

Key Recommendations for Local Practitioners:

- **Use the elements of integration.** Understand that there are many elements of integration and that you need to continually consider the various components in order to assess the status of your effort and to identify the next best strategic step for your effort.
- **Add capacity.** Make sure you have the staff capacity needed within each interest area of significance and to help assist the integration across those interest areas. Consider hiring dedicated staff.
- **Foster skills.** Consciously gather the variety of skillsets needed to advance your effort.
- **Broaden your effort.** Work to broaden the scale you are working at and the breadth of voices participating.
- **Pursue early actions.** Pursue early actions to build trust and to set the cycle of discussion, agreement, and action into motion.
- **Track and measure.** Establish a mutually agreed-upon system to track and measure progress toward your shared goals.
- **Manage data.** Invest effort into data management systems that allow for complex integration and transparency within jurisdictions, such as a county with different departments and divisions as well as with outside partners.
- **Tell stories.** Encourage storytelling as a means to building understanding and respect across people and interests.

4.5 Scalable Approaches to Integrated Planning

Starting an IFM approach can be intimidating. As described above, IFM efforts can be time- and funding-intensive. However, it is possible to start small and grow your IFM effort over time. If a full-scale IFM approach is not possible at this time, including some IFM elements in your CFHMP can be a good way to get started. Some specific scalable approaches to IFM, that start small and can be expanded upon over time, include:

- Start with one or more integrated projects. As described above in Section 4.4, early actions set IFM into motion. Collaborating with multiple interests to develop one or more integrated floodplain projects for your CFHMP can establish the basis for future collaboration and

integration. If possible, make implementation of the integrated projects in the plan a top priority after plan adoption.

- Start with a single reach. As described above in Section 4.4, IFM works best at a larger scale. However, it may not be possible to start integrating at the watershed or jurisdiction scale. Consider choosing one reach and create a collaborative team to explore various interests and develop an integrated package of projects.
- Focus on addressing one of the primary barriers to implementing your goals. What has kept you from being able to implement large-scale flood hazard reduction projects? Is it competition over available land with salmon restoration practitioners? Is it agricultural landowners who block projects out of concerns about agricultural land conversion? Start by collaborating with those interests that have been a barrier to projects and explore ways to create strategies and measures that provide benefits to both of you, then pursue implementation of those strategies and measures together.
- Start with a small collaborative team. IFM works best with more voices involved, but those voices can be added over time. If resources for IFM are limited, start with a small collaborative team of engaged staff representing several different interests and brainstorm-integrated approaches together. As you build momentum, your team will likely grow organically.

In addition to the approaches above, this guidebook is designed for a scalable approach to IFM through the modular approach to the CFHMP development steps described in Chapter 7, each of which has a separate section describing IFM considerations for that step.

CHAPTER 5: RELATED PROGRAMS AND GRANTS

5.1 Introduction

In addition to Washington State statutes on flood planning and the requirements of the FCAAP program, there are other programs that communities should consider before starting a flood planning process. These include grant programs that fund flood hazard mitigation projects (including the Hazard Mitigation Grant Program, Flood Mitigation Assistance Grant Program, Building Resilience Infrastructure and Communities grant program, and Floodplains by Design) and other planning frameworks that may need to be integrated with the CFHMP planning framework (including the Community Rating System, System Wide Improvement Framework, and Hazard Mitigation Plan). This chapter describes these programs, and Chapter 7 includes considerations related to the programs for each step of the CFHMP process.

5.2 Floodplains by Design Grant Program

Agency: Washington Department of Ecology (Ecology)

Program Description: Ecology administers the Floodplains by Design (FbD) grant program under a biennial funding cycle. Ecology awards grants on a competitive basis to eligible entities for collaborative and innovative projects throughout Washington State that support the integration of flood hazard reduction with ecological preservation and restoration. Proposed projects may also address other community needs, such as preservation of agriculture, improvements in water quality, or increased recreational opportunities, provided they are part of a larger strategy to restore ecological functions and reduce flood hazards.

Eligibility: Counties, cities, and towns; special purpose districts, such as flood control districts; federally recognized Tribes; conservation districts; municipal or quasi-municipal corporations; and not-for-profit organizations that are recognized as tax exempt by the Internal Revenue Service.

Basic Requirements: N/A

Program Uses/Types of Projects Commonly Funded: The FbD grant program provides grants for pre-construction planning, feasibility, design, permitting, construction, land acquisition/land conservation/easement purchase, residential buy-outs and relocation costs, project-specific outreach and education components, riparian/wetland restoration, and pre- and post-construction assessment elements. Ideal projects are part of an integrated strategy designed to holistically manage the floodplain within a watershed or specific reach of a river. The strategy must identify the means to reduce flood risk to affected communities, restore ecological functions, support community and environmental resiliency to future climate impacts, and provides additional community benefits. In areas where agriculture is a dominant land use, projects must minimize negative impacts on agriculture and identify strategies to support local agricultural interests.

Relationship to Flood Planning: The FbD grant program is a potential funding source for strategies and measures included in a CFHMP if they are part of an IFM strategy. Chapter 4 of this guidebook defines IFM and provides guidance for pursuing IFM, and the steps of flood hazard planning in Chapter 7 include call-out boxes with IFM guidance. Many communities in Washington State have adopted IFM approaches to flood hazard management, and many have applied for FbD grants. Preparation of a CFHMP should be closely coordinated with IFM efforts so that the CFHMP includes strategies and measures that are ready to be submitted to Ecology in an FbD grant application.

Links:

- Floodplains by Design Grants Website: <https://ecology.wa.gov/About-us/How-we-operate/Grants-loans/Find-a-grant-or-loan/Floodplains-by-design-grants>.
- Floodplains by Design Grant Funding Guidelines 2021–2023: <https://apps.ecology.wa.gov/publications/SummaryPages/1906011.html>.
Note: New funding guidelines are released every 2 years.
- Floodplains by Design Public-Private Partnership Website: <http://www.floodplainsbydesign.org/>.

5.3 Hazard Mitigation Plans

Agency: Federal Emergency Management Agency (FEMA) and Washington Emergency Management Division (EMD)

Program Description: Many FEMA grant programs (including those described in Sections 5.2, 5.3, and 5.4) require a FEMA-approved State or Tribal Hazard Mitigation Plan and a FEMA-approved Local or Tribal Hazard Mitigation Plan, in accordance with Title 44 CFR Part 201. The State Enhanced Hazard Mitigation Plan was prepared and is updated by EMD (EMD, 2018). Local communities are responsible for developing and adopting local Hazard Mitigation Plans.

Eligibility: State, tribal, and local governments

Basic Requirements: N/A

Program Uses: In addition to making a community eligible for FEMA grants, a Hazard Mitigation Plan helps the community understand the risks from natural hazards and develop strategies and actions to reduce the impacts of those events. The FEMA Local Mitigation Planning Handbook includes nine steps for developing a Hazard Mitigation Plan:

- Task 1 – Determine the Planning Area and Resources
- Task 2 – Building the Planning Team
- Task 3 – Create an Outreach Strategy
- Task 4 – Review Community Capabilities
- Task 5 – Conduct a Risk Assessment
- Task 6 – Develop a Mitigation Strategy
- Task 7 – Keep the Plan Current
- Task 8 – Review and Adopt the Plan
- Task 9 – Create a Safe and Resilient Community (FEMA, 2013)

Plans need to be updated on a 5-year cycle. The plan needs to be reviewed by the State Mitigation Strategist and by the FEMA Regional Office, and then adopted locally. The requirements for local Hazard Mitigation Plans are included in the Local Mitigation Plan Review Guide (https://www.fema.gov/sites/default/files/2020-06/fema-local-mitigation-plan-review-guide_09_30_2011.pdf).

Relationship to Flood Planning: A FEMA-approved Hazard Mitigation Plan is required to access certain FEMA grants that can fund strategies and measures included in CFHMPs. Many jurisdictions have developed Hazard Mitigation Plans separately from CFHMPs. Some jurisdictions have chosen to

fully incorporate flood planning into the Hazard Mitigation Plan; Kittitas County took this approach in 2019, and a link to that document is included in Appendix B. When developing a CFHMP, coordinate with your local emergency management department to discuss how the CFHMP should be coordinated with the Hazard Mitigation Plan. To the degree possible, the CFHMP description of risk and identification of strategies and measures should be incorporated into the next update of the Hazard Mitigation Plan.

Links:

- FEMA Hazard Mitigation Planning website: <https://www.fema.gov/emergency-managers/risk-management/hazard-mitigation-planning>.
- Local Mitigation Planning Handbook: https://www.fema.gov/sites/default/files/2020-06/fema-local-mitigation-planning-handbook_03-2013.pdf.
- Local Hazard Mitigation Planning Fact Sheet: https://www.fema.gov/sites/default/files/2020-06/fema-local-hazard-mitigation-planning-factsheet_02-06-2018.pdf.
- Local Mitigation Plan Review Guide: https://www.fema.gov/sites/default/files/2020-06/fema-local-mitigation-plan-review-guide_09_30_2011.pdf.

5.4 Hazard Mitigation Grant Program

Agency: Federal Emergency Management Agency (FEMA) and Washington Emergency Management Division (EMD)

Program Description: The Hazard Mitigation Grant Program (HMGP) provides funding for:

- Retrofitting existing buildings to make them less susceptible to damage from a variety of natural hazards.
- Purchasing hazard-prone property to remove people and structures from harm's way.
- Utility and infrastructure retrofits to reduce the risk of failure caused by natural hazards.
- Drainage improvement projects to reduce the potential for flood damage.
- Slope stabilization projects to reduce the risk to people and structures.
- Developing and adopting Hazard Mitigation Plans, which are required for state, local, Tribal, and territorial governments to receive funding for their hazard mitigation projects.
- Using aquifer storage and recovery, floodplain and stream restoration, flood diversion and storage, or green infrastructure methods to reduce the impacts of flood and drought.

Eligibility: States and federally recognized Indian Tribal governments are eligible applicants. EMD is the designated applicant for Washington State. Local governments (including cities, counties, special districts, and Indian Tribal governments) are eligible sub applicants and can submit sub applications to EMD.

Basic Requirements: To receive funding for project actions (as opposed to planning), applicants must have a FEMA-approved State or Tribal Hazard Mitigation Plan and a FEMA-approved Local or Tribal Hazard Mitigation Plan, in accordance with Title 44 CFR Part 201. A Presidential major disaster declaration must be made for funds to become available.

Program Uses/Types of Projects Commonly Funded: The HMGP provides funding for the following:

- Property Acquisition and Structure Demolition
- Property Acquisition and Structure Relocation
- Structure Elevation
- Mitigation Reconstruction
- Dry Floodproofing of Historic Residential Structures
- Dry Floodproofing of Non-Residential Structures
- Generators (for critical facilities/infrastructure)
- Localized Flood Risk Reduction Projects
- Non-localized Flood Risk Reduction Projects
- Structural Retrofitting of Existing Buildings
- Non-structural Retrofitting of Existing Buildings and Facilities
- Safe Room Construction
- Wind Retrofit for One-and Two-Family Residences
- Infrastructure Retrofit (utility systems, roads, bridges)
- Soil Stabilization
- Wildfire Mitigation
- Post-disaster Code Enforcement
- 5% Initiative Projects
- Climate Resilient Mitigation

Relationship to Flood Planning: The HMGP is a potential funding source for strategies and measures included in a CFHMP. It is also a potential funding source for flood planning if it is done as part of a Hazard Mitigation Plan framework. Development of a CFHMP should be coordinated with your community's Hazard Mitigation Plan process, and the two plans can potentially be merged. Meeting the requirements of a Hazard Mitigation Plan and of the HMGP grant application process in your CFHMP can help set the stage for funding of CFHMP elements. See Section 5.3 for more information on Hazard Mitigation Plan requirements.

Links:

- Hazard Mitigation Grant Program website: <https://www.fema.gov/grants/mitigation/hazard-mitigation>.
- Fact Sheet: <https://mil.wa.gov/asset/5ba4208fd57>.
- Washington EMD website: <https://mil.wa.gov/hazard-mitigation-grants>.
- FEMA; Mitigation Ideas: A Resource for Reducing Risk to Natural Hazards, January 2013; https://www.fema.gov/sites/default/files/2020-06/fema-mitigation-ideas_02-13-2013.pdf.

5.5 Flood Mitigation Assistance Grant Program

Agency: Federal Emergency Management Agency (FEMA) and Washington Emergency Management Division (EMD)

Program Description: The Flood Mitigation Assistance (FMA) grant program provides funding to reduce or eliminate the risk of repetitive flood damage to buildings insured by the National Flood Insurance Program.

Eligibility: States and federally recognized Indian Tribal governments are eligible applicants. EMD is the designated applicant for Washington State. Local governments (including cities, counties, special districts, and Indian Tribal governments) are eligible sub applicants and can submit sub applications to EMD.

Basic Requirements: Applicants must have a FEMA-approved State or Tribal Hazard Mitigation Plan and a FEMA-approved Local or Tribal Hazard Mitigation Plan, in accordance with Title 44 CFR Part 201.

Program Uses/Types of Projects Commonly Funded: The FMA program provides funding for project scoping, community flood mitigation projects, technical assistance, flood hazard mitigation planning, and individual flood mitigation projects for severe repetitive loss properties. Eligible community flood mitigation projects include localized flood control, floodwater storage and diversion, floodplain and stream restoration, stormwater management, and wetland restoration/creation. The program will fund up to \$25,000 federal cost share for the flood-only portion of local Hazard Mitigation Plans.

Relationship to Flood Planning: The FMA program is a potential funding source for strategies and measures included in a CFHMP. It is also a potential funding source for flood planning if it is done as part of a Hazard Mitigation Plan framework. Development of a CFHMP should be coordinated with your community's Hazard Mitigation Plan process, and the two plans can potentially be merged. Meeting the requirements of a Hazard Mitigation Plan and of the FMA grant application process in your CFHMP can help set the stage for funding of CFHMP elements. See Section 5.3 for more information on Hazard Mitigation Plan requirements.

Links:

- Flood Mitigation Assistance (FMA) Grant website: <https://www.fema.gov/grants/mitigation/floods>.
- Fiscal Year (FY) 2020 Notice of Funding Opportunity (NOFO): https://www.fema.gov/sites/default/files/documents/fema_nof-fy20-flood-mitigation-assistance_december-2020.pdf.
Note: A new NOFO is released each year.
- Washington EMD website: <https://mil.wa.gov/hazard-mitigation-grants>.

5.6 Building Resilient Infrastructure and Communities

Agency: Federal Emergency Management Agency (FEMA) and Washington Emergency Management Division (EMD)

Program Description: The Building Resilient Infrastructure and Communities (BRIC) grant program funds hazard mitigation projects to reduce the risks from disasters and natural hazards, including flooding. BRIC is a new FEMA program that replaces the Pre-Disaster Mitigation program.

Eligibility: States and federally recognized Indian Tribal governments are eligible applicants. EMD is the designated applicant for Washington State. Local governments (including cities, counties, special districts, and Indian tribal governments) are eligible sub applicants and can submit sub applications to EMD.

Basic Requirements: States must have had a major disaster declaration under the Stafford Act in the 7 years prior to the application. Applicants must have a FEMA-approved State or Tribal Hazard Mitigation Plan and a FEMA-approved Local or Tribal Hazard Mitigation Plan, in accordance with Title 44 CFR Part 201.

Program Uses/Types of Projects Commonly Funded: The BRIC program will fund: (1) capability- and capacity-building activities to enhance knowledge, skills, and expertise to expand or improve the administration of mitigation assistance (including building code activities, partnerships, project scoping, mitigation planning, and planning-related activities); (2) mitigation projects designed to increase resilience and public safety, reduce injuries and loss of life, and reduce damage and destruction; and (3) management costs associated with a specific mitigation measure or project. FEMA will also provide non-financial direct technical assistance to help build a community's capacity and capability to improve its resiliency to natural hazards. Types of projects funded by BRIC include flood control, utility and infrastructure protection, retrofits, relocation, safe rooms and shelters, mitigation reconstruction, stabilization and restoration, and acquisitions.

Relationship to Flood Planning: The BRIC program is a potential funding source for strategies and measures included in a CFHMP. It is also a potential funding source for flood planning if it is done as part of a Hazard Mitigation Plan framework. Development of a CFHMP should be coordinated with your community's Hazard Mitigation Plan process, and the two plans can potentially be merged. Meeting the requirements of a Hazard Mitigation Plan and of the BRIC grant application process in your CFHMP can help set the stage for funding of CFHMP elements. See Section 5.3 for more information on Hazard Mitigation Plan requirements.

Links:

- Building Resilient Infrastructure and Communities (BRIC) website: <https://www.fema.gov/grants/mitigation/building-resilient-infrastructure-communities>.
- FY 2020 BRIC Notice of Funding Opportunity (NOFO): https://www.fema.gov/sites/default/files/2020-08/fema_fy20-bric-notice-of-funding-opportunity_federal-register_August-2020.pdf.
- FY 2020 BRIC Notice of Funding Opportunity Fact Sheet: https://www.fema.gov/sites/default/files/2020-09/fema_bric_fy-2020_nofa_fact-sheet.pdf.

5.7 Community Rating System

Agency: Federal Emergency Management Agency (FEMA)

Program Description: The Community Rating System (CRS) is “a voluntary incentive program that recognizes and encourages community floodplain management practices that exceed the minimum requirements of the National Flood Insurance Program (NFIP)” (FEMA, 2021).

Eligibility: NFIP communities

Basic Requirements: To be eligible for CRS, all communities must keep elevation certificates for all floodplain development. Designated repetitive loss communities must also conduct floodplain management planning. Other CRS activities are optional.

Program Uses: CRS is a voluntary incentive program for communities enrolled in the NFIP. CRS can lower flood insurance rates for certain NFIP flood insurance policies in participating communities. Communities in the CRS program earn points based on their participation in certain floodplain management activities, as described in the *CRS Coordinator's Manual* (FEMA, 2017). Based on the number of points a community earns, they are assigned a CRS Rate Class, from Class 1 to Class 10. Depending on the Rate Class, property owners in the jurisdiction get a discount on their flood insurance premium. Policyholders in a Class 9 community receive a 5% discount, while policyholders in a Class 1 community receive a 45% discount. The CRS program encourages best floodplain management practices.

Relationship to Flood Planning: CRS Activity 510 (Floodplain Management Planning) provides credit to communities who develop Floodplain Management Plans. The requirements to receive credit under Activity 510 are not exactly the same as the guidance in this guidebook. Any community enrolled in CRS or interested in enrolling in CRS should incorporate CRS flood planning requirements into their CFHMP process in order to increase the credit they receive. Successfully incorporating CRS planning requirements into the CFHMP process requires forethought and a thorough understanding of the CRS requirements.

Links:

- Community Rating System website: <https://www.fema.gov/floodplain-management/community-rating-system>.
- Community Rating System Local Official's Guide: https://www.fema.gov/sites/default/files/documents/fema_community-rating-system_local-guide-flood-insurance-2018.pdf.
- CRS Coordinator's Manual (2017): https://www.fema.gov/sites/default/files/documents/fema_community-rating-system_coordinators-manual_2017.pdf.
- Addendum to the CRS Coordinator's Manual (2021): https://www.fema.gov/sites/default/files/documents/fema_community-rating-system_coordinator-manual_addendum-2021.pdf.

5.8 System Wide Improvement Framework

Agency: U.S. Army Corps of Engineers (Corps)

Program Description: The System Wide Improvement Framework (SWIF) provides a process for jurisdictions with levees in the Public Law 84-99 (PL 84-99) program to remain eligible for the program while addressing operation and maintenance deficiencies in their levees.

Eligibility: Non-federal levee sponsors (i.e., owners of levees enrolled in the PL 84-99 program)

Basic Requirements: N/A

Program Uses: Keeping levees maintained to the requirements of the PL 84-99 program can be challenging, particularly for jurisdictions that own an extensive levee system, such as counties with major river systems that are leveed. Some requirements (such as for vegetation removal) can be inconsistent with other floodplain management goals. However, losing enrollment in the PL 84-99 program would remove access to federal funds to repair damages to levees from flood events, a major liability that local governments cannot afford. Developing a SWIF plan can provide a framework for gradually addressing levee maintenance deficiencies at a system-wide scale while staying in the PL 84-99 program.

Relationship to Flood Planning: A SWIF plan should be coordinated with other goals and strategies in the Flood Plan. For example, if your goals for levees involve setting them back, then that should be reflected in the SWIF plan as well. If the SWIF plan describes capital projects, they should be consistent with the CFHMP capital projects, or potentially just reference the CFHMP. If either the SWIF plan or the CFHMP sets a level of service (LOS) (or multiple LOSs) for levees in the system, those should be carried over and consistent between the two plans. If you already have a SWIF plan, the CFHMP is an opportunity to integrate the projects, and policies in the SWIF plan with your community's other flood hazard-related goals, strategies, and measures.

Links:

- System Wide Improvement Framework website:
[https://www.mvr.usace.army.mil/Missions/Flood-Risk-Management/Levee-Safety-Program/SWIF/.](https://www.mvr.usace.army.mil/Missions/Flood-Risk-Management/Levee-Safety-Program/SWIF/)
- SWIF Fact Sheet:
[https://www.mvr.usace.army.mil/Portals/48/docs/EC/LSP/SWIFFactSheet.pdf.](https://www.mvr.usace.army.mil/Portals/48/docs/EC/LSP/SWIFFactSheet.pdf)
- SWIF Process Flow Chart:
[https://www.mvr.usace.army.mil/Portals/48/docs/EC/LSP/SWIF_ProcessFlowChart_3April2013.pdf.](https://www.mvr.usace.army.mil/Portals/48/docs/EC/LSP/SWIF_ProcessFlowChart_3April2013.pdf)

CHAPTER 6: TRIBAL RIGHTS

6.1 Tribal Rights

Tribal rights, including treaty rights, are a critically important component and consideration of natural resource management in Washington State. Tribes in the region have always been reliant upon natural resources as their personal, economic, cultural, and spiritual lifeways. Prior to statehood and as Europeans settled in the region, the natural resources upon which Tribes depended were slowly lost and depleted, and the degradation of habitat and species is ongoing to this day. As non-Indigenous settlement continued and expanded, Tribes were forcefully removed from their lands, and the United States government used treaties, executive orders, and laws to acquire tribal lands and resources, often without compensation. *“The United States recognized tribes as sovereign nations and the rightful owners of the land through the signing of treaties that carry the weight of the U.S. Constitution”* (NWIFC, 2014). Additionally, these treaties established government-to-government relationships between Tribes and the federal government, later adopted by the state. Although these treaties affirm the rights of tribal governments, in many instances, promises made between Tribes and the federal government have been forgotten or ignored. Not all Tribes in Washington State were signatories to the treaties negotiated by Governor Stevens in the 1850s (listed below). Nevertheless, all Tribes in Washington State play an important role in natural resource management issues.

Between 1854 and 1856, Washington’s territorial governor, Isaac Stevens, negotiated seven treaties with Tribes in Washington State:

- Treaty of Medicine Creek – 1854 [LINK](#)
- Treaty of Neah Bay – 1855 [LINK](#)
- Treaty of Point Elliott – 1855 [LINK](#)
- Treaty of Point No Point – 1855 [LINK](#)
- Treaty with Walla Walla – 1855 [LINK](#)
- Treaty with the Yakama – 1855 [LINK](#)
- Quinault Treaty – 1856 [LINK](#)

At the time of signing, salmon and other resources were plentiful, but as westward expansion and non-Indigenous settlement grew, the availability of natural resources declined. *“Tribes saw fewer fish returning to their rivers. When they tried to harvest fish off-reservation – a right they had reserved in the treaties – they were arrested by the state of Washington, which refused to recognize tribal treaty rights”* (NWIFC, 2014). Threats to tribal rights and tensions between tribal governments and the state continued to grow. Because treaties carry the same weight of the U.S. Constitution, they are defined as *“the ‘supreme law of the land,’ which supersedes state law in the event of a conflict”* (Understanding Tribal Treaty Rights in Western Washington, NWIFC, 2014). Through a series of highly influential federal court cases, the rights of tribal governments contained within treaties were upheld.

Despite these rulings, tribal rights, treaty rights, and access to treaty-reserved resources continue to face threats and shape modern-day natural resource management in Washington State. Washington’s obligation to the Tribes is codified in statute (RCW 43.376.020) that establishes a government-to-government relationship between State agencies and Indian Tribes, which requires the agencies to:

- 1.) Make reasonable efforts to collaborate with Indian Tribes in the development of policies, agreements, and program implementation that directly affect Indian Tribes and develop a consultation process that is used by the agency for issues involving specific Indian Tribes.
- 2.) Designate a tribal liaison who reports directly to the head of the agency.
- 3.) Ensure that tribal liaisons who interact with Indian Tribes and the executive directors of state agencies receive training as described in RCW 43.376.040.
- 4.) Submit an annual report to the governor on activities of the State agency involving Indian Tribes and on implementation of this chapter.

6.2 Tribal Rights and Floodplain Management

While floodplain managers have not always acknowledged it, floodplain management activities affect tribal rights, including treaty rights, due to the link between floodplain habitat, salmon productivity, and salmon harvests, not to mention other treaty-protected resources and access to rivers for spiritual and cultural practices. *“Floodplains play a critical ecological role in salmon recovery and creating healthy functioning habitat. Floodplains are essential to maintaining the hydrological function of streams and providing off-channel salmon habitat”* (NWIFC, 2020).

The 1974 federal court ruling, *United States v. Washington* (commonly known as the Boldt decision), affirmed tribal treaty rights and established Tribes as co-managers of fishery resources in Washington State (Treaty Indian Tribes in Western Washington, 2011). For Tribes in Washington State, habitat recovery and restoration are critically important for salmon management in order to support a robust harvest guaranteed to Tribes through their treaty rights.

“NO HABITAT EQUALS NO SALMON; NO SALMON EQUALS NO TREATY RIGHTS; AND NO TREATY RIGHTS EQUALS A BREACH OF CONTRACT BETWEEN THE TRIBES AND U.S. GOVERNMENT”
– BILLY FRANK JR., 2011

While floodplains play an important role for supporting salmon populations, the management of floodplains to reduce flood risk poses challenges for salmon recovery. *“Flood management...often results in diking and armoring streams, altering both streamflows and physical habitat”* (State of Our Watersheds, 2020). These structures and actions severely limit habitat-forming processes in floodplains and are often at odds with salmon recovery efforts. *“Salmon need cool, clean water to survive. In healthy river systems, trees and shrubs along the banks help keep temperatures low. But when dikes or levees line a river, the U.S. Army Corps of Engineers says most of that vegetation must be cut down...It’s a one-size-fits-all approach that might work on the Mississippi River, but is out of place here in western Washington”* (Billy Frank Jr., 2011). Habitat complexity has been shown to be a strong predictor of Chinook salmon productivity (Hall et al., 2018). The presence of side channel habitat, in-water structures, and large woody debris all serve to slow the flow of rivers and provide habitat for Chinook salmon (Hall et al., 2018). However, the presence of levees and other flood control measures strips rivers of these habitat-forming features and presents challenges to salmon recovery actions. Flood planning efforts should start with an acknowledgment that, on many rivers, the existing flood control infrastructure causes daily harm to salmon populations.

As populations increase in Washington State, so too do the development pressures faced by floodplain areas. *“Population growth is forecast to increase in the next decade and the remaining floodplain habitat is at risk of being converted to non-habitat use. This raises concerns about an increased need for levees, and degradation of water quality and riparian forests, and an increase in*

the amount of impervious surface areas in the lower portions of the watersheds, negatively impacting fish habitat and water quality” (State of Our Watersheds, 2020).

*“Despite their critical role in salmon survival, floodplains continually face development pressures. Floodplain management has had mixed results, with improvements in some watersheds but continued degradation in others”
(State of Our Watersheds, 2020).*

In Puget Sound, the Northwest Indian Fisheries Commission’s paper ‘Treaty Rights at Risk’ (Treaty Indian Tribes in Western Washington, 2011) made the case that management of natural resources through the existing federal, state, and local regulatory frameworks has not sufficiently protected treaty resources, specifically salmon. Habitat was and is being lost faster than it is being restored. The Commission’s intent was to shine a light on this problem, understanding that the response would need to be multi-faceted. Improved floodplain management by jurisdictions is one of the responses they are seeking.

Tribes are already highly involved in many efforts related to flood hazard management, including salmon recovery and Integrated Floodplain Management. By incorporating these efforts into the flood planning process, there will inherently be tribal involvement and consideration of treaty rights. However, it is important to engage with Tribes directly on the flood hazard planning effort, ideally as early in the process as possible. As described in Section 1.5, RCW 86.12.210 outlines a process whereby city and county governments work together in preparing CFHMPs. Best practices would also include Tribal governments in preparation of a CFHMP.

As noted above, riparian forests are important to floodplain and habitat function. Currently, a State/Tribal Riparian Protection and Restoration Workgroup is evaluating how to integrate consideration of riparian forest buffers of at least 1 Site Potential Tree Height in width into various state programs. Efforts to develop a CFHMP should consider strategies and measures to encourage the protection and restoration of riparian forest buffers.

It is important to note that treaty rights and engagement of local Tribes (including Tribes that are not signatories to treaties) are related to but distinct from environmental justice considerations. While many of the same best practices hold true for jurisdictions to consider environmental justice in the planning process, even the recommendations from the Washington State Environmental Justice Task Force note the distinction of tribal consultation as a legal requirement as opposed to a best practice, particularly for federal and state agency obligations under the treaties (Environmental Justice Task Force, 2020).

6.3 Case Study: Stillaguamish Watershed

The Stillaguamish River Watershed provides a useful case study to examine the loss of productive floodplain habitat and treaty resources through land use conversion and floodplain modifications. Beginning in the 1870s, European settlers began constructing dikes in the lower Stillaguamish Watershed to convert saltmarsh habitat into agricultural lands. Prior to European settlement, there was an estimated 1.8 km² of salt marsh at the mouth of the Stillaguamish River. Just 15 years later, only one-third of the original salt marsh remained, and by 1968, only 15% of the original salt marsh habitat remained (Collins, 1997).

Other structures, like logjams, were removed by settlers, which resulted in a decline of scouring and deposition and a subsequent loss of habitat. Other land use changes, like logging, resulted in the removal of large trees, which led to weakened bank stability and less large woody debris in the river (Collins, 1997). Over time, the main stem of the river became shorter and narrower, with an estimated loss of one-third of the channel area from 1933 to 1991 (Collins, 1997). Continued bank development and agricultural activities resulted in further loss of floodplain channels.

Upstream, logging led to increased rates of landslides, resulting in “sediment waves which affected spawning and rearing of salmonids” and increased rates of sedimentation throughout the river and estuary (Collins, 1997). Other activities, like gravel mining, have likely led to further habitat degradation.

The Stillaguamish Watershed has also seen a significant decrease in the number of beaver ponds. Beaver ponds provide slow-moving water and productive habitat for salmon (Pollock et al., 2004). European settlement and beaver trapping led to a rapid decline in beaver populations. Coupled with the dredging and diking of agricultural lands, the loss of beavers and their ponds lead to the loss of substantial portions of rearing habitat in the watershed (Pollock et al., 2004).

In spite of the long history of habitat loss and land use change in the watershed, numerous restoration opportunities are available to restore some habitats and functions. A lack of beaver ponds has been cited as a primary limitation to Coho recovery in the watershed (Pollock et al., 2004). *“In the Stillaguamish River, reclamation of all juvenile Coho salmon habitat other than beaver ponds would increase output potential by about 200,000 smolts, primarily from the reclamation of side-channel and distributary sloughs. In comparison, restoration of all former beaver pond habitat would increase smolt production by over seven times that amount”* (Pollock et al., 2004). Other actions, like the restoration of riparian trees, landslide reduction, and restoring tidal flows on diked lands, will lead to improved habitat conditions in the river and its floodplains (Collins, 1997). The history of the Stillaguamish Watershed shows how the alteration of natural resources has caused significant harm to tribal resource.

In response to the magnitude of habitat losses in the Stillaguamish watershed, stakeholders have been working for more than 20 years to restore the natural processes that create and sustain floodplain habitats. Primarily, this has involved purchasing land, deed restricting it in perpetuity, and working to restore the habitats present historically within Stillaguamish floodplains and in the estuary (riparian plantings, engineered log jam installation, levee removal, armoring removal, infrastructure removal, etc.). These efforts are guided by the Stillaguamish Chapter of the Puget Sound Salmon Recovery Plan (NMFS, 2007), including its acquisition strategy. The long-term goal of these efforts is a corridor of protected and restored lands along the major Chinook salmon-bearing waters, from the spawning grounds to tidewater, where natural processes are allowed to create and sustain habitats critical to fish and wildlife populations. Actions like those being advanced in the Stillaguamish Watershed should be considered in flood planning.

CHAPTER 7: HOW TO PREPARE A COMPREHENSIVE FLOOD HAZARD MANAGEMENT PLAN

7.1 Introduction

The process to develop a Comprehensive Flood Hazard Management Plan in conformance with Chapter 86.26 RCW and Chapter 173-145 WAC includes 14 steps:

- Step 1: Identify Related Regulatory Programs and Planning Priorities
- Step 2: Establish Process for Public and Agency Participation
- Step 3: Draft Short- and Long-term Goals and Objectives for Flood Hazard Management
- Step 4: Inventory and Analysis of Physical Conditions and Other Technical Issues
- Step 5: Set Short- and Long-term Goals and Objectives for Flood Hazard Management
- Step 6: Determine Need for Strategies and Measures for Flood Hazard Management
- Step 7: Identify Alternative Strategies and Measures for Flood Hazard Management
- Step 8: Evaluate Alternative Strategies and Measures
- Step 9: Hold Public Alternative Evaluation Workshop(s)
- Step 10: Develop Strategy and Implementation Approaches for Flood Hazard Management
- Step 11: Complete Draft CFHMP and SEPA Documentation
- Step 12: Submit Final CFHMP to Department of Ecology
- Step 13: Hold Public Hearing and Adopt the CFHMP
- Step 14: Notify Ecology that the Final CFHMP is adopted

Note that the exact order of each step is not critical, and several of the steps can take place concurrently.

This chapter describes each of the 14 steps, providing a description of the **minimum requirements** in a **black box** followed by general guidance. Following the general guidance, there is specific guidance for the following two tracks:

- **Other Programs:** Guidance for how to coordinate a CFHMP with the related programs and grants described in Chapter 5 is included in **red boxes**.
- **Integrated Floodplain Management:** Guidance for how to incorporate an IFM approach into each step of the CFHMP process is included in **teal boxes**. Additional information and guidance on IFM is included in Chapter 4.

Not every step will have a box for each track if there is not relevant information for that step.

7.2 Overview of Steps to Prepare a CFHMP

This section includes a brief overview of the 14 steps described throughout this chapter and is intended as an initial introduction and a quick reference. Note that the descriptions in this section do

not include a discussion of all requirements and best practices for development of a CFHMP, so referral to the full guidance included later in Chapter 7 is crucial.

Step 1: Identify Related Regulatory Programs and Planning Priorities

The first step in developing a CFHMP is to determine what other regulatory programs and planning priorities need to be incorporated into the plan. These include:

- Regulatory programs (such as the local Floodplain Management Ordinance, SEPA, and the ESA).
- Local plans adopted by your jurisdiction or that include your jurisdiction (such as salmon recovery plans or hazard mitigation plans).
- Related programs and grants (such as the FEMA Hazard Mitigation Grant Program and Floodplains by Design).
- Other community interests (such as agriculture and recreation).

Additionally, coordination with Tribes in the planning area should begin at this point in the process. Early and substantive outreach to Tribes is the best practice, and it should begin at this stage while identifying components of the planning.

Step 2: Establish Process for Public and Agency Participation

Participation by the public and affected public agencies is critical to the success of a CFHMP. The plan should include robust engagement of various stakeholder groups. A lack of substantive engagement or willful exclusion of interested stakeholders could compromise Ecology's ability to approve a CFHMP.

This step includes:

- Establishing an Advisory Committee.
- Defining the public participation process.
- Considering diversity, equity, and inclusion.

Step 3: Draft Short- and Long-term Goals and Objectives for Flood Hazard Management

A goal is an aim or desired result, and an objective is a specific measurable outcome that is sought. Goals and objectives for a CFHMP need to address flood safety, non-structural flood safety, and ecological restoration. Goals and objectives should also address climate change, diversity, equity, inclusion, and environmental justice. The development of goals and objectives should include input from Tribes, the advisory committee, and the public (including vulnerable communities who are traditionally underrepresented in planning processes). Goals and objectives developed at this stage of the process should be considered draft until the inventory and analysis in Step 4 is completed.

Step 4: Inventory and Analysis of Physical Conditions and Other Technical Issues

Step 4 includes three essential tasks:

- Delineate the planning area.
- Conduct an assessment of existing conditions—physical, biological, and social—and evaluate probable and potential future conditions.
- Document the flood and erosion history and identify current flood and erosion problems.

Step 5: Set Short- and Long-term Goals and Objectives for Flood Hazard Management

At this step in the process, the jurisdiction is equipped with both initial goals and objectives and a full assessment of existing conditions, flood and erosion problems, and projections for future flood and erosion hazards. Using all of this information, the jurisdiction will finalize its short- and long-term goals and objectives for flood and erosion hazard management. The initial goals and objectives should be revisited based on the information gathered in Step 4. Are there substantial hazards that were not reflected in the initial goals and objectives that should now be considered? Do any of the objectives need to be revisited based on new information about physical, biological, or social conditions?

Step 6: Determine Need for Strategies and Measures for Flood Hazard Management

A CFHMP must include a determination of the need for flood control work to include a description of all flood risk management and flood damage reduction actions. The project team should evaluate the knowledge gained through the Existing and Future Conditions Assessment along with the goals and objectives to determine the need (and opportunities) for flood hazard management strategies and measures.

Step 7: Identify Alternative Strategies and Measures for Flood Hazard Management

For each flood hazard, the CFHMP should consider a full range of potential solutions. Actions taken in this step should not attempt to develop a single project or collection of projects to address goals and objectives; instead, this step should identify multiple alternatives to fully consider potential approaches and select the best fit. Strategies and measures should include the following types:

- Development and use of updated flood hazard information (flow and inundation projections, etc.) to ensure the highest accuracy for the evaluation of need and solution design.
- Non-structural alternatives that prevent the creation of new flood and erosion risks, remove people and property from harm's way, or promote land uses that are compatible with flooding in flood hazard areas.
- Structural flood damage reduction measures that physically modify river processes to reduce flood risk.

Step 8: Evaluate Alternative Strategies and Measures

Once a set of alternatives has been identified for each flood/erosion problem, planners can evaluate alternatives and determine a preferred solution. Evaluation components include the following:

- Technical suitability of an alternative to solving problem.
- Primary reliance on non-structural measures and ecological restoration.
- Environmental impacts or benefits.
- Climate change and future conditions.
- Historic and archaeological resources.
- Consistency with the local salmon recovery plan.
- Environmental justice.
- Consistency with applicable policies, and the goals and objectives of the CFHMP.
- Consistency with the Principles of Comprehensive Flood Hazard Management (Section 1.4).
- Permits and approvals required.
- Cost of implementation, including acquisitions, design, permitting, mitigation, and project management, construction, and life cycle costs.

- Expected ongoing inspection, maintenance, and repair needs.

Step 9: Hold Public Alternative Evaluation Workshop(s)

A public workshop to present the analysis of alternative measures and solicit the public's opinion is an effective way to incorporate public participation. These workshops provide planners with an opportunity to increase public awareness about flood hazards and reaffirm their commitment to public involvement in plan development.

Workshops can be structured through a variety of approaches based on the needs of each community. These may include presentations, an open house, or a combination of both. Additional public workshops may require translated materials depending on the needs of communities, and they must meet the accessibility requirements of the Americans with Disabilities Act (ADA).

Step 10: Develop Strategy and Implementation Approaches for Flood Hazard Management

After the public input has been integrated and alternatives evaluation completed, the project team will develop the flood hazard management strategy, with implementation approaches, which will serve as the basis for the CFHMP. The strategy should include a list of actions; the priority, cost, and timeframe for each; and the coordination activities with adjacent governments, related agencies, and associated programs. This strategy should include both capital and non-capital components.

Other recommended elements of the Strategy and Implementation section of the CFHMP include:

- Identification of implementation roles or governance structure.
- Funding strategy.
- Adaptive management.
- Climate change.
- Coordination and partnerships.
- Letters of concurrence or commitment.

Step 11: Complete Draft CFHMP and SEPA Documentation

Once the overall management strategy is determined, the plan's recommendations and supporting information must be compiled into a draft plan for review. Completing the draft State Environmental Policy Act (SEPA) assessment (draft EIS or environmental checklist) at this time is also useful, so that the two documents can be distributed and reviewed together. The draft CFHMP and SEPA documentation should be distributed to agencies and special interest groups who have participated in the planning process and the public for review.

In addition to advisory committee meetings to review the plan, a public workshop may be advisable at this point to present the plan and solicit comment. When these steps are completed, the drafts will be sent to Ecology for review and consultation with WDFW, the Department of Natural Resources, and affected Native American Tribes. Afterwards, local planning staff and/or consultants should revise the draft into the final CFHMP and submit it to Ecology.

Step 12: Submit Final CFHMP to Department of Ecology

CFHMPs funded by the FCAAP program need to be submitted for approval by Ecology. A PDF and one printed copy of the plan should be submitted to the Shorelands & Environmental Assistance Program. A copy of the SEPA documentation should also be submitted. Staff from Ecology's FCAAP program will review the plan for conformance to WAC- 173-145-040 and the grant agreement scope of work. If all review comments on the draft plan have been adequately addressed and the final CFHMP is in compliance with state statutes and the grant agreement, Ecology will approve the plan, in consultation with WDFW.

Step 13: Hold Public Hearing and Adopt the CFHMP

After the CFHMP has been approved by Ecology, it should be presented to the adopting governmental body at a public hearing, along with the advisory committee's recommendation for adoption.

Step 14: Notify Ecology that the Final CFHMP is adopted

Once the plan is adopted, a letter should be sent to Ecology formally notifying them that the CFHMP is adopted.

Step 1: Identify Related Regulatory Programs and Planning Priorities

Minimum Requirements

There are no requirements relevant to this task in RCW 86.12 or WAC 173-145-040. Instead, communities developing a CFHMP should consider other requirements they need to meet, including local, state, and federal regulations, and determine whether any of those requirements should be incorporated into the CFHMP effort. See Appendix A for a description of relevant regulatory programs, including the Growth Management Act, Shoreline Management Act, and Endangered Species Act.

Guidance

The first step in developing a CFHMP is to determine what other regulatory programs and planning priorities need to be incorporated into the plan. If the CFHMP is being led by a public works department, this step will require collaboration with the jurisdiction's planning department. All of the regulatory programs described in Appendix A should be considered, including:

- The local Floodplain Management Ordinance
- The local Comprehensive Plan
- Local codes including land use, zoning, environmental protection (e.g., critical areas), and building codes
- The Shoreline Management Act and the local Shoreline Master Program
- The Washington State Hydraulic Code
- The Clean Water Act
- The Rivers and Harbors Act
- Special Districts in the planning area (such as flood control districts and drainage districts)
- The National Environmental Policy Act (NEPA) and State Environmental Policy Act (SEPA)
- The National Flood Insurance Program and State Floodplain Management Regulations (see Section 1.5)
- The Endangered Species Act and the National Marine Fisheries Service (NMFS) Biological Opinion on the National Flood Insurance Program

In addition, you should consider integration with other local plans adopted by your jurisdiction or that include your jurisdiction, including:

- Salmon recovery plans
- Climate change adaptation or action plans
- Watershed plans, including streamflow restoration act plans
- Regional guiding plans, such as the Yakima River Basin Integrated Water Management Plan (<https://ecology.wa.gov/Water-Shorelines/Water-supply/Water-supply-projects-EW/Yakima-River-Basin-projects/Yakima-integrated-plan>)
- Recreation, open space, and parks plans
- Transportation plans
- Utilities plans
- Sustainability plans
- Regional open space plans, such as the Puget Sound Regional Open Space Conservation Plan (<https://www.psrc.org/sites/default/files/regionalopenspaceconservationplan.pdf>)
- Capital improvement plans
- Hazard mitigation plans
- Agriculture plans
- Shoreline restoration plans
- Available Risk Mapping, Assessment, and Planning (Risk MAP) products (from FEMA)
- Available climate change impacts studies
- Existing flood hazard assessments

If you have not already, you should determine whether your CFHMP also needs to be coordinated with plans or applications for other related programs, as described in Chapter 5:

- FEMA Hazard Mitigation Grant Program
- FEMA Flood Mitigation Assistance
- Building Resilience Infrastructure and Communities (BRIC)
- Community Rating System (CRS)
- System-Wide Improvement Framework (SWIF)
- Washington EMD Hazard Plans
- Floodplains by Design Grant Program

Guidance for what to consider about these programs when developing a CFHMP is included throughout this chapter in red text boxes.

Finally, you should also consider which other interests should be included in the planning process. Even if you are not planning an IFM approach (see Chapter 4), other interests should be considered upfront and should be included in the advisory committee or public outreach (Step 2) to identify whether the actions in the CFHMP would negatively impact those interests. Other interests to consider include:

- Agriculture

- Community growth and affordable housing
- Salmon recovery
- Vulnerable and/or underrepresented communities
- Recreation

At this stage in the process, you should also begin coordination with Tribes in the planning area. Early and substantive outreach to Tribes is the best practice, and it should begin at this stage while identifying components of the planning. Engaging Tribes should not wait until stakeholder outreach and/or formation of an advisory committee under Step 2. See Chapter 6 for more information on the relationship between tribal treaty rights and flood hazard management. Coordination should include both: (1) tribal biologists who can speak to salmon recovery issues and treaty rights; and (2) tribal planning departments, which implement their own set of rules and regulations (not all Tribes participate in the NFIP).

Other Programs

Flood Mitigation Assistance Grant Program

The FMA program encourages communities to pursue plan integration, which is a process where communities look critically at their existing planning framework and align efforts. Integration of hazard mitigation principles into other local planning mechanisms (comprehensive plans, transportation plans, floodplain ordinances, etc.) and vice versa is vital to build a safer, more resilient community. This two-way exchange of information supports community-wide risk reduction; both before and after disasters occur.

Community Rating System

Step 1 of Activity 512 (floodplain management planning) is “Organize to prepare the plan.” This step provides credit for the following actions:

- Including the office responsible for the community’s land use and comprehensive planning in the floodplain management planning process. The office should be actively involved, meaning that staff regularly attends meetings, assist in coordination, and either write or review draft sections of the plan.
- Conducting the planning process through a committee composed of staff from community departments that implement or have expertise in flood hazard management activities (preventive measures [e.g., codes], property protection [e.g., elevation], natural resource protection, emergency services, structural flood control projects, and public information). The committee must meet more than once or twice, and should be involved in each key step of the planning process. Community departments that could be represented on the committee include, but are not limited to:
 - Building department/code enforcement
 - Engineering
 - Land use planning/zoning
 - Public works
 - Emergency management/public safety
 - Public information
 - Environmental protection/public health
 - Parks/recreation
 - A city manager or council/commission member
 - Housing/community development
- Having the planning process and/or the committee formally created or recognized by an action of the community’s governing body. The preferred method is a formal resolution that designates who is responsible for preparing the plan and specifies a completion deadline.

Additional detail for Step 1 starts on page 510-6 of the Coordinator’s Manual (FEMA, 2017).

Hazard Mitigation Plans

Coordinate with your local emergency management department to discuss how the CFHMP should be coordinated with the Hazard Mitigation Plan. Will the CFHMP be incorporated into the next update of the Hazard Mitigation Plan? Are there findings or strategies for flooding in the Hazard Mitigation Plan that should be incorporated into the CFHMP? Would it best serve your community to produce only one document and to conduct flood planning as part of the Hazard Mitigation Plan?

Depending on the level of coordination, the CFHMP process may need to meet requirements of FEMA's Local Mitigation Planning Handbook (FEMA, 2013). The rest of this Guidebook chapter includes references to the tasks in the Local Mitigation Planning Handbook that align with the steps in CFHMP planning. Depending on the level of coordination, the CFHMP planning team should review the relevant section of the Local Mitigation Planning Handbook at each step of the CFHMP process.

Task 1 of the Local Hazard Mitigation Planning Handbook is to Determine the Planning Area and Resources. Task 2 is to Build the Planning Team.

Integrated Floodplain Management

The general guidance for Step 1 is consistent with an IFM approach. However, if you are interested in IFM, your focus in identifying other interests to include in the CFHMP should be on *creating benefits for all interests*, not just *avoiding impacts on other interests*. At this stage, you should assess the level of buy-in for an IFM approach. Are other interests, such as agriculture and recreation, ready to join a collaborative effort and seek integrated benefits? Or are they mostly interested in tracking CFHMP efforts to ensure they are not negatively impacted? Is there support for an IFM approach within leadership at your agency?

Step 2: Establish Process for Public and Agency Participation

Minimum Requirements

RCW 86.12.220 Advisory Committees states:

“A county may create one or more advisory committees to assist in the development of proposed comprehensive flood control management plans and to provide general advice on flood problems. The advisory committees may include city and town officials, officials of special districts subject to chapter [85.38](#) RCW, conservation districts, appropriate state and federal officials, and officials of other counties and other interested persons.”

RCW 86.12.210 Comprehensive Flood Control Management Plan – Participation of Local Officials – Arbitration of Disputed Issues states:

“A comprehensive flood control management plan that includes an area within which a city or town, or a special district subject to chapter [85.38](#) RCW, is located shall be developed by the county with the full participation of officials from the city, town, or special district, including conservation districts, and appropriate state and federal agencies. Where a comprehensive flood control management plan is being prepared for a river basin that is part of the common boundary between two counties, the county legislative authority of the county preparing the plan may allow participation by officials of the adjacently located county.”

Guidance

Participation by the public and affected public agencies is critical to the success of a Flood Hazard Management Plan for several reasons:

1. Proposed measures will affect many local property owners, and their support will be needed to take action.
2. WAC 173-145-070 calls for the review of all Flood Control Assistance Account Program (FCAAP) projects by associated State agencies and affected parties. Therefore, appropriate public agencies such as WDFW and the Department of Natural Resources as well as affected Tribes and other public entities should be involved throughout the process for plan formulation and comments.
3. Special interest groups such as the Audubon Society, recreation clubs or associations, real estate development interests, and business organizations may also have an interest in the plan, and their objectives should be considered.
4. Since watersheds typically cross-jurisdictional lines, representation from neighboring local governments must be incorporated in the process.
5. Since the plan must ultimately be adopted by the local government, it is important to build support among the local constituency.
6. The planning process offers an opportunity for educating the public and decision-makers about the issues, opportunities, and public responsibilities of flood hazard management.

A CFHMP should include robust engagement of various stakeholder groups. A lack of substantive engagement or willful exclusion of interested stakeholders could compromise Ecology’s ability to approve a CFHMP (see Step 12).

Note that engagement with Tribes is not considered stakeholder engagement and should happen before this point in the CFHMP process, as described in Step 1.

Establish Advisory Committee

Public and agency participation should be accomplished in at least two ways. First, an advisory committee or task force should be formed that includes representation of public groups and property owners. This representation should include members of known community groups located within the affected floodplain and non-governmental organizations with interests within the affected floodplain. There may be overlap in this representation. For example, a representative from a local community council may represent a variety of local interests on the committee.

Since flood hazard management actions may affect other governmental jurisdictions, it is advisable to include staff persons or public officials from neighboring jurisdictions. Other public agencies (such as Ecology and WDFW) and other key entities (such as ports or diking districts) should be invited to participate. Relevant non-governmental organizations and conservation districts should also be invited. Tribes should have been engaged before this point (see Step 1), but they should also be invited to participate in the advisory committee. Since flood hazard management is a broad-based planning effort and not solely an engineering exercise, it is important that a wide range of interests and backgrounds be incorporated in the process.

The role of the committee and its tenure must be carefully defined. Such committees or task forces are generally advisory, providing direction throughout the process and recommending the adoption of the final plan to the local government body actually adopting the plan. Under the process recommended in this guidebook, the committee would ideally meet at least once during each major step to review technical work, provide feedback and recommendations regarding alternate proposals, and provide input to the technical planning team regarding the next step.

The size of the committee is an important consideration. An 8- to 16-person committee is generally large enough to provide comprehensive representation but small enough to allow meaningful discussions and active, productive work sessions.

The aim of the committee should be to build a consensus that balances competing objectives rather than favors a particular interest group. Therefore, attention should be given to the selection of representatives and committee procedures. It is recommended that in preparing committee recommendations, the committee attempt to define consensus positions rather than resort to divisive voting on individual issues.

Define Public Participation Process

The second recommended means to incorporate public input is through a series of public open houses or workshops where community members can express their views. Public workshops are most effective at the goal formulation, inventory of flood issues, alternative evaluation, and final review steps of the process, although public meetings may be advantageous at other points as well. Asking members of the public to describe their goals and observations of flood problems is an effective way to begin a public input process. Community members also find it relatively easy to compare and evaluate alternative flood hazard management actions when they can respond to a set of proposals. Finally, a presentation to the public just prior to the formal documentation and adoption process is a good way to check public response to the proposed plan. More guidance on public workshops is included in Step 9. The public participation process should also include the use of online tools and potentially social media. Creating a website specifically for the flood plan process can be a good way to provide information to the public.

Diversity, Equity, and Inclusion

Floodplain areas are often home to vulnerable communities who are traditionally underrepresented in planning processes due to social, cultural, economic, and/or physical barriers to participation. As part of the public participation process, you should identify communities and tailor outreach activities to proactively engage them and seek their input. Conducting public participation with diversity, equity, and inclusion in mind will set up future steps of the flood planning process that will need to consider environmental justice (defined by the Healthy Environment for All [HEAL] Act as *“The fair treatment and meaningful involvement of all people regardless of race, color, national origin, or income with respect to the development, implementation, and enforcement of environmental laws, rules, and policies. Environmental justice includes addressing disproportionate environmental and health impacts in all laws, rules, and policies with environmental impacts by prioritizing vulnerable populations and overburdened communities, the equitable distribution of resources and benefits, and eliminating harm.”*)

Inclusive outreach should start with thoughtful reflection on how planning processes, both within your jurisdiction and in general, have historically focused on traditionally privileged communities: those who have resources to attend meetings, review information, become involved in groups, and consider big picture questions for their community. Consider who has the least access to power in your community. Who defines the problem that is to be solved? Who has less access to public meetings and why? The answers to these questions should guide the identification of underrepresented communities and the design of inclusive outreach activities to solicit substantive input from those communities.

Factors that can affect both vulnerability to flood hazards and the ability to participate in traditional public engagement processes include:

- Income
- Race and ethnicity
- Citizenship
- Language
- Age
- Disabilities
- Education
- Housing
- Access to transportation
- Access to internet

The public participation process should identify vulnerable and underrepresented populations in your planning area and develop specific strategies to engage those communities. Equitable public engagement of vulnerable or underrepresented communities needs to be proactive, meaningful, transparent, and accountable. The Washington State Environmental Justice Task Force report quotes one of the 17 Principles of Environmental Justice: *“Environmental justice demands the right to participate as equal partners at every level of decision-making, including needs assessment, planning, implementation, enforcement and evaluation”* (Environmental Justice Task Force, 2020; Delegates to the First National People of Color Environmental Leadership Summit, 1991). One approach to inclusive outreach is *targeted universalism*—setting universal goals that can be achieved through targeted approaches. An example of a universal goal could be: *“Every member of our*

community affected by flood hazards will have the opportunity to provide substantive input on the CFHMP that will be considered and addressed.” An informative video on targeted universalism (“Targeted Universalism” by the Othering & Belonging Institute) is available at <https://www.youtube.com/watch?v=a0At2xbOB7w>.

Specific targeted outreach strategies that could be considered include:

- Partnering with organizations that work with low-income members of the public (such as low-income housing providers and authorities, and faith-based institutions).
- Providing outreach materials to community and social service centers and libraries.
- Identifying cultural events and providing materials at those events.
- Translating outreach materials into languages spoken in the community and providing interpreters at public meetings.
- Providing outreach materials to educational institutions (to reach a younger demographic) and senior centers and assisted living facilities (to reach an older demographic).
- Making sure outreach materials are easily readable and in multiple languages tailored to the communities in the area.
- Holding public meetings in locations that are transit and Americans with Disabilities Act (ADA) accessible.
- Holding meetings at times that are outside typical work hours, such as evenings and weekends.
- Including both in-person and virtual options for participation.
- Distributing information and meeting notices in a way that is appropriate for the age demographic of the community.

Additional guidance on inclusive public engagement is included in Appendix C of the Environmental Justice Task Force Report ([https://healthequity.wa.gov/Portals/9/Doc/Publications/Reports/EJTF%20Report_FINAL\(1\).pdf](https://healthequity.wa.gov/Portals/9/Doc/Publications/Reports/EJTF%20Report_FINAL(1).pdf)).

Climate Change

It is best to begin considering climate change before forming your advisory committee(s) or developing your engagement process. When choosing whom to include on an advisory committee, consider including staff at your jurisdiction focused on climate change, if any. Many cities and counties now have a department or a staff person dedicated to sustainability who could participate in the advisory committee. Also, consider technical experts from outside your jurisdiction. Contact the University of Washington Climate Impacts Group for regional technical expertise, or identify experts within your geographic area. For example, does a local university or university extension have a climate change expert who may be interested in participating in your flood plan process? What about the local conservation district? Climate change specialists are also employed in the private sector and can assist with assessments for individual watersheds.

Climate change should also be considered in developing your public engagement process. Are there any communities that may not currently be vulnerable to flooding but could be in the future? If so, they should be part of the engagement process. Are there any communities that are more vulnerable to climate change than others are? If so, outreach to those communities should be proactive and targeted.

Other Programs

Community Rating System

Step 2 of Activity 512 (floodplain management planning) is “Involve the public.” This step provides credit for the following actions:

- Conducting the planning process through a planning committee that includes members of the public, meeting a sufficient number of times to involve the members in the key steps of the planning process, and makes all meetings open to the public with a publicly posted meeting schedule.
- Conducting public information activities such as hosting a website that explains the planning process, conducting a public webcast, questionnaires to solicit input on natural hazards and possible solutions, brochures, mailers, booths at shopping malls, and presentations at civic or neighborhood organizations.

Additional detail for Step 2 starts on page 510-8 of the Coordinator’s Manual (2017).

Hazard Mitigation Plans

Task 3 of the Local Hazard Mitigation Planning Handbook is to Create an Outreach Strategy.

Integrated Floodplain Management

If you are pursuing IFM, you may want to form a separate stakeholder group to discuss IFM issues. If so, that group should be closely tied to the process for the flood plan. Alternately, you could use an advisory committee for your CFHMP as the IFM group. In either case, you should anticipate that the process may be longer than a traditional CFHMP and will require more meetings and process. The upside is that you will potentially end the process with a set of projects that will achieve multiple goals and will have a broader base of support in your community.

Identify participants that hold an interest, legal right, and/or management authority in the watershed and/or reach scales. How a group is convened and who participates influence the process and where issues may occur. It may be more important to start small, with the most-affected stakeholders, and build momentum at a realistic scale relative to the staff and leadership capacity. Starting small is acceptable and often the best option for building relationships and trust.

Participants will vary by river system. Examples of participants include Tribes, agencies, agricultural interests, fish interests, landowners, recreation interests, business interests, and the public. Some processes start with authorizing or high-level support for a shared vision, while others may have authorizing and high-level support but lack the skills or expertise to move the vision to the reach scale or project level. A series of thoughtfully designed management structures and processes is likely necessary to bridge interests with authorizing institutions and people in the areas on the ground. As these processes often take multiple years, or even decades, there is a constant shift of participants and a need to bring new participants up to speed. This must be done intentionally each time the group changes.

Step 3: Draft Short- and Long-term Goals and Objectives for Flood Hazard Management

Minimum Requirements

WAC 173-145-040 Comprehensive Flood Control Management Plan (CFCMP) states that a CFHMP must include “Short-term and long-term goals and objectives for the planning area.”

Guidance

This guidance defines goals and objectives as follows:

- **Goal:** An aim or desired result
- **Objective:** A specific measurable outcome that is sought

Many people think of goals as being a more general statement, with specific measurable objectives attached. Some jurisdictions may also develop “strategies” that describe how the goals and objectives are to be approached, or “guiding principles” that act as the technical and policy foundation for how a jurisdiction addresses flooding. The way these different terms are used to help a jurisdiction organize and communicate its aspirations and intentions is less important than the action of articulating them. All of these terms are strongest when a performance standard is attached.

Goals and objectives need to address flood safety, non-structural flood safety, and ecological restoration. The balance between flood damage reduction and river ecology is important. A truly integrated set of goals and objectives could convey the ecological opportunities associated with flooding and channel migration, and establish a neutral foundation for evaluating potential solutions. Goals should also address the use of non-structural actions to reduce flood hazards, such as policy changes or adopting higher regulatory standards.

When developing goals and objectives, an organization needs to look both within their jurisdiction and outside their jurisdiction. Because floodwaters do not respect jurisdictional boundaries, actions that one jurisdiction takes may negatively impact another. Similarly, management of channel migration risks can also have unwanted impacts on downstream jurisdictions. From an internal perspective, managing flood and erosion risks affects many responsibilities within an organization, including land use planning and regulation, utilities, transportation, and public safety. The process of goal development should consider risk as a factor of both hazard and vulnerability. The goals and objectives should also address areas outside of the floodplain that are relevant to flood hazards.

Goals and objectives should also address climate change. When developing draft goals and objectives:

- Consider how climate change could affect your other goals and objectives. For example, if you have a goal to establish a certain level of protection in your flood system, consider how that level of service could be impacted by future conditions, and adjust if necessary.
- Consider articulating and including a climate change-specific goal consistent with the expected lifespan of your project. For example, do you have a goal to increase the resilience of your community to future flood levels and/or extreme events? Do you have a goal to identify and mitigate flood impacts from climate change?

- Identify whether climate impacts could be barriers to achieving your other goals and objectives. Which objectives are most sensitive to changes in hydrology, sea level rise, increased sediment, or higher groundwater levels due to sea level rise?
- Consider the most immediate pressures related to climate change in your planning area. Do your objectives address those pressures?

Goals and objectives also need to consider diversity, equity, inclusion, and environmental justice. Consider whether past goals and objectives for flood hazard management (whether explicitly stated and included in a plan or not) have prioritized certain communities over others, for example by focusing flood safety measures in areas with higher property values. Consider who has had the power and access to set goals and objectives for flood hazard management in the past, and how that has affected the distribution of resources. Adopt goals and objectives that address these issues and that will help your jurisdiction be accountable to all community members.

In addition, goals and objectives should address the following considerations:

1. Level of flood protection that will be provided (can vary geographically and for different land uses).
2. Goals related to channel migration and bank protection.
3. Goals related to public infrastructure.
4. Goals related to community values.
5. Partnership goals.

The development of goals and objectives should include input from Tribes, the advisory committee, and the public (including vulnerable communities who are traditionally underrepresented in planning processes; see Step 2). Goals and objectives developed at this stage of the process should be considered draft until the inventory and analysis in Step 4 is completed. Because the draft goals and objectives are developed before a systematic analysis of existing and future conditions assessment is complete, final goals and objectives may evolve to be more realistic than first ambitions, to address needs discovered through the assessment work, and/or to benefit from synergies with related needs and opportunities. The draft goals and objectives should inform the analysis in Step 4; if a topic is the subject of a goal, then conditions related to that topic should be examined and analyzed. Goals and objectives should be finalized after completion of the inventory and analysis – see Step 5.

Other Programs

Community Rating System

Step 6 of Activity 512 (floodplain management planning) is “Set goals.” The goals should incorporate or be consistent with other community goals for the affected areas. Additional detail for Step 6 is on page 510-18 of the Coordinator’s Manual (2017).

Integrated Floodplain Management

Genuine commitment to a shared vision of the floodplain is critical. Depending on the situation, this could be across an entire floodplain area or at a reach scale. The shared vision and goals may be very general to very specific depending on the level of trust, the ability of an interest area to describe and agree upon their interests, and the ability of interest areas to understand and respect the needs of others. The importance of this step cannot be overstated and will likely be revisited many times over the years. The ability to move effectively from visioning to solutions and implementation is fundamentally rooted in:

- Level of trust and mutual respect.
- Commitment to the group, the process, and the outcomes.
- Effective linkages between interest area leaders, decision-makers and authorizing bodies, and on-the-ground affected parties.
- Solid understanding of the interests in each of the interest areas.

Over the life of an IFM effort, groups tend to progress through the following steps related to a shared vision:

- Having no shared vision or a very general shared vision.
- Having a multi-interest shared vision that is not yet tightly linked to actions.
- Having a multi-interest shared vision directly tied to actions.

If you already have an IFM group with a shared vision (whether it is general or more specific and multi-interest), developing a CFHMP presents an opportunity to tie the shared vision directly to the strategies and actions included in the CFHMP.

Similarly, IFM efforts tend to progress through the following steps related to goals:

- Some interests have clearly articulated needs and goals, others may not.
- All interests have needs and goals that are known by other interests.
- All interests have needs and goals that are integrated and actively shared.

If you already have an IFM group, a CFHMP process is an opportunity to further develop and add more specificity to the goals of each interest and to integrate goals.

Step 4: Inventory and Analysis of Physical Conditions and Other Technical Issues

Minimum Requirements

RCW 86.12.200 Comprehensive Flood Control Management Plan Elements states that a CFHMP shall include “*Designation of areas that are susceptible to periodic flooding, from inundation by bodies of water or surface water runoff, or both, including the river’s meander belt or floodway.*”

WAC 173-145-040 Comprehensive Flood Control Management Plan (CFCMP) states:

“Area of coverage for the comprehensive plan shall include, as a minimum, the area of the one-hundred-year frequency floodplain within a reach of the watershed of sufficient length to ensure that a comprehensive evaluation can be made of the flood problems for a specific reach of the watershed. The plan may or may not include an entire watershed. Comprehensive plans shall also include flood hazard areas not subject to riverine flooding such as areas subject to coastal flooding, flash flooding, or flooding from inadequate drainage. Either the meander belt or floodway must be identified on aerial photographs or maps that will be included with the plan.”

Guidance

Step 4 includes three essential tasks:

1. Delineate the planning area and identify areas at risk from flood hazards.
2. Conduct an assessment of existing conditions—physical, biological, social, and regulatory—and evaluate probable and potential future conditions.
3. Document the flood and erosion history and identify current flood and erosion problems.

Delineate Planning Area and Identify Areas at Risk from Flood Hazards (Task 1)

The general planning area will likely be identified before a CFHMP is initiated, but before the Existing and Future Conditions Assessment begins, it is critical to delineate the planning area in detail.

Planning area options may include:

- Complete watershed including tributaries.
- Floodplains of one or more mainstem rivers. The planning area could include the floodplain area for a larger recurrence interval (such as the 0.2% annual chance flood) and/or areas protected by levees to support a more comprehensive analysis of risk.
- Coastal flood risk areas.
- Jurisdictional boundary (e.g., county, city, or Native American reservation).

The choices made in delineating the planning area will influence the level of detail in the CFHMP as well as available solutions. For example, if a CFHMP does not include tributaries, then it will not be prepared to identify and consider solutions that involve tributary actions. Similarly, jurisdictionally bound planning areas are limited unless coordinated planning is happening for flood and erosion hazards in those adjacent jurisdictions (this also relates back to the need for outward-looking goals and objectives).

A jurisdiction that limits the planning area to less than the entire watershed will need to compensate in some way to responsibly plan for a more limited area. It will need to consider areas outside the planning area that could affect flood and erosion conditions within the planning area and areas that could be affected by actions proposed in the CFHMP, as well as assign conservative assumptions to cover potential scenarios. Ecology recommends planning for the entire WRIA in the CFHMP if possible.

While the recommendation is to define a planning area that is as large as possible for the purposes of comprehensive planning, it will also be necessary to identify areas at risk from flood hazards. To plan properly, this should go beyond the regulatory floodplain identified on FEMA maps. Four steps should be followed in identifying areas at risk from flood hazards. Note that these steps should be conducted iteratively with the Existing and Future Conditions Assessment (Task 2), which includes analyses and studies that will inform the understanding of areas at risk from flood hazards.

1. Use existing resources that delineate the floodplain. This often starts with the FEMA Flood Insurance Rate Map (FIRM) and Risk MAP products. Other existing sources can include data on the flood of record, Corps of Engineers studies, or locally developed hydrologic and hydraulic modeling.
2. Identify channel migration zones (CMZs) using existing studies, information developed for the local Shoreline Master Program, and/or using Ecology’s planning-level CMZ methodology (Olson et al., 2014; available online at <https://apps.ecology.wa.gov/publications/SummaryPages/1406025.html>).
3. Identify areas that would potentially be impacted by climate change, both coastal (due to sea level rise) and riverine (due to changing hydrology). More guidance on climate change is included below as part of the Existing and Future Conditions Assessment, and additional resources are listed in Appendix B.
4. Identify any areas that are at risk of flooding from other natural sources, such as groundwater flooding, flash flooding, or other areas of known flooding that are unmapped.

Existing and Future Conditions Assessment (Task 2)

The Existing and Future Conditions Assessment will be the foundation for identifying needs, and developing and evaluating solutions. While the level of available data may vary greatly in quantity and detail between planning areas, a significant amount of relevant and easily accessible data should be available to all planning jurisdictions (see Table 7-1). Undoubtedly, you will encounter data gaps and should make a documented assessment of the impact of that data gap on all aspects of the CFHMP – understanding flood and erosion risks, identifying and evaluation solutions, and implementation recommended plan actions. If that impact is significant, the data item should be flagged for potential early action if funds are available.

Table 7-1. Common Data/Information Sources for Physical Data Useful for CFHMPs		
Data/Information	CFHMP Use	Data Source/Link
Topography/ LiDAR	Flood Risk Evaluation	Washington State Department of Natural Resources (https://www.dnr.wa.gov/lidar) Puget Sound LiDAR Consortium (http://pugetsoundlidar.ess.washington.edu/lidardata/index.html) U.S. Geological Survey (https://earthexplorer.usgs.gov/)

Geologic Setting	Basin Understanding/ History	Washington State Department of Natural Resources (https://www.dnr.wa.gov/geology) Puget Sound River History Project (UW) (http://riverhistory.ess.washington.edu/)
Climate	Projected future snowpack, streamflow, rainfall intensity, and sea level conditions	Climate Impact Group (CIG, UW) (https://cig.uw.edu/) Local stormwater manuals (for rainfall maps, infiltration rates, etc.)
Hydrology/ Hydraulics	Effective and historic FEMA floodplain mapping Stream gage data Stream gage/flood forecast data Regional Regression Equations	FEMA Map Service Center (https://msc.fema.gov/portal/home) U.S. Geological Survey Current Water Data for Washington (https://waterdata.usgs.gov/wa/nwis/rt) NOAA/NWS Northwest River Forecast Center (https://www.nwrfc.noaa.gov/rfc/) U.S. Geological Survey StreamStats (https://streamstats.usgs.gov/ss/) Corps of Engineers Natural Resources Conservation Service

Physical Conditions

Physical watershed conditions are the fundamental drivers for how a river system functions. They include topography, climate, geologic setting, hydrology, hydraulics, and geomorphology.

Topography

Topography refers to the vertical and spatial variation of the Earth’s surface within a given area. Bathymetry, a specific type of topographic data, refers to vertical variations of the ground in submerged areas (i.e., rivers, lakes, or oceans). Combined, topographic, and bathymetric (topo-bathymetric) data are a vital component of flood hazard management as they determine how water is conveyed through a landscape, defining flow capacity and flood potential. Together they also provide valuable insight on historic geomorphic conditions and current trajectories related to morphology and sediment flux. They also inform the nature of flooding that can be expected in different settings. Commonly, topographic and bathymetric data form the underlying basis for any geomorphic investigation and the foundation of hydraulic models built to compute flood extents and hazards.

Topographic data useful for flood hazard studies include LiDAR data, river bathymetry data (which can be collected using traditional survey methods, sounders, and in some cases using green band LiDAR), and (for basin-scale questions) 10-m USGS Digital Elevation Model (DEM) data.

Technological advancement has made the acquisition and availability of high quality topographic data much easier. The most common technology is LiDAR, a remote sensing method, often conducted from aircraft, where laser pulses are used to collect information on the ground surface. Blue-green LiDAR is a specialty type of data collection in which bathymetric data can be collected in addition to terrestrial topography. Application of this method, however, is somewhat limited in practice; therefore, collection of bathymetric data still typically relies on conventional ground survey (wading) in shallow systems or boat-based methods using sounding equipment in deeper water bodies.

Table 7-1 provides sources of available LiDAR and DEM data. If none exists, collection of a LiDAR dataset would be recommended during the early stages of CFHMP development. Depending on the project scope and scale, DEM data may already be available for a given area and appropriate for

initial planning. These data are collected at a lower resolution (typically 10 m) as compared to LiDAR (10 cm resolution).

The topography of the contributing basin governs the processes concentrating water and sediment in the river channel, and thus defines the character of flood hazards. In steep basins, short duration flash flooding or infrequent, high-magnitude sediment mobilization events like debris flows and debris floods may be the dominant flood hazards, while larger, low gradient basins tend to be dominated by longer duration clear water floods. Visualizing the long profiles of tributary streams and computing basin morphometric parameters like the Melton Ratio (Melton, 1957; Jackson et al., 1987; Wilford et al., 2004) are tools to help understand these processes.

The topography of the valley bottom and bathymetry of river channels both govern how future fluxes of water and sediment will pass through a reach and integrate responses to the past history. Because of these fundamental relations, detailed bathymetric and topographic data are vitally important underlying data for flood hazard management. They are the foundation for flood (hydrologic and hydraulic) models and can be used to evaluate the past history of channel migration.

Geologic Setting

Geologic setting influences river function in several ways. First, the erodibility and character of underlying bedrock influence the slope and sediment load inputs. They also affect the mechanism for and how readily the valley sides erode, which influences river confinement. For example, hard rock valley sides are more likely to erode through rock fall or landslide events, whereas unconsolidated valley sides are more likely to erode through debris slides, debris flows, debris torrents, or slumping driven by the river undermining the toe of the slope.

In much of Washington State, the surficial geology is highly affected by the region's glacial history (Booth et al., 2004). Movement of sediment by glaciers during previous ice ages scoured surficial sediment, leaving bare bedrock in some areas and large deposits of sediment in others. Glaciers and glacier-river interactions also left unique features on the current landscape (e.g., Pierce County potholes that experience groundwater flooding), and re-routing of major rivers (e.g., the Sauk River).

Present-day rivers are overlain on whatever geologic setting exists (Montgomery, 1999; Collins and Montgomery, 2011) and, through modern geomorphic processes, are re-shaping it in response to the modern climate and hydrology. Geomorphic processes are described below.

Hydrology and Hydraulics

Hydrologic elements to include in the Existing and Future Conditions Assessment include the following:

- Description of the surface water bodies in the planning area (rivers, streams, lakes, major wetlands, and saltwater bodies if adjacent).
- Rainfall-to-runoff quantification and description. Quantification is accomplished using one or more of several available methods, including stream gage data, regional regression relations (see Table 7-1) or numerical modeling (see Table 7-2). These methods can be used to characterize flow and flood conditions. The hydrologic inputs must be developed to establish the flows that will be routed through the hydraulic model to project flood levels, inundation areas, flow velocities, and shear stress (for evaluating erosion potential).

Hydrology versus Hydraulics

Hydrology and hydraulics are terms that are often paired, and not well understood by many.

Hydrology broadly means the study of water and how it circulates on (or below) the earth's surface. In the context of a CFHMP, hydrology typically refers to the study, measurement, and analysis of regional rainfall and runoff that feed river systems.

Hydraulics refers to the analysis of flowing water within rivers and streams.

- In some settings, groundwater is important to flood management. One example is where high groundwater levels create flood problems, especially in settings where the water table aquifer is very permeable and groundwater levels rise rapidly in response to river or coastal flooding. Another example is where high groundwater levels exacerbate slope instabilities along riverbanks or valley walls.

Hydraulic elements to include in the Existing and Future Conditions Assessment include the following:

- If available, review effective FEMA flood hazard studies provided through FEMA's Map Service Center (Table 7-1). The Map Service Center provides an online viewer to access and download Flood Insurance Rate Maps (FIRMs). FIRMs delineate the minimum area governed by National Flood Insurance Program regulations. Note that FIRMs do not consider the effects of climate change. Flood Insurance Study (FIS) reports are also available and provide background of the hydrologic and hydraulic analyses conducted to produce the flood hazard mapping. Detailed hydrologic and hydraulic data (including models) are available but typically require a formal request to FEMA. FEMA data provide a baseline understanding of hazards in an area and can be useful for identifying data gaps or areas of focus.
- Unless the cost of new hydraulic modeling is included in the planning effort, initiating new modeling is unlikely to be the best use of resources. However, if more detailed information on specific flood areas is warranted to increase the understanding of specific flood hazards, an existing hydraulic model could be updated or new model developed. Topo-bathymetric data would be needed to represent the model geometry, and hydrologic inputs must be developed to establish the flows that will be routed to compute flood levels, inundation areas, flow velocities, and shear stress (for evaluating erosion potential). HEC-RAS is the primary modeling platform used for hydraulic analyses in flood mapping situations (Table 7-2). Depending on available data and characteristics of the reach in question, either one-dimensional (1D) or two-dimensional (2D) modeling may be implemented. One-dimensional models are more applicable to steeper systems with relatively simple floodplain geometries. Two-dimensional models are useful in more complex flood situations involving broad floodplains and flood protection measures. Typically, the 10-, 50-, 100-, and sometimes 500-

year flows (for an extreme flood or sometimes used to represent future climate conditions) are modeled. More frequent (1.01- or 2-year flows) are sometimes modeled to provide information on riverine habitat or morphologic processes.

It is possible that technical analysis done in support of the CFHMP will inform future FIRM updates. While FIRM updates have specific requirements for analysis and are limited by the fact that they do not consider the effects of climate change, technical studies that support a CFHMP may help to inform elements of the flood risk analysis or the development of specific RISK Map products that later support floodplain management. A CFHMP should not be developed with the expectation that it will simplify future FEMA mapping requirements and efforts. However, the technical analysis supporting a CFHMP may provide an overview of the flood risk that is mapped on the FIRM.

Table 7-2. Numerical Models Frequently Used for CFHMPs	
Model	Common Uses for CFHMP
HEC-RAS 1D/2D (U.S. Army Corps of Engineers, Hydrologic Engineering Center)	Floodplain Mapping
HEC-HMS (U.S. Army Corps of Engineers, Hydrologic Engineering Center)	Event hydrologic simulation to model rainfall-runoff
HSPF (Hydrologic Simulation Program-Fortran)	Continuous hydrologic simulation to model rainfall-runoff
WWHM (Western Washington Hydrologic Model)	Continuous hydrologic simulation to model rainfall-runoff

Geomorphology

The character and position of alluvial channels are dynamic over decades, and so it is important to understand key river processes that control these, how these processes interact with different flood hazard management strategies, and how potential changes in the river morphology may impact flood hazards. Geomorphic investigations supporting flood hazard studies should include documentation of the grainsize distribution of the channel bed material, documentation of typical channel morphology (width, depth, planform morphology, profile morphology), evaluation of how sediment transport interacts with the channel hydraulics, documentation of historic patterns of channel migration and changes in channel morphology, and evaluation of historical, present, and possible future function of large wood in the channel. Figure 7-1 illustrates the relationships between sediment volume, sediment size, channel slope, and channel pattern.

Each reach should be placed in both its river continuum and process-domain context, which requires definition of key lateral controls and incoming and outgoing fluxes of water, sediment, and wood. Process-domain is an organizing framework for linking the dynamics of watershed processes and aquatic ecosystems (Montgomery, 1999). Transition points, such as alluvial fans, river deltas, and hinge points between aggrading and degrading reaches, are often key areas that control geomorphic processes; thus, understanding these areas is important. Maintenance of habitat- and channel-forming geomorphic processes requires that flood managers understand the amount of space rivers need to convey incoming sediment and water fluxes dissipate energy, form a diverse mosaic of floodplain habitat, and, in aggrading reaches, store the incoming sediment load. Documentation of these geomorphic controls and processes is fundamental to a geomorphic characterization.

River managers also need to understand how geomorphic processes may impact flood hazards. In steeper landscapes, hydro geomorphic hazards must be identified and quantified, as processes such as debris flows and debris floods can generate peak discharges and impact forces much higher than floods driven by large rainfall and/or snowmelt events (Borga et al., 2014; Jakob et al., 2015).

In areas of chronic sediment deposition, gravel accumulation can reduce the channel capacity to convey floods. Flood protection measures should account for expected sediment accumulation volume and provide adequate vertical freeboard and/or lateral accommodation space to safely store the expected aggradation volume over the planning timescale. Further, channels downstream of large sediment injections (e.g., the Lillooet River in British Columbia, the Toutle River below Mount Saint Helens, or the Elwha River below the removed dams) can aggrade over an accelerated timescale of weeks to years.

Hydrogeomorphic Hazards

Hydrogeomorphic refers to flood hazards that are driven by slope instability. Examples include debris flows, debris torrents, and debris floods—a range of soil- and rock-dominated flowing masses. These are most common in steep watersheds. These hazards can also occur in post-fire landscapes susceptible to extensive surface erosion.

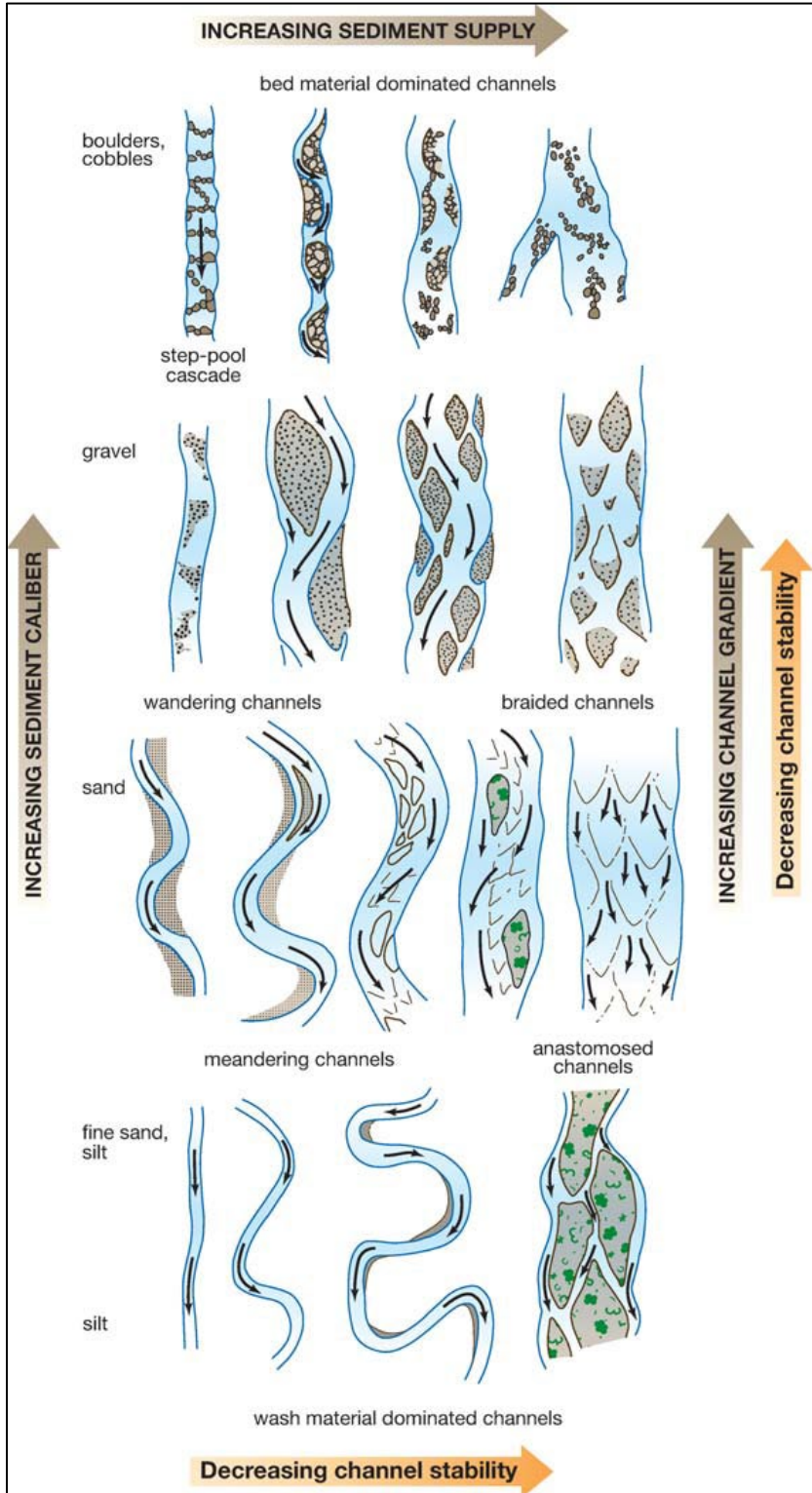


Figure 7-1: Characteristic relations between channel morphology and character and quantity of sediment transport. From Church (2006).

Climate and Climate Change

Climate

Historical climate data are needed to determine precipitation patterns that fuel streamflow, snow cover, and temperature. Climate data most frequently used for CFHMPs are listed in Table 7-1.

Types of Climate Effects

Planning for future flood and erosion risks necessitates consideration of future climate scenarios that will affect flood and erosion. Resources to help with this element of the CFHMP are listed in Table 7-1. In general, future climate effects include the following:

- Reduced snowpack is expected, especially in rain-snow transitional areas. This will shift river flows to a more rainfall-dominated regime, with higher flows during the winter months and lower flows during the summer months.
- Sediment loading to rivers is expected to increase due to a variety of factors, including increased landslide frequency (associated with more intense rainfall, fire, and changes in vegetation) and increased sediment inputs from alpine areas affected by glacial retreat.
- Channel migration may also increase, driven by higher winter flows and more sediment transport.
- The increase in wildfires will decrease the stability of hillside sediments, increasing debris flood and debris flow risks.
- Sea level rise will cause more coastal flooding, higher groundwater levels in coastal areas, and more coastal erosion.

Considerations

It is not always necessary to conduct new climate studies. Instead, focus first on making use of existing information and considering sensitivities.

- What do existing resources on climate change suggest are possible impacts that your community could face? Review the Puget Sound State of Knowledge report (Mauger et al., 2015) and other resources identified in Appendix B. Have climate projections been developed for your watershed or jurisdiction? Consider contacting the University of Washington Climate Impacts Group or other technical experts for help identifying existing resources.
- Think about extreme events. What damages occur in your planning area in extreme flood events? What would happen if those events become more frequent in the future? What would happen if flood levels become higher during extreme events? What would you need to plan for those events?
- Consider sensitivity. What damages would occur if you had 10% more flooding? What if coastal flooding were to go up by 1 foot? Do you have existing models or tools that could be used to run sensitivity scenarios?
- Identify whether flooding in your basin is driven by snowmelt or by rainfall. In a snow-dominated basin, climate change is likely to shift snowmelt peaks earlier and increase the likelihood of rain-on-snow events. In rain-dominated basins in western Washington, climate projections indicate an increase in the frequency and intensity of the atmospheric river storms that historically produce large floods.
- What portions of your planning area would be flooded if levees or other flood control infrastructure failed due to higher flood levels in the future? Consider topography. While it

was developed for a different purpose, the Puget Sound Partnership's floodplain extent used for tracking the Floodplain Restoration Target approximates the floodplain area in Puget Sound prior to modifications, and can help you envision which areas could potentially flood if your flood control infrastructure is overtopped or otherwise overwhelmed by increased flood levels with climate change. It is available online at: <https://wa-psp.maps.arcgis.com/apps/Styler/index.html?appid=85aac9497d84890a5137502051760b5>.

- Consider whether areas of your watershed are susceptible to increased wildfire risk. If so, make sure to consider hazards associated with post-wildfire flooding (sometimes known as “flood-on-fire”) events.

Potential Studies

Investment in new climate studies or modeling should be carefully considered, as it is possible to put substantial effort into technical information that ends up being hard to interpret, high in uncertainty, or not applicable to identifying flood hazard management strategies and measures. That said, in many cases, new studies will be necessary and helpful to fill in gaps and provide the information needed for decision-making. Some types of studies that could be conducted include:

- Flood damage sensitivity tests using existing hydraulic models.
- Hydrology modeling with climate change scenarios.
- Developing new hydrologic projections by downscaling regional climate model projections.
- Mapping future flood depth and extent.
- Identifying how often certain flood stages will be reached in the future.
- Modeling groundwater changes with sea level rise.
- Modeling changes in aggradation with sea level rise.
- Modeling inland flooding due to sea level rise (such as storm drain flooding).
- Modeling future patterns of sediment deposition and transport.
- Estimating rates of land subsidence.

Biological Conditions

Biological conditions describe the aquatic, semi-aquatic, and terrestrial species and habitats that intersect with flood and erosion planning. Flood and erosion processes create and refresh habitats that are critical to many species. In some cases, these processes can also harm species. It is important to understand the interrelationships so that solutions to flood and erosion problems do not damage biological conditions. Even better is to develop solutions that are beneficial to both people and the natural environment.

Ecological Context

A general description of the ecological context sets the stage to describe specific species use and habitats in more detail. This section should describe the historical and current conditions that alter the ecological conditions of the planning area. For example, historical logging impacts may still limit available large wood to a river system. Channel incision from historical splash damming during historical timber harvest and transport is present in some watersheds. Draining or filling of floodplain wetlands for farming or urbanization can increase downstream flooding. Urban watersheds likely have impacts from urban land uses (sedimentation, incision, pollutants), and rivers may be channelized, straightened, and constrained by levees.

Aquatic and Semi-Aquatic Species Use and Habitats

Salmonid use is often the primary aquatic species of interest, but many other native fishes, amphibians, and semi-aquatic mammals (such as beaver) are also important. At a minimum, this description should cover any ESA-listed salmonids and other species, and refer to any relevant recovery plans or strategies that overlap the geography of interest. Depending on the goals, objectives, and specific issues in the planning area, it may be good to also describe other native fishes, amphibians, and semi-aquatic mammals.

This section should include an inventory of species that are known to be present in the planning area, including timing and life cycles. The presence of habitat and uses for different life stages should also be inventoried and described. Many aquatic and semi-aquatic habitats are identified or otherwise protected by additional programs. For example, wetlands are designated as a priority habitat under the WDFW Priority Habitats and Species program, as are rivers and streams that provide fish habitat. Understanding and describing the habitat in the area will result in a more complete understanding of how they interact with the floodplain.

Terrestrial Species Use and Habitats

Terrestrial species are less directly affected by most flood and erosion projects; however, they should be inventoried and described at a summary level. There may be examples of migratory species (such as elk) that utilize floodplain areas during certain times of the year. Access to these areas may be important and displacing them could cause unintended consequences elsewhere. In addition, foraging by these species may challenge new plantings from flood damage reduction or restoration projects. At a minimum, this section should address any ESA-listed species. Terrestrial habitat within or adjacent to floodplains can include buffers of aquatic and semi-aquatic habitats and should be described in the context of function relative to the floodplain and the buffered habitat.

Ecological Restoration Activities

Most planning areas in Washington have overlapping habitat restoration plans and associated ecological restoration activities, primarily for salmon and steelhead trout. CFHMPs should work to complement ecological restoration activities. Taking the time to understand the priorities and completed/planned actions will help the CFHMP team avoid conflicting actions and may reveal synergies between the two efforts.

Social

Social conditions describe how communities use the floodplain, including land use, recreational uses, cultural and spiritual uses, development patterns, and community composition & environmental justice.

Land Use

Land use is the largest social element to include in a CFHMP. This includes a description of current land uses (urban, suburban, rural, forestry, etc.) and future projected changes to land use. Transportation and utility infrastructure are also important to document, especially if there are roads, bridges, or railroad lines that affect flooding, erosion, and channel migration in the planning area.

Recreational Uses

Rivers provide recreational enjoyment for many. Recreation in and near rivers includes fishing, boating, floating, swimming, and family water play. Adjacent areas are often used for biking, hiking, and/or running trails. These recreational uses should be documented in the Existing and Future Conditions Assessment, including types of uses, locations where activities occur, levels of use, and season of use. Parks and other river access points should be identified and included on CFHMP maps. Note that recreational activities (particularly in-water recreation) can be incompatible with other river management objectives (such as public safety and habitat objectives). Any recreational

uses that take place within the river or floodplain should be considered carefully in the development of strategies and mitigation measures.

Cultural and Spiritual Uses

Tribal rights and access to rivers and floodplains include not only fishing access but also access for other cultural and spiritual activities. This is distinct and separate from other users or recreation by the broader community.

Agriculture

Agriculture is a common land use in the floodplain, and is often considered a floodplain-compatible land use because seasonal flooding of fields does not necessarily cause lasting damage. However, flooding has the potential to threaten buildings (such as barns and farmhouses), equipment, livestock, and perennial crops. Agricultural uses of the floodplain should be documented in the Existing and Future Conditions Assessment, including the extent and type of agriculture, the presence of equipment and structures in the floodplain, the presence of livestock, and the potential for agriculture to be converted to development.

Development Impacts

Impacts from human activities should also be considered when assessing future flood and erosion risks. Major activities to consider include:

- **Urbanization** – Increased development with increased impervious surfaces will increase runoff rate to the river if not retained/detained. Urbanization can also increase the risk of polluted runoff, as well as increased introduction of invasive species to rivers (aquatic weeds can cause summer flood problems). Urban creeks may also be confined to narrow corridors, exacerbating urban “drainage” flooding.
- **Forest Management** – Most headwater areas in Washington are forested and many are in managed forest. Most timber companies now use a shorter cutting cycle than in historical times, meaning that managed forests rarely exceed 30 years in age. Mature forests over 40 years old provide a storage function within the watershed, but younger stands do not. So, in the future, headwater areas in managed timber will yield more streamflow during the winter. In addition, sediment inputs from managed forest areas may be higher, and these areas may be more susceptible to mass wasting events.
- **River Confinement and Bank Hardening** – With space at a premium, communities are inclined to try to contain rivers and streams within their boundaries to allow for higher density development. This should be considered and addressed through solution development and interjurisdictional coordination within the planning area river corridor.
- **Floodplain Fill, Disconnection, and Loss of Wetlands** – Many of the impacts of development in floodplain areas (whether for agriculture, residential or commercial structures, or other uses) relate to the degradation of natural floodplain functions through filling or disconnection of the floodplain or filling in wetlands. Identifying solutions that restore floodplain functions can increase flood storage capacity, address sediment management issues, and improve water quality and habitat.

Community Composition & Environmental Justice

The Existing and Future Conditions Assessment should identify vulnerable or overburdened communities located in your community’s flood hazard areas. The Washington State Environmental Justice Task Force Final Report defines “overburdened communities” as “*communities who experience disproportionate environmental harms and risks due to exposures, greater vulnerability to environmental hazards, or cumulative impacts from multiple stressors*” (Environmental Justice

Task Force, 2020). Factors that can increase vulnerability to flood hazard include income, race and ethnicity, citizenship, language, age, disabilities, education, and housing. Understanding the communities that live in your floodplain areas or are otherwise at risk from flood hazards is necessary to develop a suite of strategies and measures that are equitable in addressing hazards. Resources to identify vulnerable and overburdened communities include the United States Census (<https://www.census.gov/>), the American Community Survey (<https://www.census.gov/programs-surveys/acs>), the Washington Environmental Health Disparity Map (<https://fortress.wa.gov/doh/wtnibl/WTNIBL/>), EPA's EJSCREEN tool (<https://ejscreen.epa.gov/mapper/>), Washington Office of the Superintendent of Public Instruction demographic information on schools in the planning area (<https://washingtonstatereportcard.ospi.k12.wa.us/>), and proactive, substantive outreach (see Step 2).

This step should also include a qualitative assessment of environmental justice and equity as they relate to the existing flood hazard management system and infrastructure within the planning area. The assessment should consider the following questions:

- Has the investment of resources for flood hazard management in the planning area been ethical, balanced, and responsible?
- Do flood hazards disproportionately impact vulnerable populations?
- Has a reliance on cost-benefit analysis in prioritizing and sequencing flood hazard management actions caused a disproportionate allocation of benefits to high property value areas?
- Have decisions about flood hazard management taken into account tribal rights, including treaty rights?
- Has past community engagement around flood hazard issues been accessible to underserved communities? Have their concerns been heard and meaningfully addressed?
- Have past flood planning efforts been focused on traditionally privileged communities?
- Has your local government been accountable to all residents, including those who have less access to power or resources, in addressing flood hazards?

Regulatory

The inventory and analysis of issues should include consideration of relevant regulations and their effectiveness in protecting floodplain areas and preventing flood hazards. Related regulatory programs will have already been identified and considered in Step 1, so this step should be focused on documenting the programs and assessing whether there are any gaps or contradictions between various regulations (for example, between the Floodplain Management Ordinance, Shoreline Master Program, and Critical Areas Ordinance). This step should also include an assessment of whether the local Floodplain Management Ordinance is meeting or exceeding NFIP minimum requirements.

Document the Flood and Erosion Risks (Task 3)

This section of the CFHMP will describe the existing flood and erosion risks, including the locations of flood facilities and description of historical floods and erosion events. Special hazards, such as hydro geomorphic events, levee breach flooding, and groundwater flooding, are also described.

Existing Flood Facilities

Flood facilities include levees and dikes, floodwalls, dams, revetments, channel “training” structures such as barbs, floodgates, and pump stations. Elevated roads and railroads also act as levees, although they were never designed as such; these should also be evaluated. An inventory and description of all known features should be included in the Existing and Future Conditions Assessment.

Flood and Erosion History

A compilation of historical flood and erosion events is a mandatory element of the CFHMP. This compilation should include the date, locations affected, flood magnitude and duration, flood frequency, associated climatic event, major damage, and other noteworthy information associated with the event. This compilation can reveal significant patterns and illustrate how variable flood impacts can be depending on contributing weather and watershed conditions.

It is useful to include a list of FEMA damage records for events as well as locations of FEMA repetitive loss structures. These can help home in on flood problem areas.

Identified and Mapped Flood Inundation Risks (Flood Problem Areas)

Flood and erosion problem areas can be identified from historical flood damage records, known inundation areas, and known erosion areas. These should be mapped and described with as much information as is readily available – affected parties or infrastructure, frequency of problem, rate of increase of problem, subsidence, hydrology and hydraulics/geomorphic context, etc.

Uncommon flood risks include special situations where flooding may arise from a different source than a climate-induced rainfall-runoff event. Examples of such situations include:

- **Groundwater Flooding** – As described in the *Hydrology and Hydraulics* section above, high groundwater levels may cause flooding where a permeable water table aquifer enables groundwater levels to rise quickly in response to nearby surface water levels.
- **Dam Failure Risk** – Flooding from a dam failure could be catastrophic and life threatening in areas proximal to a dam failure, or muted in more downstream areas. These risks are addressed specifically through a Dam Emergency Action Plan, which is required for all dams classified as “significant hazard” or “high hazard.”
- **Levee Failure Risk** – Levees are also at risk of failure through overtopping or breaching. Development behind certified levees is not subject to NFIP requirements and therefore is at risk from flooding in the event of a levee failure.
- **Coastal Flooding** – Coastal flooding has become more frequent, caused by rising sea level, more extreme high (king) tides, shoreline encroachment, and destruction of estuary wetlands. Shoreline erosion risks have also increased, driven in part by higher sea levels, more extreme weather events, and shoreline hardening that does not diffuse wave energy.

Identified and Mapped Erosion Risks (Erosion Problem Areas)

In the United States, the total annual damage related to flooding along streams with severe erosion problems is approximately US\$ 1.5B (ASFPM, 2016), and much of this damage is believed to result from erosional processes related to flooding rather than direct inundation. Furthermore, these processes can create a direct risk to human life and safety because of the way they can rapidly reshape the landscape and shift the locations of fast and deep flow.

Transport of sediment in alluvial rivers characteristically causes channel migration as concentrated flow forces on the outsides of meander bends erode material from the floodplain, and less concentrated flow forces on the inside of the bend allow bed load to settle out of transport, building point bars moving sediment down valley through progressive sequences of erosion and deposition. Further, sediment and wood carried by rivers and streams can accumulate and block the path of the flow, resulting in sudden shifts (termed avulsions) of the channel position during floods. In some environments, avulsions may happen in response to channel-blocking landslides, which may be triggered by fluvial undercutting of the valley wall and run out across the valley bottom (e.g., Wartman et al., 2016). Because they fundamentally re-shape the valley bottom, these processes can

cause fluvial hazards to impact areas outside the flood inundation area that would be predicted by a hydraulic model.

Notwithstanding the negative interaction that can occur between channel migration and human infrastructure, channel migration is a vital process to sustain river and riparian health. It allows the river channel to dynamically adjust to changing inputs of water, sediment, and wood (Church, 2006), produces topographic variability across the floodplain to support diverse aquatic and terrestrial habitats (Jones, 2006; Latterell et al., 2006), is a primary mechanism by which large wood is entrained into rivers (Abbe and Montgomery, 1996), and ultimately creates the complexity and diversity in channel hydraulics that is necessary for aquatic organisms to flourish. The importance of lateral channel migration and other processes in underpinning the health of the fluvial ecosystem was formally recognized by NMFS in a 2008 Biological Opinion, which concluded that the further implementation of the NFIP in Puget Sound is likely to jeopardize the continued existence, as well as destroy or adversely modify the critical habitat, of Puget Sound Chinook salmon and steelhead, Hood Canal summer-run chum salmon, and the Southern Resident Killer Whale (NMFS, 2008). This determination resulted in the implementation of additional floodplain management requirements for NFIP communities in the Puget Sound watershed that require those communities to confirm compliance with the Biological Opinion before permitting any development in the special flood hazard area (NMFS, 2008). Proactive planning to minimize conflict between human infrastructure and channel migration, therefore, is needed both to protect human safety and property and fluvial ecosystem health.

Delineation of the channel migration zone (CMZ) and related mapping of areas affected by fluvial hazards are valuable tools that can support planning efforts. CMZ mapping is an emerging discipline that seeks to identify the area where lateral channel migration is likely to affect the landscape. Washington State has published several guidance documents to support CMZ mapping efforts (Rapp and Abbe, 2003; Forest Practices Board, 2004; Legg and Olson, 2014; Olson et al., 2014). Additional helpful guidance has been published in Colorado (Colorado Water Conservation Board, 2020) and Vermont (Kline and Dolan, 2008). Additional programs exist in many other jurisdictions (see Appendix A of Colorado Water Conservation Board, 2020 for a helpful review). In addition to traditional hazard-focused CMZ delineation approaches, flood hazard management planning efforts may benefit from proactive planning to define the river corridor width required to support the integrity of ecological and geomorphic processes, which may in some cases be narrower than the full footprint of the CMZ.

Erosion in the immediate vicinity of flood protection or other vital infrastructure may require intervention to prevent the loss or catastrophic failure of that infrastructure. The integrated streambank protection guidelines (Washington State Aquatic Habitat Guidelines Program, 2003) provide extensive advice on approaches to determine appropriate ways to manage such localized erosion.

Other Programs

Hazard Mitigation Grant Program

Project submission for the HMGP will require identification of risks and problems that a mitigation project addresses.

System Wide Improvement Framework

If your community has a System Wide Improvement Framework (SWIF) plan or is currently developing a SWIF plan, the information about the levee system, its level of protection, its deficiencies, and the risks associated with those deficiencies should be incorporated into the CFHMP description of physical conditions as well.

Community Rating System

Step 3 of Activity 512 (floodplain management planning) is “Coordinate.” This step provides credit for the following activities:

- Including a review of existing studies, reports, and technical information and of the community’s needs, goals, and plans for the area. This review needs to include a review of community needs and goals, past flood studies, disaster damage reports, natural areas plans, and other documents that will provide information for the planning process.
- Coordinating with agencies and organizations outside the community’s governmental structure to ask for data or information related to the hazard, ask if the agency or organization is doing anything that might affect flooding or properties in flood-prone areas, and offering the agency or organization an opportunity to be involved in the planning effort, such as by attending a committee meeting or commenting on the draft plan.

Additional detail for Step 3 starts on page 510-11 of the Coordinator’s Manual (FEMA, 2017).

Step 4 of Activity 512 (floodplain management planning) is “Assess the hazard.” This step provides credit for the following activities:

- Including an assessment of the flood hazard in the plan, including the Special Flood Hazard Area, repetitive loss areas, areas not mapped on the FIRM that have flooded in the past, and other surface flooding identified in other studies. The assessment should:
 - Include a map of the flood hazard areas.
 - Provide a description of the known flood hazards, including source of water, depth of flooding, velocities, and warning time.
 - Discuss past floods.
- Including an assessment of less-frequent flood hazards in the plan, including an inventory of levees that would result in a flood of developed areas if they failed or were overtopped during a flood, preparing an inventory of dams that would result in a flood of developed areas if they failed, identifying flood-related special hazards, and identifying the coastal A Zone. The assessment should:
 - Map the affected areas.
 - Summarize the hazards in lay terms.
- Identifying areas likely to be flooded and flood problems that are likely to get worse in the future as a result of: (1) changes in floodplain development and demographics, (2) development in the watershed, and (3) climate change or sea level rise.

- Including a description of the magnitude or severity, history, and probability of future events for other natural hazards, such as earthquakes, wildfires, or tornados.

Additional detail for Step 4 starts on page 510-13 of the Coordinator's Manual (FEMA, 2017).

Hazard Mitigation Plans

Task 1 of the Local Hazard Mitigation Planning Handbook (FEMA, 2013) is to Determine the Planning Area and Resources. Task 4 is to Review Community Capabilities. Task 5 is to Conduct a Risk Assessment.

Integrated Floodplain Management

At the same time that you are identifying physical conditions that relate to flooding, you should also identify the interests and values of each group of participants. It is often easier for participants to express their position, a preconceived notion of a right answer, than to state their interest, which is a combination of needs, fears, concerns, and hopes. It often takes work within each interest group (for example, just the people interested in flood risk reduction or salmon recovery) to become clear about what is needed, where, and why. Once participants are able to express their interests instead of their positions, it can open groups to seeing more options and uncommon partnerships, which may mean that seeking mutually beneficial solutions will be successful. It is important to articulate interest-specific goals, measurable where possible, at both the watershed scale and the reach scale. Facilitation needs to ensure that these meetings do not solidify positions but truly move the group to better articulating interests and even differences of opinion within the interest area. Also, technical work may be necessary for groups to feel "equal" in their ability to collaborate or compromise. This technical work may need to happen specifically for one interest group and should not be lumped in with a compromise or collaborative approach if there are high levels of distrust, uncertainty, fear, or resentment of other interest area needs.

Step 5: Set Short- and Long-term Goals and Objectives for Flood Hazard Management

Minimum Requirements

WAC 173-145-040 Comprehensive Flood Control Management Plan (CFCMP) states that a CFHMP must include “*Short-term and long-term goals and objectives for the planning area.*”

Guidance

At this step in the process, the jurisdiction is equipped with both initial goals and objectives and a full assessment of existing conditions, flood and erosion problems, and projections for future flood and erosion hazards. Using all of this information, the jurisdiction will finalize its short- and long-term goals for flood and erosion hazard management. The initial goals and objectives should be revisited based on the information gathered in Step 4. Are there substantial hazards that were not reflected in the initial goals and objectives that should now be considered? Do any of the objectives need to be revisited based on new information about physical, biological, or social conditions?

Along with the goals and objectives drafted during Step 3, the team should consider including the following elements when refining and setting its goals and objectives:

- Climate change resilience.
- Climate variability, robustness.
- Uncertainty around the 100-year flood.
- Robust design standards that accommodate or can be adapted to meet objectives even if we are not perfect in our predictions.
- Changed hydrology due to development.
- Risk tolerance for structures in 50 years, not just now.

These goals will set the framework for the remainder of the CFHMP planning effort. It is important that these goals incorporate community flood safety needs with other elements of the CFHMP rules. This multiple-objective framework includes flood safety as well as the preservation of ecological resources and water quality. Serious consideration of alternatives to instream structural work must be part of the plan development process.

Other Programs

Community Rating System

Step 6 of Activity 512 (floodplain management planning) is “Set goals.” The goals should incorporate or be consistent with other community goals for the affected areas. Additional detail for Step 6 is on page 510-18 of the Coordinator’s Manual (2017).

Integrated Floodplain Management

The IFM guidance recommended for Step 3 applies to this step as well. Additionally, the technical information gathered in Step 4 should be shared with IFM participants and used to collaboratively revise goals.

Step 6: Determine Need for Strategies and Measures for Flood Hazard Management

Minimum Requirements

WAC 173-145-040 Comprehensive Flood Control Management Plan (CFCMP) states that a CFHMP must include a “Determination of the need for flood control work,” including:

- (a) Description of the watershed.
- (b) Identification of types of watershed flood problems.
- (c) Location and identification of specific problem areas.
- (d) Description of flood damage history.
- (e) Description of potential flood damages.
- (f) Short-term and long-term goals and objectives for the planning area.
- (g) Description of rules that apply within the watershed including, but not limited to, local shoreline management master programs, and zoning, subdivision, and flood hazard ordinances.
- (h) Determination that the instream flood control work is consistent with applicable policies and rules.

Guidance

As described above, WAC 173-145-040(1) requires documentation for the need for “flood control work.” Ecology’s interpretation of this language includes all flood risk management and flood damage reduction actions, not just flood control actions.

To accomplish Step 6, the project team should evaluate the knowledge gained through the Existing and Future Conditions Assessment completed in Step 4 along with the goals and objectives to determine the need (and opportunities) for flood hazard management strategies and measures. Specific needs should be documented, including the following:

- Existing and historic flood inundation problem areas.
- Existing erosion problem areas.
- Projected future flood and erosion problem areas.
- Areas of greatest sensitivity to climate change and associated potential hazards.
- Disproportionate impacts of flood hazards or of historic flood hazard management actions on vulnerable communities and/or inequitable distribution of benefits from historic flood hazard management actions.
- Data/information gaps that impede the jurisdiction’s ability to fully plan for flood and erosion hazard management.
- Interjurisdictional issues/standards that need to be coordinated within a CFHMP.

The documentation from this step should focus on the need (including problem impact and potential consequences), not the solutions.

Other Programs

Community Rating System

Step 5 of Activity 512 (floodplain management planning) is “Assess the problem.” This step provides credit for the following actions:

- Including an overall summary of the jurisdiction’s vulnerability to each identified flood hazard and the impact on the community.
- Including a description of the impact that the hazards have on:
 - Life safety and the need for warning and evacuating residents and visitors.
 - Public health, including health hazards to individuals from flood waters and mold.
 - Critical facilities and infrastructure.
 - The community’s economy and major employers.
 - The number and types of affected buildings (e.g., residential, commercial, industrial, with or without basements, etc.).
- Including a review of historical damage to buildings.
- Describing areas within the floodplain that provide natural functions, such as wetlands, riparian areas, sensitive areas, and habitat for rare or endangered species.
- Including a description of development, redevelopment, and population trends and a discussion of what the future brings for development and redevelopment in the community, the watershed, and natural resource areas.
- Including a description of the impact of future flooding conditions on people, property, and natural floodplain functions.

Additional detail for Step 5 starts on page 510-16 of the Coordinator’s Manual (2017).

Integrated Floodplain Management

For an IFM approach, it is important not to limit your determination of need to only flood hazard management needs. The needs of other interests in your IFM effort also need to be determined. For example, if you are focused on a flood/farm/fish IFM effort, you should also articulate the needs of salmon recovery and of the agricultural industry in your planning area. More importantly, you should articulate where the needs overlap.

If you are incorporating IFM into your CFHMP with the intention of submitting an application for a Floodplains by Design grant, the FbD application will require an articulation of the need for flood risk reduction, salmon recovery, and agricultural viability (separately) as well as the need for other interests represented in your application.

Step 7: Identify Alternative Strategies and Measures for Flood Hazard Management

Minimum Requirements

RCW 86.12.200 Comprehensive Flood Control Management Plan – Elements states that a CFHMP shall include:

Establishment of a comprehensive scheme of flood control protection and improvements for the areas that are subject to such periodic flooding, that includes:

- (a) Determining the need for, and desirable location of, flood control improvements to protect or preclude flood damage to structures, works, and improvements, based upon a cost/benefit ratio between the expense of providing and maintaining these improvements and the benefits arising from these improvements.
- (b) Establishing the level of flood protection that each portion of the system of flood control improvements will be permitted.
- (c) Identifying alternatives to in-stream flood control work.
- (d) Identifying areas where flood waters could be directed during a flood to avoid damage to buildings and other structures.
- (e) Identifying sources of revenue that will be sufficient to finance the comprehensive scheme of flood control protection and improvements.

RCW 86.12.200 also states that a CFHMP shall include elements related to land use regulations, including:

- Establishing land use regulations that preclude the location of structures, works, or improvements in critical portions of such areas subject to periodic flooding, including a river's meander belt or floodway, and permitting only flood-compatible land uses in such areas.
- Establishing restrictions on construction activities in areas subject to periodic floods that require the floodproofing of those structures that are permitted to be constructed or remodeled.
- Establishing restrictions on land clearing activities and development practices that exacerbate flood problems by increasing the flow or accumulation of flood waters, or the intensity of drainage, on low-lying areas. Land clearing activities do not include forest practices as defined in chapter 76.09 RCW.

WAC 173-145-040 Comprehensive Flood Control Management Plan (CFCMP) states that a CFHMP must include “Alternative flood control work,” including a “Description of potential measures of instream flood control work” and “Description of alternatives to instream flood control work.”

Guidance

Flood hazard management strategies and measures are described here in the following categories:

- Development and use of updated flood hazard information (flow and inundation projections, etc.) to ensure the highest accuracy for the evaluation of need and solution design.
- Non-structural alternatives prevent the creation of new flood and erosion risks, remove people and property from harm's way, or promote land uses that are compatible with flooding in flood hazard areas.
- Structural flood damage reduction measures that physically modify river processes to reduce flood risk.

As described in Principle 1 of Comprehensive Flood Hazard Management (in Section 1.4), comprehensive flood hazard management must shift to focus on non-structural alternatives and on ecological restoration. This focus must be demonstrated in the strategies and measures developed as part of this step. While structural measures are described in this step because they may be the most appropriate actions to implement in some areas or to address certain flood hazards, the primary focus must be on non-structural alternatives.

For each flood/erosion problem, the CFHMP should consider a full range of potential solutions. The long-range costs of removing human infrastructure from flood and erosion hazard areas may be much lower than a flood protection facility that requires maintenance and repairs and will never eliminate the residual risk to adjacent people and structures.

In this step, do not try to develop a single project or set of projects to address your goals and objectives; instead, identify multiple *alternatives*. Identifying alternative solutions allows your community to fully consider potential approaches and select the best fit. In this stage, focus on identifying alternatives; you will evaluate the alternatives in Step 8.

Best practices for both non-structural and structural strategies and measures are frequently changing and are also highly specific to a community's needs and goals. This section describes high-level guidance for the types of strategies and measures to consider. Communities should refer to the most up-to-date resources for more specific guidance. Good sources of information on potential strategies and measures include:

- CRS Coordinator's Manual: https://www.fema.gov/sites/default/files/documents/fema_community-rating-system_coordinators-manual_2017.pdf.
- Corps of Engineers Planning Guidance for Flood Risk Management: <https://planning.erdc.dren.mil/toolbox/guidance.cfm?Option=BL&BL=AllFloodRiskMgmt&Type=None&Sort=Default>.
- Corps of Engineers Levee Manual: <https://planning.erdc.dren.mil/toolbox/guidance.cfm?Option=BL&BL=AllFloodRiskMgmt&Type=None&Sort=Default>.
- No Adverse Impact Floodplain Management Toolkit: [https://www.floods.org/resource-center/association-of-state-floodplain-managers-nai-no-adverse-impact-floodplain-management/.](https://www.floods.org/resource-center/association-of-state-floodplain-managers-nai-no-adverse-impact-floodplain-management/)
- U.S. Bureau of Reclamation/Corps of Engineers National Large Wood Manual: Assessment, Planning, Design, and Maintenance of Large Wood in Fluvial Ecosystems: Restoring Process, Function, and Structure: <https://www.usbr.gov/research/projects/detail.cfm?id=2754>.
- CFHMPs from other jurisdictions (see Appendix B).

- FEMA Region X Floodplain Management and the Endangered Species Act: https://www.fema.gov/pdf/about/regions/regionx/nfip_esa_faq/nfip_esa_model_ordinance_final.pdf.

The alternative development process should refer to other planning processes, actions, and funding sources within your planning area for potential strategies and measures. For example, are there projects in the local salmon recovery plan that would also address flood hazards, or that could be modified to address flood hazards, that could also be included in the CFHMP? Are there planned upgrades to roads or bridges in the local Capital Improvement Plan that could be used as opportunities to reduce floodplain encroachments if flood hazard reduction goals are considered in design of the new infrastructure? The more consistent actions in the CFHMP are with other plans, the easier it will be to fund and implement the actions.

The alternatives and measures (whether updated information, non-structural, or structural) need to include measures to address environmental justice issues identified through the analysis in Steps 4 and 6, and to address issues identified through outreach to vulnerable and underrepresented communities in Step 2. This relates to: (1) the alternatives and measures developed, (2) the locations where the alternatives and measures would be implemented, and (3) the distribution of benefits from the alternatives and measures.

Updated Flood Hazard Information

When a need for updated flood hazard information is identified in the prior planning step, this should be completed before proceeding to considering alternatives. Some common technical elements that may be identified for updating include:

- **Flood Flow Frequencies.** This may involve updating flood statistics using longer stream gage records, developing new hydrologic models, or considering expected flow changes under future climate and land use conditions.
- **Updated Hydraulic Studies and Mapping.** This includes using updated hydrologic information for input into hydraulic models, developing new hydraulic models, often using modern two-dimensional methods, and mapping the results onto new topography, typically from recent LiDAR flights.
- **Geomorphic and Hydrogeomorphic Studies.** Additional analysis may be needed where there is potential channel migration, sedimentation, debris flow, or landslide-induced flooding risk with inadequate previous technical studies to characterize the risk.
- **Structure Inventory Updates.** Developing or updating GIS-based inventories of at-risk structures and infrastructure on a reach, neighborhood, or individual structure basis provides a strong basis for evaluation of alternatives.

Economic studies are another common technical element that may be identified for updating; however, economic studies need to be designed and used carefully to avoid environmental justice impacts. It may be useful to integrate the hydrologic, hydraulic, and structure inventory studies into a flood damage economic model. Typical models used for this include Hazus (from FEMA), and HEC-FDA and its successors from the Corps. These tools offer the most robust comparison of flood damage reduction economic benefits and full project life-cycle costs and are required for many federally funded grant programs to show a positive benefit-cost ratio. However, economic studies and benefit-cost analyses rely on market values only, which mean that results often favor actions in areas with higher property values over low-income areas because the areas being conserved or “saved” from future flood damage are valued higher in the marketplace. Relying on economic studies to select, sequence, or prioritize strategies or measures in a CFHMP can reinforce historic inequitable investments. It may be more appropriate to use economic studies to support the funding and implementation of projects that have been prioritized and sequenced based on other factors.

The results of both existing and updated technical studies can then be used to support regulatory updates, design of new and modification of existing flood damage reduction structures, and non-structural flood risk reduction measures, which are described next. Note that any changes to regulations or to flood maps used to enforce regulations must involve more restrictive management to be consistent with the NFIP. If data suggest that a location should not have been included in the special flood hazard area or that the base flood elevation is lower than shown on the FIRM, for example, a formal Letter of Map Revision (LOMR) process must be completed to update the FIRM before that data can be used to lessen regulatory restrictions in those areas.

Updated hydraulic studies or mapping could also lead to an alternative or measure to update FEMA maps to provide the best data for communication and regulation of flood risk. Avenues for updates to FEMA maps include:

- The Cooperating Technical Partners program, which is designed to leverage partnerships between FEMA and local jurisdictions to maintain up-to-date flood hazard maps and other flood hazard information. More information is available at: <https://www.fema.gov/flood-maps/cooperating-technical-partners>.
- The Risk MAP program, which develops flood risk products that go beyond the basic flood hazard information on regulatory flood hazard maps. Local communities can submit mapping need requests in FEMA's Coordinated Needs Management Strategy tool (<https://msc.fema.gov/cnms/>). More information is available at: <https://www.fema.gov/flood-maps/tools-resources/risk-map>.
- Pursuing a LOMR, as mentioned above, to update the FIRM based on new information about flood elevations. More information is available at: <https://www.fema.gov/flood-maps/change-your-flood-zone/lomr-clomr>.

Non-Structural Flood Mitigation

As described in Sections 1.1 and 1.4, development of a CFHMP must focus on non-structural flood hazard management measures and ecological restoration.

Regulatory tools should be considered first. Land development directly affects flood damages by encroaching on the waterway, placing investments in flood-prone areas, and reducing the natural storage capacity of the floodplain. Local flood damage prevention ordinances are the primary mechanism for reducing development in the floodplain. Your community is likely already in the National Flood Insurance Program (NFIP) and has adopted a floodplain ordinance that meets at least the NFIP and State of Washington minimum standards. However, your alternative strategies and measures should consider making the following regulatory improvements:

- **Revising your floodplain development regulations to go beyond the minimum standards.** The Community Rating System Coordinator's Manual is a good resource for identifying higher regulatory standards that your community may adopt. Additional information on the Community Rating System is included in Section 5.7 of this guidebook.
- **Integrating floodplain management to strengthen other regulatory programs in your jurisdiction.** Shoreline master programs, critical areas ordinances, open space programs, and building codes are all examples of regulatory programs that can be used to provide additional regulation of floodplain areas to reduce flood hazards. Note that these programs may allow for exemptions or administrative determinations that are not allowed under the NFIP. Therefore, use of these regulatory programs to strengthen flood hazard reduction needs to be carefully considered to ensure there are no gaps.
- **Mapping flood hazards and regulating to those hazards.** Your community can go beyond the Flood Insurance Rate Map provided by FEMA and map flood hazards based on the flood of

record, mapping of channel migration zones, mapping of special flood hazards (such as groundwater flooding or urban flooding), and mapping of future flood scenarios. If you are aware of a flood issue that is not covered by your adopted flood maps, you should adopt additional mapping data to fill the gap.

Non-structural measures should also include protection or mitigation of existing properties and buildings. These include elevations, relocations, and acquisitions. Home elevations can be an effective tool to reduce flood damages to existing structures at less cost than outright acquisition. This technique should consider all flood hazards before being selected—for instance, elevating a flood-prone home in a channel migration zone may not be a good use of funds. Easements can also be used to protect floodplain areas. For example, agricultural conservation easements can ensure that floodplain agricultural areas will not be developed with residential or commercial buildings that will be at high risk of flooding, while at the same time protecting resource lands important to your community. Channel migration easements are a relatively new approach to establishing a river corridor for lateral channel movement while enabling minimal disruption to existing land uses.

Natural resource protection measures that dovetail with non-structural flood hazard management efforts should also be considered. These include wetlands protection, erosion and sediment control, natural area preservation and restoration, riparian forest buffer preservation and restoration, and coastal barrier protection. Protecting natural resources preserves open space in the floodplain and maintains the ecosystem services provided by the natural resource, such as the flood storage capacity provided by wetlands.

Emergency response is another way to protect against flood hazards without building structural solutions. Emergency response measures include having a flood warning system, protection of critical facilities, and developing clear emergency response plans. Automated flood warning systems and designated evacuation routes can reduce damages by giving floodplain residents time to move damage-prone contents to safe locations prior to flooding.

The non-structural alternatives in your plan should also include public education and information approaches. Public education should focus on providing information about flood hazards and ways to protect against the hazards. Public information activities can include the use of websites, mobile device applications, mailers, and direct outreach at community events.

Structural Flood Damage Reduction Measures

Structural flood damage reduction measures include a variety of techniques to reduce flood risk by preventing bank erosion and confining water within engineered flow corridors. Table 7-3, adapted from the Naches River Comprehensive Flood Hazard Management Plan (Yakima County, 2005), provides a summary of structural flood damage reduction measures.

Bank protection measures to reduce erosion and scour can use a variety of techniques including armored revetments, spur dikes, and barbs. In recent years, building engineered log structures that function in the same way as traditional rock-based structures has become common due to easier permitting and less environmental impact. The Integrated Streambank Protection Guidelines (Washington State Aquatic Habitat Guidelines Program, 2003) provide guidance on the selection of appropriate bank protection measures based on river processes and habitat impacts.



Levees, dikes, and floodwalls act to confine floodwaters and reduce or prevent flooding on the landward side. When built on the riverbank, these structures typically need additional protection from scour and erosion using bank protection measures. Levees can lead to a false sense of security to those living behind them, and if they do fail in some cases can lead to worse flooding than had they not been built. Structural flood damage measures can also cause a geomorphic response that can contribute to new or increased flood hazard upstream, downstream, and/or across the river.



Setback levees can be a viable alternative with substantial benefits over riverbank levees. Erosion and scour protection requirements are usually much less, the increase in flood levels due to confinement can be less, permitting is generally easier, and long-term maintenance costs (which are typically driven by erosion-related damage) are less.

Engineered “log jacks” provide bank protection at the City of Montesano Wastewater Treatment Plant along the Wynoochee River in Grays Harbor County. Top photo is during construction, bottom photo is 1-year post construction. Note that the river angle of attack has shifted away from the facility.

Interior drainage measures may be needed where proposed or existing levees create flooding on the landward side due to inadequate drainage. Structural measures to address this commonly include pump stations and increasing stormwater storage capacity.

In-channel sediment management techniques such as dredging and bar scalping have become very rare in Washington on medium to large rivers due to the repetitive costs incurred, environmental permitting difficulties, and lack of flood damage reduction benefit. However, there are still situations where sediment removal may be a viable alternative, for instance on alluvial fans of smaller systems, or where it is also serving a navigation function.



In 2016, the City of Renton dredged the lower 1.25 miles of the Cedar River to maintain adequate flood conveyance and protection. The permitting process, albeit rigorous, was aided by precedent as the work is a continuation of a Seattle District Corps Section 205 Flood Hazard Reduction Project initiated in 1997.

Channel aggradation can also be managed by allowing rivers to migrate rather than confining them. By increasing the area over which the river can move, the net aggradation is distributed over a wider area, reducing the depth of deposited sediment. In some cases, this may have significantly greater long-term sediment storage potential and flood hazard reduction benefits than active sediment removal (Czuba et al., 2020).

Structural measures for hydrogeomorphic hazards such as debris flows and landslides are often much more difficult than river flooding, due to the much greater flows and forces involved and higher consequences in terms of life safety risk from these events. Non-structural alternatives such as acquisition are usually a better alternative in these situations.

Table 7-3. Structural Flood Hazard Management Options

Measure	Description	Typical Activities
Alignment Control and Bank Protection	Measures designed to accommodate discharge along a course that allows the channel to develop without eroding adjacent property and/or to produce a stable, durable streambank that can withstand floodwaters up to the predicted 100-year flood	<ul style="list-style-type: none"> • Groins • Buried groins • Barbs • Engineered log jams • Drop structures • Porous weirs • Remove or reduce feature • Anchor points • Roughness trees • Riprap • Log toes • Roughened rock toes • Log cribwalls • Manufactured retention systems • Woody plantings • Herbaceous cover • Soil reinforcement • Coir logs

		<ul style="list-style-type: none"> • Bank reshaping • Subsurface drainage systems
Conveyance/Storage Capacity	Measures designed to reduce or remove artificial flow obstructions and/or increase off-channel storage or floodplain storage	<ul style="list-style-type: none"> • Constructing overflow/secondary channels • Controlling growth of vegetation in the floodway • Increasing flooding storage by removing or setting back levees or moving roads • Replacing multi-span bridges with single span bridges (no interior piers) • Installing culverts through embankments to minimize obstructions to flow • Upstream impoundments or off-line detention
Floodplain Protection	Measures that reduce flood hazards for property, structures, and occupants in the 100-year floodplain; protection from inundation, floating debris, sediments, and the force of water flowing in the floodplain	<ul style="list-style-type: none"> • Constructing setback levees • Constructing low dikes (floodplain levees) • Constructing ring levees • Constructing cutoff levees • Elevating roads • Redesigning and replacing bridges • Constructing/expanding storage reservoirs • Changing the configuration/alignment of headgate structures at diversions
Streambed Control	Measures to prevent streambed degradation and upstream headcutting and control bed slope, bed elevation, and water surface elevation by dissipating stream energy that would otherwise alter the characteristics of the streambed	<ul style="list-style-type: none"> • Constructing stabilizers • Constructing drop structures • Large wood placement • Constructing engineered log jams

Climate Change

When identifying alternative flood hazard management strategies and measures, your strategies and measures should address the anticipated impacts of climate change. For example, if a location in your planning area is not currently at risk from flooding but is anticipated to be in the future, and you have identified that need in Step 6, then your alternatives should include measures to address that risk.

Additional considerations for climate change when developing strategies and measures include:

- **Design your projects to future conditions.** For example, if you are designing a setback levee, design the height of the levee to provide your intended level of protection in future conditions, not just current conditions.
- **Identify strategies and measures that enhance resilience to climate change.** Consider actions that reduce your community’s *exposure* to risk, reduce your community’s *sensitivity* to risks, and increase your community’s *adaptive capacity*. Programmatic actions, such as

more restrictive land use policies in floodplain areas, can reduce sensitivity by keeping development out of floodplain areas that will face greater flood hazards in the future.

- **Consider the compatibility of strategies and measures with future needs.** It may not be the right time to pursue measures that will protect against anticipated flood levels 50 years in the future, but the actions taken now must consider those future needs so you do not preclude opportunities and so that you are being efficient with funding.

Documentation for Alternative Identification

It is important that the alternative measures be described in specific terms and located on a map. This is true for measures that rely on increased flood information, regulatory measures, and education, preparedness, and emergency response measures. This will help highlight the importance of nonstructural measures such as updating floodplain regulations or developing better modeling tools for evaluating flood risks and solutions. Documentation should also describe all of the alternative strategies and measures that were considered, along with a discussion of why they were not selected.

Other Programs

Hazard Mitigation Grant Program

The HMGP provides points for nature-based solutions. Guidance states:

“Nature-based solutions are used as a technical evaluation criterion to score sub applications submitted to the national competition. To receive the point allotment for this criterion, the sub application must indicate and describe how the project incorporates one or more nature-based solutions, which are sustainable environmental management practices that restore, mimic, and/or enhance nature and natural systems or processes and support natural hazard risk mitigation as well as economic, environmental, and social resilience efforts.”

System Wide Improvement Framework

If your community has a SWIF, or is currently developing a SWIF, and the SWIF describes capital projects, they should be consistent with the CFHMP capital projects, or potentially just reference the CFHMP. If either the SWIF or the CFHMP sets a level of service (LOS) (or multiple LOSs) for levees in the system, those should be carried over and consistent between the two plans.

Community Rating System

Step 7 of Activity 512 (floodplain management planning) is “Review possible activities.” This step provides credit for the following actions:

- Reviewing preventive activities, such as zoning, stormwater management regulations, building codes, subdivision ordinances, and preservation of open space, and the effectiveness of current regulatory and preventive standards and programs.
- Reviewing whether the community’s floodplain management regulatory standards are sufficient for current and future conditions.
- Reviewing property protection activities, such as acquisitions, retrofitting, and flood insurance.
- Reviewing activities to protect the natural and beneficial functions of the floodplain, such as wetlands protection.
- Reviewing emergency services activities, such as warning and sandbagging.
- Reviewing structural projects, such as levees, reservoirs, and channel modifications.
- Reviewing public information activities, such as outreach projects and environmental education programs.

Additional detail for Step 7 starts on page 510-18 of the Coordinator’s Manual (2017).

Hazard Mitigation Plans

Task 6 of the Local Hazard Mitigation Planning Handbook is to Develop a Mitigation Strategy.

Integrated Floodplain Management

For an IFM approach, it is recommended that you develop a package of actions that address all of the interests involved. Some actions will be multi-benefit actions that address all actions at a single project site, but other actions will focus on one interest. If a single-purpose project that only benefits agriculture (for example) is part of a reach-scale package of projects and it helps build support for the overall integrated strategy, then it can make sense to include it in your CFHMP.

A package of actions will likely represent the ever-evolving and deepening process. This means that some actions may be more “integrated” than others may. Early in building trust, it may be important to get reciprocal support for high priority actions for each interest group with limited integration as a critical trust-building step—essentially verifying that different interest groups understand the needs of others and will support those needs. If the group is committed to learning and deepening their understanding of the needs of other interest areas, then as long as momentum is positively maintained and projects are not moving forward that break trust, imperfect actions can help. As trust is built, it will become possible to brainstorm a list of more creative solutions that may better meet the vision and goals at a watershed, reach, and/or project scale. Solutions can be policy or on-the-ground actions.

Given that past efforts have developed suites of single purpose solutions in Puget Sound, early solutions often include projects originally developed for just one purpose (such as projects in an existing flood plan). These are an excellent place to start, if they can truly be revisited in ways that expand possibilities and create projects that address a broader suite of interests. Many solutions should include policy actions if long-term results are to be achieved. Early success may be less innovative and not as integrated but is still a huge advancement if trust in the group is being built. If a group is building off of an earlier “salmon” or “flood” project, it is critical to ensure that these projects are revisited in a manner that fully explores their potential to advance these and other needs. It is easy for other interest areas to feel that the addition of token “fish” elements to a “flood” project, for example, is disingenuous unless the project itself or the broader suite of projects truly addresses the needs of the given interest area. Similarly, if a habitat enhancement project is permitted with hydraulic analyses and later causes increases in flood levels at adjacent properties, landowners may lose enthusiasm for larger recovery efforts.

Lack of policy advancement, alongside project development, potentially undermines trust and the ability to achieve results over time. As actions are developed, new stakeholders may engage who are now affected, often negatively, by these actions but were not involved earlier. This should not be seen as a negative, but a necessary part of the process as momentum and scale are built.

Over the course of an IFM effort, it is common to move through the following stages (not necessarily in a linear pathway):

- Developing a package of site-specific individual interest actions that may or may not conflict.
- Developing a package of individual interest actions that do not conflict.
- Developing a package of single-interest and multi-benefit actions that do not conflict.

Step 8: Evaluate Alternative Strategies and Measures

Minimum Requirements

WAC 173-145-040 Comprehensive Flood Control Management Plan (CFCMP) states that a CFHMP must include a “Determination that the instream flood control work is consistent with applicable policies and rules.”

WAC 173-145-040 also states that a CFHMP must include “*Identification and consideration of potential impacts of instream flood control work on the following instream uses and resources.*”

- (a) Fish resources;
- (b) Wildlife resources;
- (c) Scenic, aesthetic, and historic resources;
- (d) Navigation;
- (e) Water quality;
- (f) Hydrology;
- (g) Existing recreation;
- (h) Other impacts.”

Guidance

Once a set of alternatives has been identified for each identified flood/erosion problem, the team is ready to evaluate alternatives and determine a preferred solution. This is best done through a semi-quantitative evaluation process. The evaluation components should directly and clearly tie back to the goals and objectives of the plan. Evaluation components include the following:

- **Technical suitability of alternative to solving problem.** How confident is the team that the alternative will work? Are there site conditions or implementation factors that decrease the certainty of meeting project objectives?
- **Primary reliance on non-structural measures and ecological restoration.** Do the alternatives focus on non-structural alternatives and on ecological restoration (as described in Principle 1 of Comprehensive Flood Hazard Management in Section 1.4)?
- **Environmental impacts or benefits.** Will the alternative (or portions of it) negatively impact the environment? Conversely, can the alternative be configured to provide an environmental benefit?
- **Climate change and future conditions.** Will the alternatives and measures be durable against the climate change impacts you anticipate based on the work conducted under Step 4? Will your measures provide the intended benefits if flood flows become higher? If not, can they be modified so that they will? In some cases, it may make sense to pursue near-term actions that will not be durable under projected future conditions, but that decision should be made deliberately.
- **Historic and archaeological resources.** Will the alternative negatively impact historic resources? Does it have the potential to disturb archaeological resources? Can that potential be reduced through cultural resources surveys and/or construction monitoring?

- **Consistency with the local salmon recovery plan.** Is the alternative consistent with the recommendations in the local salmon recovery plan? Does it incorporate elements that contribute to recovery plan goals? Can it be altered to increase compatibility with salmon recovery goals?
- **Environmental justice.** Will any impacts of the alternative (for example, on recreation or transportation) disproportionately impact vulnerable communities? Refer to the demographic analysis conducted under Step 4. Will the benefits of the alternative disproportionately accrue to populations with greater resources or with a history of being protected by flood hazard management actions? Does the alternative address all flood hazards, even in areas where flood hazards have traditionally not been addressed or areas where those vulnerable to flooding did not participate in the public involvement process?
- **Consistency with applicable policies, and the goals and objectives established for the CFHMP.** Do the selected alternatives and measures meet the goals set in Step 5? Are they consistent with the applicable policies and regulations and the related plans identified in Step 1?
- **Consistency with the Principles of Comprehensive Flood Hazard Management (Section 1.4).** Do the alternatives and measures, as a whole, address the Principles of Comprehensive Flood Hazard Management?
- **Permits and approvals that will be required to implement the measures.** The strategies and measures in the plan will need to be permutable, including compliance with NFIP minimum requirements, the local flood ordinance, the local Shoreline Master Program, and the Frequently Flooded Areas section of the local Critical Areas Ordinance. Strategies and measures will also be subject to other local, state, and federal permits and approvals, which could affect the feasibility of implementing certain actions.
- **Cost of implementation, including land acquisition, design, permitting, mitigation, and project management, construction, and life cycle costs.** Depending on the organization’s objectives, a formal benefit-cost evaluation may be necessary. This is a requirement for most Corps and FEMA grant funding programs. Note that benefit-cost evaluations can have environmental justice implications, focusing flood hazard mitigation projects in areas with higher property values (that thereby show a higher economic benefit to providing flood protection). It is recommended that benefit-cost evaluations not be used unless necessary. If required for Corps or FEMA funding, a benefit-cost evaluation can be conducted on flood hazard mitigation measures that have already been selected and prioritized based on other factors.
- **Expected ongoing inspection, maintenance, and repair needs.** How much will it cost to inspect, maintain, and repair any structural measures? Will the required inspection, maintenance, and repair be feasible?

Most jurisdictions find that it is essential to evaluate the alternatives in a transparent, logical framework. Some criteria can be quantified, such as estimated construction costs, expected operations and maintenance costs, and level of protection, but other criteria are inherently subjective or unrealistic to quantify at this stage of planning. Examples include the ease of permitting, environmental impacts, and aesthetic characteristics. Evaluating alternatives within a framework that includes both quantitative and non-quantitative factors usually works best. When planning includes integrating preferences from Tribes and stakeholder agencies and groups, additional non-quantified factors may weigh on alternative selection.

Depending on organizational philosophies, evaluating cost through a full cost accounting framework (or environmental full cost accounting framework) will provide the most accurate comparison between alternatives. As an example, the costs of a development in the floodplain should not just

consider direct costs of the flood risk to the development but also account for the flood risk threat to the infrastructure needed to support the development, ecological costs, and lost ecosystem services. Similarly, acquisition of floodplain land carries a long-term cost to the landowner for stewardship and security of the land.

Other Programs

Hazard Mitigation Grant Program

The HMGP submittal guidelines recommend that applicants “*refine the mitigation activity in areas of technical feasibility, cost-effectiveness and EHP [environmental and historic preservation] and other regulatory requirements.*” The submission will need to document the examination of alternative solutions. All projects must:

- Be cost-effective.
- Reduce or eliminate risk and damage from future natural hazards.
- Meet either of the two latest International Building Codes (i.e., 2015 or 2018) if applicable.
- Align with the applicable hazard mitigation plan.
- Meet all EHP requirements.

Flood Mitigation Assistance Grant Program

The FMA program requires a benefit-cost analysis: “*Applicants and sub applicants applying for mitigation projects (community flood mitigation projects or individual flood mitigation projects) must provide a Benefit-Cost Analysis (BCA) or other documentation that validates cost-effectiveness. BCA is the method of estimating the future benefits of a project compared to its cost. The end results a benefit-cost ratio (BCR), which is derived from a project’s total net benefits divided by its total project cost.*”

System Wide Improvement Framework

Strategies and measures should be reviewed to determine whether they are consistent with levee maintenance standards and any other policies or projects included in the SWIF.

Integrated Floodplain Management

Within an IFM approach, potential strategies and measures should be evaluated based on how well they fulfill the interests of the various participants as identified in Step 4. Strategies and measures that provide benefits for multiple interests should be identified and given high priority. Consider developing a shared set of criteria for solutions based on the interests of various participants and use that shared criteria to evaluate strategies and measures. Not all measures need to address multiple interests to be valuable. If a measure provides a benefit to one interest and does not negatively impact others (or negative impacts can be mitigated), it should be included in the final set of strategies and alternatives.

Step 9: Hold Public Alternative Evaluation Workshop(s)

Minimum Requirements

Holding a public workshop to solicit input on the alternatives being considered for the CFHMP is required, but there is flexibility in how the workshop is conducted. Because the CFHMP will need to be adopted by the applicable decision-making entity (such as a County Council/Board of Commissioners or City Council), local public engagement requirements should be considered.

Guidance

A public workshop to present the analysis of alternative measures and solicit the public's opinion is an effective way to incorporate public participation for three reasons. First, it provides the planning team the opportunity to increase public awareness about flood and erosion hazards, present the results of the technical evaluation, and to answer questions. Second, it allows the public the opportunity to compare all alternatives. It is easier for public participants to deliver informed input when they are represented clear choices with the implications of each choice. Finally, it is an opportune time to reaffirm the commitment to the public involvement because it demonstrates that the public goals and objectives developed earlier are incorporated into the decision-making process. The workshop should be well publicized to ensure that all members of the community are invited to participate.

While the focus of the public workshop should be on potential strategies and measures, it is also an opportunity to provide information about climate change. If the presentation includes a discussion of the need for flood hazard planning, climate change information should be included. If your workshop has an open house format, consider setting up a station with climate change information and an informed team member who can answer questions. Provide resources, such as copies of reports that members of the public can read or review during the meeting, or factsheets that summarize key information and point to additional resources. The goal of including climate information in the public meeting is to: (1) provide additional information for those who are curious to learn more; and (2) explain the considerations (in this case, climate change considerations) that went into the development and analysis of strategies and measures.

Many approaches can be used to structure a public workshop, and the format should be chosen based on what works for your community. A workshop can be structured around a presentation followed by the opportunity to make formal comments, or by a more informal question and answer session. Alternately, the workshop could be structured as an open house with information stations and with planning team members available to answer questions and take comments one-on-one. The best approach is often to do both—hold an open house with a scheduled presentation in the middle, and provide many ways for the public to provide comments: signing up to give a spoken comment, giving a spoken comment to a court reporter in an adjacent room, filling out and submitting a comment form, and taking a handout with a web address, email address, and mailing address to submit a comment later. Based on the demographics of your community and your floodplain area (as discussed in Steps 2 and 4), consider having interpreters at the workshop and otherwise accommodating your community. Depending on the size of your planning area, you should consider holding multiple workshops in different geographic areas to make it easy for members of the community to participate. The meeting design needs to be inclusive of all members of the community who may be affected by flood hazards; see Step 2 for more guidance on inclusive public involvement.

An in-person workshop is recommended. However, it may be necessary or preferred to conduct the meeting virtually. If a meeting is held virtually, be cognizant that not all members of your community will be able to access the meeting, and consider direct outreach to gain additional input. It is recommended that both in-person and virtual/online options be provided when possible for increased access and participation.

In-person public workshops should be held at locations that are transit and Americans with Disabilities Act (ADA) accessible. Depending on the demographics of the population affected by flood hazards in your community, you should consider having translated outreach materials and interpreters present at the workshop.

If a formal SEPA checklist or EIS process is used in the planning process, it may be advantageous to hold two public workshops during the alternative evaluation. During the first workshop, the planning team would just present the alternative measures and ask the participants what potential impacts or consideration they feel should be considered. This workshop would then serve as a "scoping meeting" within the EIS process. The second workshop, held after evaluation analysis is underway, would then allow participants to evaluate the alternatives and indicate their preferences.

Integrated Floodplain Management

In addition to reaching a broad range of the public, your public workshop should reach key audiences for the interests that you are integrating as part of your CFHMP update. For example, if your IFM effort includes agriculture and recreation, you will want to reach individual farmers and recreational users. This may require holding multiple meetings to reach multiple audiences. If your meeting needs to reach farmers, it likely makes sense to hold meetings in the rural areas of your jurisdiction so it is easy for farmers to attend. However, if you also need to reach vulnerable communities in urban floodplain areas, you would want to hold a separate meeting in a convenient location for that audience. For meetings intended to reach farmers, you should consider the timing of the meeting to avoid the growing season if possible. Ideally, the meeting would be held in the winter.

Step 10: Develop Strategy and Implementation Approaches for Flood Hazard Management

Minimum Requirements

WAC 173-145-040 Comprehensive Flood Control Management Plan (CFCMP) states that a CFHMP must include a “Conclusion and proposed solution(s),” including:

- Recommended corrective action with proposed impact resolution measures for resource losses.
- Corrective action priority.

Guidance

After the public input has been integrated and alternatives evaluation completed, the project team will develop the flood hazard management strategy, with implementation approaches, that will serve as the basis for the CFHMP. The strategy should include a list of actions; the priority, cost, and timeframe for each; and the coordination activities with adjacent governments, related agencies, and associated programs. There should be a capital and non-capital component to this strategy.

Other recommended elements of the Strategy and Implementation section of the CFHMP include the following:

- **Identification of implementation roles or governance structure.** Many counties now have flood control zone districts, authorized under Chapter 86.15 RCW, that oversee flood hazard management that is largely implemented by county staff. An example of an interjurisdictional organization providing flood damage reduction services for an entire basin is the Chehalis River Basin Flood Authority, which was formed through interlocal agreements. The CFHMP should be clear about who is responsible for each action.
- **Funding strategy.** Common funding sources include flood control zone assessments and grant funding (such as Floodplains by Design or FEMA). Note that jurisdictions are required to have an adopted multi-hazard mitigation plan to access FEMA mitigation grant programs. Other potential funding sources are the Corps’ Planning Assistance to States (PAS) program, 1135 programs, etc.
- **Adaptive management.** Conditions change with time, including physical conditions (e.g., an avulsion causes an immediate change to the river channel location), social conditions (e.g., a jurisdiction may shift to an integrated floodplain management approach as issues and participation interest increase), new science or planning tools incorporating climate projections, or funding conditions as new or different funding sources are created. In addition, a jurisdiction may find some flood damage reduction strategies more effective than others. Most CFHMPs include a periodic update cycle; 5 years is a typical timeframe to review and update the plan.
- **Climate change.** The Strategy and Implementation section should also consider climate change. How will you update the CFHMP as new climate projections or models become available? How will strategies and measures be updated if climate conditions change more quickly or differently than anticipated? Are there key thresholds that should trigger new planning and/or reconsiderations of strategies and measures?
- **Coordination and partnerships.** It is rare for a jurisdiction to be so isolated as to not need to coordinate or collaborate with neighboring jurisdictions, Tribes, and stakeholder

organizations. These should be identified in the CFHMP so that nurturing these relationships is resourced and prioritized.

- **Letters of concurrence or commitment.** Signing letters of concurrence or commitment to certain courses of action can ensure that plan elements are implemented as intended.

Other Programs

Community Rating System

Step 10 of Activity 512 (floodplain management planning) is “Implement, evaluate, and revise.” This step discusses activities that happen after the adoption of the flood plan; this guidebook for development of CFHMPs does not include guidance after the adoption of the CFHMP. However, this step of the CFHMP guidance includes development of an implementation approach; that implementation approach can include a discussion of implementation, evaluation, and revision in line with Step 10 of the CRS activity.

This step provides credit for the following actions:

- Having procedures for monitoring implementation, reviewing progress, and recommending revisions to the plan in an annual evaluation report. The report must be submitted to the governing body, released to the media, and made available to the public.
- Having the annual evaluation report prepared by the same planning committee that prepared the plan or by a successor committee with a similar membership. The more frequently the committee meets, the more CRS points are rewarded (up to meeting quarterly).

Step 10 states that the community must update its plan at least every 5 years.

Additional detail for Step 10 starts on page 510-25 of the Coordinator’s Manual (2017).

Hazard Mitigation Plans

Task 6 of the Local Hazard Mitigation Planning Handbook is to Develop a Mitigation Strategy.

Integrated Floodplain Management

Ideally, an IFM package of projects will be implemented by a variety of partners, not just the jurisdiction responsible for completion of the CFHMP. Therefore, IFM partners should be involved in the development of the Strategy and Implementation section. What role will partners play in implementation? Will they contribute to funding actions?

For adaptive management, consider a collaborative tracking system, as described in the IFM checklist in Section 4.3. One example of a tracking program for IFM is the Puyallup Watershed Floodplains for the Future Shared Monitoring Program: <https://floodplainsforthefuture.org/>.

Step 11: Complete Draft CFHMP and SEPA Documentation

Minimum Requirements

WAC 173-145-040 Comprehensive Flood Control Management Plan (CFCMP) states that a CFHMP must include: “A certification from the state department of community, trade, and economic development that the local emergency management organization is administering an acceptable comprehensive emergency operations plan.”

Adoption of the CFHMP is subject to review under the State Environmental Policy Act (SEPA) – Chapter 43.21C RCW and Chapter 197-11 WAC. Each jurisdiction has its own SEPA policies and procedures that need to be followed.

Guidance

Once the overall management strategy is determined, the plan’s recommendations and supporting information must be compiled into a draft plan for review. Example outlines for a CFHMP are included in Chapter 3. The most prominent element, of course, should be the recommended actions in the selected alternative(s), along with their time frame, participants, impact mitigation measures, costs, and funding sources. The recommendations should also indicate priorities for the various actions.

Also, completing the draft State Environmental Policy Act (SEPA) assessment (draft EIS or environmental checklist) at this time is also useful, so that the two documents can be distributed and reviewed together. The draft CFHMP and SEPA documentation should be distributed to agencies and special interest groups who have participated in the planning process and the public for review. Comments received on draft plans should be incorporated into the final plan and SEPA documentation.

In addition to advisory committee meeting(s) to review the plan, a public workshop may be advisable at this point to present the plan and solicit comment. The plan must also include certification from the Washington State Emergency Management Division that the local emergency management organization is administering an acceptable comprehensive emergency plan. Once these steps have been taken, a PDF and one printed copy of the draft plan and the SEPA documentation should be submitted to Ecology. Ecology staff will disseminate the plan for review by other Ecology sections as well as consult with WDFW, the Department of Natural Resources, and affected Native American Tribes. Other affected parties may comment on the draft plans as well (WAC 173-145-070(2)). Ecology staff will consolidate review comments and arrange a meeting with the submitting government to discuss the submittal. After receiving the review comments, it is recommended that the grantee write a letter to Ecology indicating how they will respond to the comments. Once Ecology and the local jurisdiction are in agreement on the proposed plan revisions, the local planning staff and/or consultant should revise the draft into the final CFHMP and submit to Ecology (Step 12).

Other Programs

Community Rating System

Step 8 of Activity 512 (floodplain management planning) is “Draft an action plan.” This step provides credit for the following actions:

- Identifying, for each recommendation, who is responsible for implementing the action, when it will be done, and how it will be funded.
- Prioritizing actions.
- Establishing or revising post-disaster redevelopment mitigation policies and procedures.

Additional detail for Step 7 starts on page 510-22 of the Coordinator’s Manual (2017).

Step 12: Submit Final CFHMP to Department of Ecology

Minimum Requirements

WAC 173-145-040 Comprehensive Flood Control Management Plan (CFCMP) states:
“Comprehensive flood control management plans, and any revisions to the plans, must be approved by ecology, in consultation with the department of fish and wildlife.”

Guidance

CFHMPs funded by the FCAAP program need to be submitted for approval by Ecology. After comments from the public and regulatory agencies have been incorporated into the final plan and SEPA documentation, the plan is ready for submittal to Ecology. A PDF and one printed copy of the plan should be submitted to the Shorelands & Environmental Assistance Program. A copy of the SEPA documentation should also be submitted.

Staff from Ecology’s FCAAP program will review the plan for conformance to WAC- 173-145-040 and the grant agreement scope of work. If all review comments on the draft plan have been adequately addressed and the final CFHMP is in compliance with state statutes and grant agreement, Ecology will approve the plan, in consultation with WDFW.

If a CFHMP has not been funded by FCAAP but instead by other funding sources (such as an FCZD), it does not need to be approved by Ecology. However, at your request, Ecology can review the CFHMP and send a letter stating that it meets the requirements of state statutes. Ecology’s approval of a CFHMP is recommended, regardless of whether it was funded by FCAAP, in order to ensure that actions included in the plan are eligible for Ecology funding.

Step 13: Hold Public Hearing and Adopt the CFHMP

Minimum Requirements

The public hearing and CFHMP adoption will need to follow local decision-making requirements.

Guidance

After the CFHMP has been approved by Ecology, it should be presented to the adopting governmental body at a public hearing, along with the advisory committee's recommendation for adoption. Where a plan encompasses more than one participating governmental jurisdiction (e.g., county and a city within the county), both governments should adopt the plan. If there is a dispute, it must be resolved in accordance with RCW 86.12.210.

Other Programs

Community Rating System

Step 2 of Activity 512 (floodplain management planning) is “Involve the public.” This step provides credit for conducting one or more public meetings to obtain input on the recommended plan at the end of the planning process, at least 2 weeks before submittal of the recommended plan to the community’s governing body. The Coordinator’s Manual states: “*Simply discussing the plan at a regular public meeting of the governing body, just before it is voted on, is not sufficient public input for CRS credit.*” Additional detail for Step 2 starts on page 510-8 of the Coordinator’s Manual (2017).

Step 9 of Activity 512 (floodplain management planning) is “Adopt the plan.” This step provides credit if the plan is officially adopted by the community’s governing body as an official plan of the community, not as an internal staff proposal. “Adopted” means that there is a resolution or other formal document that is voted on by the community’s governing body. Additional detail for Step 9 is on page 510-25 of the Coordinator’s Manual (2017).

Hazard Mitigation Plans

Task 8 of the Local Hazard Mitigation Planning Handbook is to Review and Adopt the Plan.

Integrated Floodplain Management

Consider the same guidance provided for IFM for Step 9.

Step 14: Notify Ecology that the Final CFHMP is Adopted

Minimum Requirements

Once the plan is adopted, a letter should be sent to Ecology formally notifying them that the CFHMP is adopted.

CHAPTER 8: REFERENCES

- Abbe, T.B., and D.R. Montgomery. 1996. Large Woody Debris Jams, Channel Hydraulics and Habitat Formation in Large Rivers. *Regulated Rivers: Research & Management*, 12(2-3), 201-221. doi:10.1002/(SICI)1099-1646(199603)12:2/3<201:AID-RRR390>3.0.CO;2-A.
- ASFPM (Association of State Floodplain Managers). 2003. *No Adverse Impact: A Toolkit for Common Sense Floodplain Management*.
- ASFPM (Association of State Floodplain Managers). 2016. ASFPM Riverine Erosion Hazards White Paper.
- Booth, D.B., K.G. Troost, J.J. Clague, and R.B. Waitt. 2004. The Cordilleran ice sheet. *The Quaternary Period in the United States*, 1, 17-43.
- Borga, M., M. Stoffel, L. Marchi, F. Marra, and M. Jakob. 2014. Hydrogeomorphic response to extreme rainfall in headwater systems: Flash floods and debris flows. *Journal of Hydrology*, 518, 194-205. doi:10.1016/j.jhydrol.2014.05.022.
- Collins, Brian. 1997. Effects of Land Use on the Stillaguamish River, Washington, ~1870 to ~1990: Implications for Salmonid Habitat and Water Quality and their Restoration. Report to: Stillaguamish Tribe of Indians Department of Natural Resources.
- Church, M. 2006. Bed Material Transport and the Morphology of Alluvial River Channels. *Annual Review of Earth and Planetary Sciences*, 34(1), 325-354. doi:10.1146/annurev.earth.33.092203.122721.
- Collins, B.D., and D.R. Montgomery. 2011. The legacy of Pleistocene glaciation and the organization of lowland alluvial process domains in the Puget Sound region. *Geomorphology*, 126(1-2), 174-185. doi:10.1016/j.geomorph.2010.11.002.
- Colorado Water Conservation Board. 2020. Colorado Fluvial Hazard Zone Delineation Protocol Public Review Draft.
- Czuba, Jonathan A., Christiana R. Czuba, Christopher S. Magirl, and Frank D. Voss. 2020. *Channel-conveyance capacity, channel change, and sediment transport in the lower Puyallup, White, and Carbon Rivers, western Washington*. United State Geological Survey. Prepared in cooperation with Pierce County Public Works and Utilities, Surface Water Management. Scientific Investigations Report 2010-5240.
- Delegates to the First National People of Color Environmental Leadership Summit. 1991. The Principles of Environmental Justice (EJ). Available online at <https://www.nrdc.org/sites/default/files/ej-principles.pdf>.
- Ecology (Washington State Department of Ecology). 1991. Comprehensive Planning for Flood Hazard Management. Publication #91-44.
- Ecology (Washington State Department of Ecology). 2019. Floodplains by Design Grants Funding Guidelines 2021-2023. Publication #19-06-011. Available online at: <https://apps.ecology.wa.gov/publications/documents/1906011.pdf>.

- Ecology (Washington State Department of Ecology). 2021. Floods & floodplain planning. Available online at: <https://ecology.wa.gov/Water-Shorelines/Shoreline-coastal-management/Hazards/Floods-floodplain-planning>. Accessed on March 30, 2021.
- EMD (Washington Emergency Management Division). 2018. Washington State Enhanced Hazard Mitigation Plan. Effective 2018-2023. Approved 10/1/2018. Prepared by the Washington Emergency Management Division.
- Environmental Justice Task Force. 2020. Recommendations for Prioritizing EJ in Washington State Government. Report to the Washington State Governor and Legislature. Fall 2020.
- EPA (Environmental Protection Agency). 2021. Summary of the Endangered Species Act. Available at: <https://www.epa.gov/laws-regulations/summary-endangered-species-act>. Accessed on April 5, 2021.
- FEMA (Federal Emergency Management Agency). 2013. Local Mitigation Planning Handbook. Available online at: https://www.fema.gov/sites/default/files/2020-06/fema-local-mitigation-planning-handbook_03-2013.pdf.
- FEMA (Federal Emergency Management Agency). 2017. National Flood Insurance Program Community Rating System Coordinator’s Manual. FIA-15/2017. Available online at: https://www.fema.gov/sites/default/files/documents/fema_community-rating-system_coordinators-manual_2017.pdf.
- FEMA (Federal Emergency Management Agency). 2021. National Flood Insurance Program Community Rating System. Available online at: <https://www.fema.gov/floodplain-management/community-rating-system>. Accessed on April 5, 2021.
- Floodplains by Design. 2016. Advancing Integrated Floodplain Management at the Local Level. [online] Available from: <http://www.floodplainsbydesign.org/work/>.
- Floodplains by Design. 2018. *Floodplains by Design: Toward a New Paradigm: Integrated Floodplain Management Status Report*.
- Forest Practices Board. 2004. Forest Practices Board Manual: Section 2 Standard Methods For Identifying Bankfull Channel Features and Channel Migration Zones. [online] Available from: http://www.dnr.wa.gov/Publications/fp_board_manual_section02.pdf. Accessed 12 May 2015.
- Frank Jr., Billy. 2011. “Every Bit of Habitat is Important.” Northwest Treaty Tribes. September 6, 2011. Available online at: <https://nwtreatytribes.org/every-bit-of-habitat-is-important/>. Accessed on March 23, 2021.
- Hall, Jason E., Correigh M. Greene, Oleksandr Stefankiv, Joseph H. Anderson, Britta Timpane-Padgham, Timothy J. Beechie, and George R. Pess. 2018. Large river habitat complexity and productivity of Puget Sound Chinook salmon. PLoS ONE 13(11): e0205127. <https://doi.org/10.1371/journal.pone.0205127>.
- Jackson, L.E., R.A. Kostaschuk, and G.M. MacDonald. 1987. Identification of debris flow hazard on alluvial fans in the Canadian Rocky Mountains. Reviews in Engineering Geology (pp. 115–124). Geological Society of America [online] Available from:

- <https://pubs.geoscienceworld.org/books/book/790/chapter/4806751/>. Accessed 21 October 2020.
- Jakob, M., J.J. Clague, and M. Church. 2015. Rare and dangerous: Recognizing extra-ordinary events in stream channels. *Canadian Water Resources Journal / Revue canadienne des ressources hydriques*, 1–13. doi:10.1080/07011784.2015.1028451.
- Jones, J.L. 2006. Side channel mapping and fish habitat suitability analysis using LIDAR topography and orthophotography. *Photogrammetric Engineering and Remote Sensing*, 72(11), 1202.
- Kline, M., and K. Dolan. 2008. River Corridor Protection Guide. River Management Program Vermont Agency of Natural Resources. 25 pp. [online] Available from: <https://anr.vermont.gov/sites/anr/files/co/planning/documents/guidance/River%20Corridor%20Protection%20Guide.pdf>.
- Latterell, J.J., J. Scott Bechtold, T.C. O'keefe, R. Van Pelt, and R.J. Naiman. 2006. Dynamic patch mosaics and channel movement in an unconfined river valley of the Olympic Mountains. *Freshwater Biology*, 51(3), 523–544. doi:10.1111/j.1365-2427.2006.01513.x.
- Legg, N.T., and P.L. Olson. 2014. Channel Migration Processes and Patterns in Western Washington: A Synthesis for Floodplain Management and Restoration (14-06–028). Washington Department of Ecology Shorelands & Environmental Assistance.
- Mauger, G.S., J.H. Casola, H.A. Morgan, R.L. Strauch, B. Jones, B. Curry, T.M. Busch Isaksen, L. Whitely Binder, M.B. Krosby, and A.K. Snover. 2015. *State of Knowledge: Climate Change in Puget Sound*. Report prepared for the Puget Sound Partnership and the National Oceanic and Atmospheric Administration. Climate Impacts Group, University of Washington, Seattle. doi:10.7915/CIG93777D.
- Melton, M.A. 1957. An analysis of the relations among elements of climate, surface properties, and geomorphology. Columbia Univ., New York.
- Montgomery, D.R. 1999. Process Domains and the River Continuum¹. *JAWRA Journal of the American Water Resources Association*, 35(2), 397–410. doi:10.1111/j.1752-1688.1999.tb03598.x.
- NMFS (National Marine Fisheries Service). 2007. Puget Sound Salmon Recovery Plan. Adopted by NMFS on January 19, 2007. Submitted by the Shared Strategy Development Committee.
- NMFS (National Marine Fisheries Service). 2008. Anadromous Salmonid Passage Facility Design. National Marine Fisheries Service, Northwest Region. [online] Available from: 2008 - repository.library.noaa.gov.
- Northwest Treaty Tribes. 2016. Climate Change and Our Natural Resources: A Report from the Treaty Tribes in Western Washington. [online]. Available from: <https://nwtreatytribes.org/climatechange/>.
- NWIFC (Northwest Indian Fisheries Commission). 2014. Understanding Tribal Treaty Rights in Western Washington. Available online at: <http://nwifc.org/w/wp-content/uploads/downloads/2014/10/understanding-treaty-rights-final.pdf>.

- NWIFC (Northwest Indian Fisheries Commission). 2020. State of Our Watersheds Report. Olympia, Washington, USA. [online] URL: <http://maps.nwifc.org/sow2020>.
- Olson, P.L., N.T. Legg, T.B. Abbe, M.A. Reinhart, and J.K. Radloff. 2014. A Methodology for Delineating Planning-Level Channel Migration Zones (14-06-025). Washington Department of Ecology Shorelands & Environmental Assistance, Olympia, WA. [online] Available from: <https://fortress.wa.gov/ecy/publications/SummaryPages/1406025.html>.
- Pierce County Planning and Public Works Surface Water Management. 2021. Comprehensive Flood Hazard Management Plan. [online] Available online at: <https://www.piercecountywa.gov/7037/2023-Comprehensive-Flood-Plan>.
- Poff, N. LeRoy, J. David Allan, Mark B. Bain, James R. Karr, Karen L. Prestegard, Brian D. Richter, Richard E. Sparks, and Julie C. Stromberg. 1997. "The Natural Flow Regime: A paradigm for river conservation and restoration." *BioScience* Vol. 47 No. 11. December 1997.
- Pollack, Michael M., George R. Pess, Timothy J. Beechie, and David R. Montgomery. 2004. The Importance of Beaver Ponds to Coho Salmon Production in the Stillaguamish River Basin, Washington, USA. *North American Journal of Fisheries Management* 24:749–760, 2004.
- Rapp, C., and T.B. Abbe. 2003. A Framework for Delineating Channel Migration Zones (#03-06-027). Ecology Publication. Washington State Department of Transportation and Washington State Department of Ecology.
- Sherwin, Brie. 2019. After the Storm: The Importance of Acknowledging Environmental Justice in Sustainable Development and Disaster Preparedness. *Duke Environmental Law & Policy Forum*, Vol. XXXIX:273.
- Swain, D.L., O.E.J. Wing, P.D. Bates, J.M. Done, K.A. Johnson, and D.R. Cameron. 2020. Increased flood exposure due to climate change and population growth in the United States. *Earth's Future*, 8, e2020EF00177 8. <https://doi.org/10.1029/2020EF001778>.
- Treaty Indian Tribes in Western Washington. 2011. Treaty Rights at Risk. Ongoing Habitat Loss, the Decline of the Salmon Resource, and Recommendations for Change [online, website]. Available from: <https://treatyrightsatrisk.org/#:~:text=As%20the%20salmon%20disappear%2C%20so%20do%20our%20tribal,tribal%20treaty%20rights%20and%20recovery%20of%20salmon%20habitat>. Accessed in 2021.
- USFWS (U.S. Fish and Wildlife Service). 2021. Endangered Species Act Overview. Available online at: <https://www.fws.gov/endangered/laws-policies/>. Accessed on April 5, 2021.
- Wartman, J., D.R. Montgomery, S.A. Anderson, J.R. Keaton, J. Benoît, J. dela Chapelle, and R. Gilbert. 2016. The 22 March 2014 Oso landslide, Washington, USA. *Geomorphology*, 253, 275–288.
- Washington State Aquatic Habitat Guidelines Program. 2003. *Integrated Streambank Protection Guidelines*.
- Wilford, D.J., M.E. Sakals, J.L. Innes, R.C. Sidle, and W.A. Bergerud. 2004. Recognition of debris flow, debris flood and flood hazard through watershed morphometrics. *Landslides*, 1(1), 61–66. doi:10.1007/s10346-003-0002-0.

Yakima County. 2005. Naches River Comprehensive Flood Hazard Management Plan. October 2003.
Updated February 2005.

APPENDIX A: REGULATORY PROGRAMS

Introduction

Federal, state, and local regulatory programs directly affect flood hazard management. To sort out the numerous jurisdictions with a role in flood hazard management, this appendix has grouped the many regulations into five major types listed below.

1. Endangered Species Protection
2. Land Use Management
3. Resource Management
4. Environmental Management
5. Flood Hazard Management

The regulatory context is summarized below for each of these types, with a focus on how they relate to a Comprehensive Flood Hazard Management Plan (CFHMP).

Flood Hazard Management

This section identifies the policies and programs directly related to flood hazard management and the protection of life and property. A primary regulatory tool is the National Flood Insurance Program (NFIP), which provides low-cost insurance to communities that have adopted approved floodplain management regulations.

National Flood Insurance Program

The U.S. Congress initiated the National Flood Insurance Program (NFIP) in 1968 for the purpose of relieving the national treasury and local jurisdictions from the burden of disaster relief. The thrust of the program is to make affordable flood insurance available to property owners in participating communities. To qualify, the community must adopt approved floodplain management regulations for development occurring in special flood hazard areas (SFHA), which are the areas inundated by the 1% annual-chance flood (100-year flood). In 1973, Congress expanded the NFIP to require that funding for structures related to government programs within the SFHA be permitted only if the structure is covered under a flood insurance policy and the community participates in the NFIP. The NFIP is administered by FEMA who, in collaboration with state partners, provides oversight and technical support to local NFIP communities.

A community must be enrolled in the NFIP for residents in the community to be eligible to purchase NFIP flood insurance policies. To enroll in the NFIP, a community must adopt and enforce floodplain regulations that meet or exceed the NFIP's minimum criteria as well as any higher standards required by the state. Washington State requirements for floodplain management ordinances, as well as the authorities and responsibilities of the Department of Ecology in administering the NFIP at the state level, are contained in Chapter 86.16 RCW.

FEMA prepares floodplain maps and data for communities enrolled in the NFIP. The floodplain maps, known as Flood Insurance Rate Maps (FIRMs), and the Flood Insurance Studies (FIS) that produce them, are used as the basis for regulating development in the SFHA. FIRMs show riverine, coastal, and shallow floodplain areas, all of which must be regulated in compliance with the local floodplain management ordinance. For riverine areas, the FIRMs identify the zones of the SFHA and, if applicable, the floodway. The floodway identifies the area where any encroachment by development

is likely to increase flood elevations and worsen flood conditions. Any development proposals in the floodway (including flood hazard management measures and habitat restoration projects) require hydrologic and hydraulic analyses to determine any potential impacts to flood elevations or to the boundaries of the SFHA. Communities are required to update their FIRMs whenever any proposed development would change the flood risk depicted on the map, which may be true for many flood hazard management measures. This can be accomplished through the Letter of Map Revision (LOMR) process.

All communities have the authority and responsibility to manage development in their floodplain. FEMA's definition of development is any man-made change to improved or unimproved real estate, including buildings or other structures, mining, dredging, filling, grading, paving, excavation or drilling operations, or storage of equipment or materials. All development in the floodplain requires local review and permitting, and communities must enforce compliance with the local floodplain management ordinance and NFIP minimum requirements or they will risk their enrollment in the NFIP.

The primary focus of the NFIP regulations is to require buildings that are built in the floodplain to be designed to standards calculated to minimize potential flood damage. The minimum NFIP regulations do not prohibit development in the floodplain. In addition to building standards, the NFIP regulations also have minimum standards to address watercourse alterations, subdivisions, and floodway development.

State Floodplain Management

Chapter 86.16 RCW - Floodplain Management forms the core of the state's regulatory program. WAC 173-158 includes the rules developed by Ecology to administer the provisions of Chapter 86.16 RCW. The state's regulatory program has adopted the NFIP minimum standards as the state minimum standards for floodplain management. Washington exceeds the minimum federal standards in one area - Chapter 86.16 RCW - which has a provision prohibiting new or substantially improved residential development in any designated floodway. Other provisions of the state's program include technical assistance to localities in determining floodplain boundaries, the ability to assist localities in the development of additional standards that exceed the minimum federal requirements, and the responsibility to enforce compliance of these regulations and assist communities in handling violations when requested.

The Washington Growth Management Act (Chapter 36.70A RCW) includes Frequently Flooded Areas as critical areas. WAC 365-190-110(1) provides that frequently flooded areas should include, at a minimum, the 100-year flood plain designations of the Federal Emergency Management Agency and the National Flood Insurance Program.

WAC 365-190-110(2) provides that counties and cities should consider the following when designating and classifying frequently flooded areas:

- (a) Effects of flooding on human health and safety, and to public facilities and services;
- (b) Available documentation including federal, state, and local laws, regulations, and programs, local studies and maps, and federal flood insurance programs, including the provisions for urban growth areas in RCW 36.70A.110;
- (c) The future flow flood plain, defined as the channel of the stream and that portion of the adjoining flood plain that is necessary to contain and discharge the base flood flow at build out;
- (d) The potential effects of tsunamis, high tides with strong winds, sea level rise, and extreme weather events, including those potentially resulting from global climate change;
- (e) Greater surface runoff caused by increasing impervious surfaces.

Endangered Species Protection

Endangered Species Act

The U.S. Environmental Protection Agency (EPA) Summary of the Endangered Species Act (16 U.S.C. §1531 et seq.) states:

The Endangered Species Act (ESA) provides a program for the conservation of threatened and endangered plants and animals and the habitats in which they are found. The lead federal agencies for implementing ESA are

- U.S. Fish and Wildlife Service (USFWS), which maintains a [worldwide list of endangered species](#). Species include birds, insects, fish, reptiles, mammals, crustaceans, flowers, grasses, and trees.
- U.S. National Oceanic and Atmospheric Administration (NOAA) Fisheries Service (EPA, 2021).

The U.S. Fish and Wildlife Service (USFWS) Endangered Species Act Overview states:

When Congress passed the Endangered Species Act (ESA) in 1973, it recognized that our rich natural heritage is of "esthetic, ecological, educational, recreational, and scientific value to our Nation and its people." It further expressed concern that many of our nation's native plants and animals were in danger of becoming extinct.

The purpose of the ESA is to protect and recover imperiled species and the ecosystems upon which they depend. It is administered by the U.S. Fish and Wildlife Service (Service) and the Commerce Department's National Marine Fisheries Service (NMFS). The Service has primary responsibility for terrestrial and freshwater organisms, while the responsibilities of NMFS are mainly marine wildlife such as whales and anadromous fish such as salmon.

Under the ESA, species may be listed as either endangered or threatened. "Endangered" means a species is in danger of extinction throughout all or a significant portion of its range. "Threatened" means a species is likely to become endangered within the near future. All species of plants and animals, except pest insects, are eligible for listing as endangered or threatened. For the purposes of the ESA, Congress defined species to include subspecies, varieties, and, for vertebrates, distinct population segments (USFWS, 2021).

Salmonid Listings

A number of salmonid populations in Washington State are listed as either endangered or threatened. The populations are listed below by their salmon recovery region. All populations are listed as threatened with two exceptions; the Snake River Sockeye and Lower Columbia River Chum are listed as endangered.

- Snake River:
 - Snake River Sockeye
 - Snake River Spring/Summer Chinook
 - Snake River Fall Chinook
 - Snake River Basin Steelhead
- Upper Columbia
 - Upper Columbia River Spring Chinook

- Upper Columbia River Steelhead
- Middle Columbia
 - Middle Columbia River Steelhead
- Lower Columbia
 - Lower Columbia River Chum
 - Lower Columbia River Coho
 - Lower Columbia River Chinook
 - Lower Columbia River Steelhead
- Hood Canal
 - Hood Canal Summer Chum
- Puget Sound
 - Puget Sound Chinook
 - Puget Sound Steelhead
- Coastal
 - Ozette Lake Sockeye

Bull trout are also listed as threatened throughout Washington State.

The listing of these species has major ramifications for floodplain management in these regions, as floodplains are important habitats for salmonids.

In 2007, NMFS adopted the Puget Sound Salmon Recovery Plan (NMFS, 2007). The Plan includes a vision and goals, a description of the status of threatened species, watershed profiles, regional salmon recovery strategies, an adaptive management plan, and sections on financing and implementation. Volume II of the Salmon Recovery Plan includes individual plans for Puget Sound watersheds. Many watersheds have updated or are currently updating their salmon recovery plans and strategies.

NMFS Biological Opinion on the National Flood Insurance Program

On September 22, 2008, NMFS issued a Biological Opinion that required changes to the implementation of the National Flood Insurance Program in order to meet the requirements of the ESA in the Puget Sound watershed. The transmittal letter for the Biological Opinion stated:

As required under the Endangered Species Act for consultations concluding with Jeopardy and Adverse Modification determinations, the National Marine Fisheries Service discussed with the Federal Emergency Management Agency, the availability of a reasonable and prudent alternative that the Federal Emergency Management Agency can take to avoid violation of the Federal Emergency Management Agency's Endangered Species Act section 7(a) (2) responsibilities (50 CFR 402.14(g) (5)). Reasonable and prudent alternatives refer to alternative actions identified during formal consultation that 1) can be implemented in a manner consistent with the intended purpose of the action, 2) that can be implemented consistent with the scope of the Federal agency's legal authority and jurisdiction, 3) that is economically and technologically feasible, and 4) that the Director believes would avoid the likelihood of jeopardizing the continued existence of listed species or resulting in the destruction or adverse modification of critical habitat (50 CFR 402.02) The biological opinion includes a reasonable and prudent alternative which can be implemented to avoid jeopardy and adverse modification of critical habitat, while meeting each of the other requirements listed above.

The Biological Opinion Reasonable and Prudent Alternative (RPA) include seven elements, and RPA Element 3 (Floodplain Management Criteria) is the most relevant to local floodplain management. FEMA provided local jurisdictions with three options for complying with the ESA and the Biological Opinion (BiOp):

1. Prohibit all development in the floodway and other areas as specified by the RPA.
2. Enact regulations that allow development that meet the criteria specified in the Biological Opinion by either:
 - a. Adopting the FEMA Region 10 Model Ordinance for Floodplain Management and the Endangered Species Act and the review and permitting procedures necessary to its administration, or
 - b. Enforcing the same requirements with the support of other ordinances, such as the growth management, zoning, or critical areas regulations.
3. Show compliance with ESA on a permit-by-permit basis.

Flood planning should consider the community's approach to BiOp compliance. Strategies and measures in the flood plan should be compatible with the BiOp and with the community's chosen approach.

Land Use Management

Land use management provides guidance for growth and development and the associated physical improvements that coincide with it. Both the State of Washington and federal agencies require counties to adopt specific regulations concerning land use issues and, as such, many of the county regulations are similar. Within most cities/counties, development regulations include a comprehensive plan, zoning ordinance, building code, subdivision ordinance, shoreline master program, and a floodplain management ordinance. The land use management regulations that affect flood hazard management plans are described briefly below.

Comprehensive Plan

The purpose of a city/county comprehensive plan is to give long-range direction and guidance for systematic growth and development. The plan should emphasize immediate local concerns, which can include land use, transportation, utilities, water resources, open space, environmentally sensitive areas, drainage, and others. Typically, these plans are non-regulatory, lacking the enforcement mechanisms to ensure compliance. Their purpose is to provide goals, objectives, and policy statements that are met through various ordinances set by the jurisdiction. In 1990, the State of Washington passed the Growth Management Act (GMA). The intent of the GMA is to manage growth in the state's fastest-growing counties through the adoption of local comprehensive land use plans and development regulations. Although comprehensive planning is a common tool used by many local governments, the legislature found that too often growth occurred in an uncoordinated and unplanned manner, lacking common goals that expressed the public's interest in conservation and wise use of lands. The citizenry of the state saw the effects of undirected growth as a threat to their quality of life. Growth without direction was seen as posing a threat to not only the environment, but to the sustainability of economic development across the state. The GMA attempts to bring consistency and coordination to long range planning by reforming the decision-making processes that have been often unpredictable and disjointed. The planning goals of the GMA range from economic land use issues such as urban growth, transportation, housing, economic development, and others to resource/environmental issues dealing with open space, conservation, and cultural resources. The resource/environmental planning goals specifically address critical areas (which include the following areas and ecosystems: wetlands, critical recharge areas affecting aquifers used

for potable water, fish and wildlife habitat, frequently flooded areas, and geologically hazardous areas), requiring affected counties to adopt development regulations that preclude land uses or development deemed incompatible with those critical areas. The protection given these critical areas is intended to cross over jurisdictional boundaries in a coordinated manner. At the comprehensive plan level, whether defined by the GMA or through a local effort, communities are able to set a direction for regulations. For example, some comprehensive plans identify special flood hazard areas and include a set of guidelines to direct growth within those areas. These areas are typically designated by the United States Department of Housing and Urban Development using maps developed by the Federal Emergency Management Agency (FEMA). Using the FEMA maps to designate special flood hazard areas in a comprehensive plan is one of several steps needed to be taken.

Zoning Ordinance

The purpose of a zoning ordinance is to implement the growth management policies of the comprehensive plan. Typically, the zoning code assigns use and density requirements that guide land use in either a city or county. The major tools are a zoning map that identifies specific land use zones, accompanied by a zoning code that defines each zone and provides specific regulations. Zoning codes have the ability to grant variance and conditional uses as well as enforce the code if they are not complied with. Land use zones are determined by environmental constraints and infrastructure. The availability of water, sewer, fire protection, and transportation sets limits to densities. Environmental constraints include geology, soils, slopes, drainage, earthquake potential, avalanche danger, flooding, as well as wildlife protection for fisheries and endangered species. Employing zoning regulations is a useful tool in flood hazard management. Zoning sets the density and standards of development and has the ability to direct growth in such a way as to minimize the impact on floodplains. Development diminishes the ability of soils to absorb precipitation and recharge groundwater. This removal of pervious soil increases the loads on drainage systems and elevates the frequency and extent of flooding. Similarly, development constructed on fill intended to withstand a 100-year storm reduces the floodplain's capacity to carry the increased flow by displacing volume. Setting zoning regulations that address the impacts of development assist in the management of floodplains. Some jurisdictions have prepared "unified development codes" (or land use codes) that contain a range of development regulations, regulating how land is subdivided, used, and developed. Other jurisdictions have separate titles of their codes for zoning, subdivision, and environmental regulations.

Building Code

Building codes are meant to regulate the safety and quality of a structure. The Uniform Building Code (UBC) is often used to set those standards. The building code is intended to be used in conjunction with other regulations such as the zoning ordinance. When used in consort with flood hazard management planning, the building code ensures proper floodproofing of new construction in flood hazard areas. The State Building Code (SBC) is the minimum construction requirement for the State of Washington and includes the 2018 International Existing Building Code, 2018 International Swimming Pool and Spa code, and 2009 ICC/ANSI A117.

Subdivision Ordinance

A Subdivision Ordinance prescribes procedures and conditions for dividing land into smaller parcels. The definition of a subdivision may vary among jurisdictions but is usually determined by some specified amount of parcels, usually five or more. Typically, subdivisions must conform to zoning regulations in effect at the time of the proposed subdivision. Subdivisions influence flood hazard management planning by their intrinsic nature of increasing density. Because they are tied to zoning, subdivision is often limited by environmental constraints, including flood hazards. The subdivision of

land into lots is governed in Washington State by [chapter 58.17 RCW](#) and by city and county ordinances adopted under that chapter's authority.

Washington State Shoreline Management Act

The purpose of the Washington State Shoreline Management Act (SMA) is to protect the public's interests in preserving natural resources such as water, fish, and wildlife, and their habitat by regulating public and private development in shoreline areas. Through an innovative administrative framework that involves joint state and local jurisdiction, the SMA provides an effective tool for protecting, utilizing, and enhancing shorelines within SMA jurisdiction. The Department of Ecology (Ecology) is the agency mandated to oversee the development of local Shoreline Master Programs and their subsequent implementation. The legal basis for SMA regulatory documents is through the Washington Administrative Code (Chapter 173-18, 20 and 22, 26, and 27). The WAC defines several shoreline designations including shorelines of statewide significance; provides guidance to both Ecology and local jurisdictions for developing procedures and rules for shoreline uses, activities, and modifications; establishes time lines for the development of local shoreline master programs; and identifies uses and activities generally exempt from certain shoreline permits. The SMA requires permits for any substantial development within the 200-foot shoreline jurisdiction. A substantial development is defined as any development where the total cost of fair market value exceeds certain cost thresholds, or any development that materially interferes with the normal public use of the water or shorelines of the state; except as specifically exempted pursuant to RCW 90.58.030(3)(e) and WAC 173-14-040. Permits can be issued on a "conditional use" or on a "variance" basis. Permits are issued through the local Shoreline Master Programs and are reviewed by Ecology.

The Shoreline Management Act and shoreline master programs are extremely useful in flood hazard management planning. The SMA requires local governments to define their shoreline jurisdictions along rivers in one of two ways:

- The area 200 feet from the ordinary high-water mark (OHWM) or floodway, whichever is greater, plus all wetlands in the 100-year floodplain associated with them; or
- All or any portion of the 100-year floodplain as long as it includes all of those areas falling within the area describe in option 1 above.

There are advantages to using the entire 100-year floodplain to define the shoreline jurisdiction. One advantage is that it accommodates the complete meandering river ecosystem so that changes in the riverbed itself will not affect jurisdictional boundaries. It also automatically places shoreline management protection on lands surrounding wetlands in the floodplain and allows more comprehensive shoreline management planning of the entire floodplain. This is a strong tool for flood hazard management planning, as well as shoreline management because it carries the legal and administrative status associated with a state regulation.

The SMA recognizes our state's shorelines as an important public natural resource that should be protected from degradation. The SMA authorizes local jurisdictions to develop local Shoreline Master Programs that reflect a community's goals and values in keeping with the SMA. The local regulations are used as an overlay to zoning and as such can guide future development within the floodplain and its watersheds.

Shoreline Master Program

Local governments develop Shoreline Master Programs (SMPs), guided by Ecology, the SMA, and the WACs pertaining to it as described above. As a regulatory tool, the SMP provides local government a strong means by which to manage the effects of development on shorelines, including floodplains. All streams with a mean annual flow of 20 cubic feet per second (cfs) or more, and associated

wetlands, are included within the shoreline management jurisdiction. Development can be regulated around these streams, reducing urban runoff effects by creating buffers, ensuring proper containment of runoff, and reducing density. Wetlands can be retained to perform one of their major functions: absorbing excess water and thereby reducing storm surge effects downstream. Upstream in watersheds, base flow can be increased by increasing vegetation in both forested wetlands and wet meadows. These habitats have a great capacity to absorb and retain water, reducing storm surges, and releasing water slowly during low-flow periods. Often times such systems fell under the jurisdiction of the SMA, providing the opportunity to manage the resource. The SMP is an excellent tool to use in consort with a flood hazard management plan because it directs land use and activities along shorelines, sets design criteria to ensure best management practices, and provides the enforcement mechanism that will be backed by Ecology.

Resource Management

The purpose of resource management is to preserve and protect our nation's natural resources from degradation. Resource management emphasizes sustainability of natural resources, and the industries based on their exploitation, as the timber, agricultural, and fisheries industries. To this end, resource conservation and best management practices of productive forest and agricultural lands, and habitats associated with fisheries are the direction that resource management regulations have taken. Various state and federal agencies are involved in resource management. All cities/counties must comply with these state and federal regulations depending on the type of project. Resource management regulations affecting flood hazard management include the Washington State Hydraulic Code (Hydraulic Code), Sections 404 and 401 of the Federal Clean Water Act, Section 10 of the Rivers and Harbor Act, and other local ordinances developed to reflect the needs of the particular community.

Hydraulic Code

The purpose of the Washington State Hydraulic Code, RCW 77.55, is to preserve fish and wildlife habitat by regulating activities within the state's salt and fresh waters. Any construction that will use, divert, obstruct, or change the natural flow or bedding of any of our state's waters within high water areas, including many wetlands, will require a Hydraulic Project Approval (HPA) permit. Such activities include, but are not limited to, streambank protection; dredging; culvert installation; pile driving; construction of bridges, piers, and docks; pond construction; log jam or debris removal; mineral prospecting and extraction; and alteration or realignment. Within the code, specific technical provisions for hydraulic projects are provided by WDFW. An application may be denied when the administering agency determines that the project will be directly or indirectly harmful to fish life and acceptable mitigation cannot be assured. The Hydraulic Code provides city/county jurisdictions a tool to ensure that no harm to fish and wildlife habitat will occur during the construction of any structural or bioengineering modifications of shorelines. The provision given to assist in the design and construction of shoreline modification structures can also be useful to evaluate proposed projects.

Section 404 - Clean Water Act

Section 404 of the Clean Water Act is one of three federal laws that expanded the regulatory authority of the U.S. Army Corps of Engineers (Corps) during the 1970s from regulating navigable waters of the United States to maintaining the biological integrity of the nation's waters. Section 404 is the most relevant to structural flood control measures; although Section 401 of the Clean Water Act ensures that federally, permitted activities comply with the federal Clean Water Act, state water quality laws, and any other appropriate state laws. Section 404 requires a Corps permit for any project that alters or degrades the waters of the United States, ranging from the open water disposal of dredge or fill material to the filling of nearshore areas. This includes adjacent wetlands and tributaries to navigable waters, and any degradation or destruction of which could affect interstate or

foreign commerce. Guidelines for permit approval have been developed by the EPA. There are two types of permits issued: an individual permit and a general, or nationwide, permit. The following details each.

1. **Individual Permit** - This permit is generally issued for a single proposed activity, unless it falls under a blanket authorization for a general permit or if the project involves an especially valuable ecological area, such as a wetland. The determination is based on whether the benefits of the project outweigh the predicted environmental impacts. Known as public interest review, the evaluation process entails:
 - Pre-application meeting with the Corps and other resource agencies (optional).
 - Submittal of a permit application to the Corps.
 - Public notice for a 30-day review period by federal, state, and local permitting agencies, Tribes, interest groups, and the general public.
 - Consideration of all comments received from public review process.
 - Additional information from the applicant may be required.
 - The Corps decides on whether to prepare an Environmental Assessment and Finding of No Significance, or to prepare a National Environmental Policy Act (NEPA) Environmental Impact Statement (EIS).
 - Public hearing is held, if needed.
 - The Corps prepares the appropriate decision documentation.
 - The District Engineer approves or rejects the permit application.
 - The applicant's permit is advised of the decision.

2. **General Permit** - The General Permit, also called the Nationwide Permit 26, provides blanket authorization on a nationwide, state, or regional level for actions that have minimal adverse impacts on the environment. Such actions would include, but are not limited to, bank stabilization projects, navigation markers, utility line structures, minor road crossings and bridges, boat docks, minor dredge, and fills involving less than 10 cubic yards, or fills involving 1 to 10 acres of isolated wetland or adjacent wetlands located above the headwaters of a stream with an average annual flow of less than 5 cfs. The process involves the following:
 - Notify the Corps, EPA, and other permitting agencies for a review of the potential environmental impacts.
 - Based on feedback from other agencies, the Corps accepts or denies permit.
 - If denied, the applicant may appeal the decision by applying for an Individual Permit.

Section 401 - Clean Water Act

Section 401 is closely tied to Section 404, with the difference being that it is a certification process issued through Ecology. Whenever an activity requires a federal permit, the applicant must obtain certification as a prerequisite. The state essentially certifies the materials discharged into a water body, ensuring compliance with discharge limitations, water quality standards, and any other applicable conditions of state law (Chapter 173-201 WAC). This certification also applies to the eventual operation of the facility. If Ecology denies the certification, then the federal permit must be denied. If the state imposes any conditions on a certification, those conditions become part of the

federal permit. The certification process begins with notification of Ecology at the time a Section 404 permit is filed with the Corps. Ecology becomes the clearinghouse for all state agency responses to Section 404 with the Environmental Review Section (ERS) reviewing all documents. The ERS prepares a state comment letter based on the responses from various state agencies along with the 401 certification or denial. Ecology has the authority to override any state agency recommendation unless a violation of state law would result. All state 401 certifications are exempt from the State Environmental Policy Act (SEPA) requirements. As Section 401 applies to flood hazard management measures, the application often requires what is called a "modification." Typical structural flood control measures such as stream bank protection and instream gravel removal have the potential of temporarily creating excess instream turbidity during the construction phase. This will require a Temporary Modification of Water Quality Criteria from Ecology before a water quality certification will be issued. This is an additional step that projects need to take if water quality is deemed in jeopardy. Structural shoreline modification or bioengineering techniques have the potential to affect water quality due to the proximity of construction to the shoreline. Section 401 certifications are an important part of the permitting process required through Section 404 of the Clean Water Act and in fact, take precedence over it.

Section 10 - Rivers and Harbors Act

Enacted in 1889 to preserve the navigability of the nation's waterways, Section 10 prohibits the unauthorized obstruction or alteration of those navigable waters without a permit from the Corps. The provisions apply to all structures or activities associated with a structure located "in, over, or affecting" navigable waters below the mean high-water mark of tidal waters or ordinary high-water mark of fresh waters. This law pertains to navigable waters that are currently, historically, or have a reasonable potential to be navigable and all waters subject to the ebb and flow of the tide up to mean higher high tide or ordinary high-water mark. The permit process includes consideration of navigational waters, flood control, fish and wildlife management, and environmental impacts. Section 10 review often occurs simultaneously with the Section 404 permitting process and includes compliance with NEPA.

Special Districts

A special district is a quasi-governmental body that is formed by an agreement of the affected property owners and maintained by special assessment on those property owners to provide particular services. The services vary depending on the districts (i.e., diking and drainage, water, sewer, public utilities districts, and flood control zone districts). Each district has an elected governing body that is empowered to ensure that the needs of the district are met. Any of these districts have the authority to engage in flood control activities. For illustration purposes, the structure of a flood control district will be used to represent what is typical for a special district. The flood control district is designed to protect life and property, to preserve public health, and to conserve and develop the natural resources of the state. They are authorized to acquire, purchase, sell, lease, and manage real and personal property either inside or outside the district's boundary. They also have the right to maintain and operate flood control works, including their scoping, planning, construction, improvement, replacement, repair, and/or acquisition of flood control works. These flood control works can include, but are not limited to dams, dikes, levees, ditches, channels, canals, banks, revetments, and other techniques convenient and necessary to reduce floods and lessen their danger. It also has the right to enter into contracts, the right to sue and be sued, the right to eminent domain, and the right to do all lawful acts necessary to achieve their purposes.

National Environmental Policy Act

With the passing of the National Environmental Policy Act (NEPA) (42 U.S.C. 4321 et. seq.), a process was initiated requiring federal agencies to consider the environmental impacts of both development projects sponsored by the agency and those privately sponsored projects that require agency permits

and approval. Concerned with project impacts, the NEPA process stresses full disclosure of environmental impacts along with technical and economic considerations of a development project, prior to an agency decision. The Council on Environmental Quality (CEQ) provides the guidance to implement NEPA; however, most federal agencies have adopted their own regulations for implementation. The CEQ Regulation (40 CFR 1500–1508) emphasizes the consideration of alternatives, including ways to mitigate harmful environmental effects through reducing or avoiding those effects. The NEPA process generally occurs concurrently with Section 404. Any major federal action that would have significant adverse environmental impacts is required by NEPA to prepare an environmental impact statement (EIS). The EIS must thoroughly evaluate any negative environmental impacts caused from the proposed action and its alternatives. Privately sponsored projects may also be required to perform an EIS if any federal monies are a part of the project or if anyone recommends to the permitting federal agency that an EIS be performed. Such a recommendation should be based on evidence that indicates a proposed action would result in significant adverse environmental impacts. To determine whether a proposal would produce significant adverse environmental impacts, an environmental assessment (EA) must be performed. Typically, the permit applicant provides much of the information and analysis used to prepare the EA. If it is determined that an EIS is not required, a Finding of No Significant Impact (FONSI) document is prepared, explaining why an EIS is not needed. Generally, all structural and bioengineering flood control projects are federally funded and as such must comply with NEPA requirements. Even when grants are appropriate for operations and maintenance, those funds trigger the NEPA process and must comply with the rules. Private projects are also subject to preparing an EIS when, during review by state or federal agencies, the project is seen as potentially detrimental to the environment.

Washington State Environmental Policy Act

The Washington State Environmental Policy Act (SEPA) was passed by the legislature in 1971 for the purpose of providing a process to analyze the environmental impacts of development. SEPA is not a permit but rather a process of information gathering for the purpose of helping agency decision-makers and the general public understand how a project would affect the environment. SEPA requires a full disclosure of likely significant adverse environmental impacts of a proposed action and a mitigation plan for identified impacts to either the natural or the built environment. Proposed actions with possible significant adverse environmental impacts are required to prepare an EIS. Many agency decisions can only be made after the SEPA process has been completed, which may include: Hydraulic Project Approval, Shoreline Substantial Development permit, and many other local permits (clearing and grading, utility, street use, etc.). A variety of actions are "categorically exempt" from the SEPA process.

APPENDIX B: RESOURCES FOR FLOOD AND ECOLOGICAL RESTORATION INFORMATION

This appendix lists and provides links to resources that communities can use to enhance their flood planning efforts. Other resources are listed throughout this guidebook and in Chapter 8 (References).

General Floodplain Management

The Ecology page on floods and floodplain planning (<https://ecology.wa.gov/Water-Shorelines/Shoreline-coastal-management/Hazards/Floods-floodplain-planning>) is regularly updated and includes information on planning and regulations, grant programs, and the Risk MAP program.

The Northwest Regional Floodplain Management Association (<https://norfma.org/>) is a professional organization for floodplain managers in Washington, Alaska, Idaho, Oregon, and British Columbia. NORFMA regularly provides informational events, including an annual conference.

The Association of State Floodplain Management (<https://www.floods.org/>) is a national professional organization for floodplain managers that offers the Certified Floodplain Manager (CFM) certification program, an annual conference, and a robust library of resources (<https://library.floodsciencecenter.org/>).

The Salish Sea Wiki (https://salishsearestoration.org/wiki/Welcome_to_Salish_Sea_Restoration) includes a wide-ranging collection of floodplain resources, including specific sites and efforts and documents, on its Floodplains page (<https://salishsearestoration.org/wiki/Floodplains>).

Information on the National Flood Insurance Program (NFIP) is available at the FloodSmart website (<https://www.floodsmart.gov/>). Other resources on the NFIP include:

- National Flood Insurance Technical Bulletins (<https://www.fema.gov/emergency-managers/risk-management/building-science/national-flood-insurance-technical-bulletins>).
- The Community Rating System website (<https://www.fema.gov/floodplain-management/community-rating-system>).
- The FEMA Flood Risk Communication Toolkit for Community Officials (<https://www.fema.gov/floodplain-management/manage-risk/communication-toolkit-community-officials>).
- Resources for wildlife conservation for NFIP communities (<https://www.fema.gov/floodplain-management/wildlife-conservation>).

Example Flood Plans in Washington State

Existing CFHMPs can provide a helpful example. Completed Flood Plans and current flood planning efforts in Washington State include:

- Confederated Tribes of the Chehalis Reservation Comprehensive Flood Hazard Management Plan (2009): <https://www.chehalis-tribe.org/departments/planning/resources/Chehalis-Tribe-CFHMP.pdf>.

- Dungeness River Comprehensive Flood Hazard Management Plan (2009):
[https://www.whatcomcounty.us/DocumentCenter/View/1400/Comprehensive-Flood-Hazard-Management-Plan-PDF?bidId=.](https://www.whatcomcounty.us/DocumentCenter/View/1400/Comprehensive-Flood-Hazard-Management-Plan-PDF?bidId=)
- King County
 - 2013 King County Flood Hazard Management Plan Update:
[https://www.kingcounty.gov/depts/dnrp/wlr/sections-programs/river-floodplain-section/documents/flood-hazard-management-plan-update.aspx.](https://www.kingcounty.gov/depts/dnrp/wlr/sections-programs/river-floodplain-section/documents/flood-hazard-management-plan-update.aspx)
 - 2006 King County Flood Hazard Management Plan:
[https://www.kingcounty.gov/depts/dnrp/wlr/sections-programs/river-floodplain-section/documents/flood-hazard-management-plan.aspx.](https://www.kingcounty.gov/depts/dnrp/wlr/sections-programs/river-floodplain-section/documents/flood-hazard-management-plan.aspx)
- Kittitas County Hazard Mitigation Plan (2019):
[https://www.co.kittitas.wa.us/uploads/documents/public-works/hazard-mitigation-plan/downloads/2019/WA_Kittitas_HMP_Volume1.pdf.](https://www.co.kittitas.wa.us/uploads/documents/public-works/hazard-mitigation-plan/downloads/2019/WA_Kittitas_HMP_Volume1.pdf)
- Pierce County
 - 2023 Comprehensive Flood Hazard Management Plan (underway):
[https://www.piercecountywa.gov/7037/2023-Comprehensive-Flood-Plan.](https://www.piercecountywa.gov/7037/2023-Comprehensive-Flood-Plan)
 - Pierce County Rivers Flood Hazard Management Plan (2013):
[https://www.piercecountywa.gov/DocumentCenter/View/96736/Pierce-County-Rivers-Flood-Hazard-Management-Plan-Volume-I-2-19-13compressed.](https://www.piercecountywa.gov/DocumentCenter/View/96736/Pierce-County-Rivers-Flood-Hazard-Management-Plan-Volume-I-2-19-13compressed)
 - Pierce County Rivers Flood Hazard Management Plan Update (2018):
[https://www.piercecountywa.gov/DocumentCenter/View/96736/Pierce-County-Rivers-Flood-Hazard-Management-Plan-Volume-I-2-19-13compressed.](https://www.piercecountywa.gov/DocumentCenter/View/96736/Pierce-County-Rivers-Flood-Hazard-Management-Plan-Volume-I-2-19-13compressed)
- Whatcom County
 - Floodplain Integrated Planning (underway):
[https://www.whatcomcounty.us/2971/FLIP-Reports.](https://www.whatcomcounty.us/2971/FLIP-Reports)
 - Lower Nooksack River Comprehensive Flood Hazard Management Plan (1999):
[https://www.whatcomcounty.us/DocumentCenter/View/1400/Comprehensive-Flood-Hazard-Management-Plan-PDF?bidId=.](https://www.whatcomcounty.us/DocumentCenter/View/1400/Comprehensive-Flood-Hazard-Management-Plan-PDF?bidId=)
- Yakima County:
 - Ahtanum-Wide Hollow Comprehensive Flood Hazard Management Plan (2012):
[https://www.yakimacounty.us/324/Ahtanum-Wide-Hollow-CFHMP.](https://www.yakimacounty.us/324/Ahtanum-Wide-Hollow-CFHMP)
 - Naches River Comprehensive Flood Hazard Management Plan (adopted 2006):
[https://www.yakimacounty.us/DocumentCenter/View/997/2006-Naches-River-Plan-PDF?bidId=.](https://www.yakimacounty.us/DocumentCenter/View/997/2006-Naches-River-Plan-PDF?bidId=)
 - Upper Yakima River Comprehensive Flood Hazard Management Plan (1998):
[https://www.yakimacounty.us/322/1998-Upper-Yakima-River-CFHMP.](https://www.yakimacounty.us/322/1998-Upper-Yakima-River-CFHMP)
 - Upper Yakima River Update (2007): [https://www.yakimacounty.us/328/2007-Upper-Yakima-River-Update.](https://www.yakimacounty.us/328/2007-Upper-Yakima-River-Update)
 - Cowiche Addendum (2018):
[https://www.yakimacounty.us/DocumentCenter/View/17847/UPPER-YAKIMA-CFHMP-2018-COWICHE-ADDENDUM?bidId=.](https://www.yakimacounty.us/DocumentCenter/View/17847/UPPER-YAKIMA-CFHMP-2018-COWICHE-ADDENDUM?bidId=)

Innovative Flood Hazard Management Programs in Other Geographic Areas

The California Water Commission: Headwaters to Floodplains Initiative (<https://mavensnotebook.com/2020/02/13/ca-water-commission-headwaters-to-floodplains-initiative/>) is an integrated regional watershed management approach to flood management. The cornerstones of the program are engagement, technical assistance, and funding assistance.

The U.S. Forest Service has implemented several “Stage Zero” projects in the upper portions of watersheds to remove logging roads, add large woody debris, and fill incised channels to provide storage and reduce flood peaks in lower watershed areas. One example is the Lower South Fork McKenzie River Floodplain Enhancement Project, in Oregon’s Willamette National Forest (https://www.fws.gov/pacificlamprey/Documents/Lamprey%20Info%20Exchange_2018/Restoration_Recolonization_Speed%20Session/6_Stage%200_South%20Fork_Lamprey%20Exchange.pdf).

Montana Aquatic Resources Services (MARS) operates a Channel Migration Easement program that compensates landowners for their right to armor the river. The program allows the river to migrate and to maintain natural processes. Resources include the program website (<https://montanaaquaticresources.org/cme/>), a white paper on channel migration easements (<https://montanaaquaticresources.org/beta/wp-content/uploads/2017/10/MARS-CME-Whitepaper-FINAL-DRAFT-20171004-v1.0.pdf>), and the short documentary film *The Shape of a River* (<https://vimeo.com/214590995>).

The “Working with Natural Process” approach to flood management in the United Kingdom (UK) addresses both river restoration and flood management. The UK government maintains a webpage with resources and case studies (<https://www.gov.uk/flood-and-coastal-erosion-risk-management-research-reports/working-with-natural-processes-to-reduce-flood-risk>) and a presentation at the 2017 River Restoration Northwest conference (https://www.rnw.org/wp-content/uploads/2.4_J-Mant-Ricardo_WWNP-NFMJM.pdf) described the approach.

The 2010 article “Collaborative watershed partnerships in urban and rural areas: Different pathways to success?” (https://www.researchgate.net/publication/229092225_Collaborative_watershed_partnerships_in_urban_and_rural_areas_Different_pathways_to_success) reviews two collaborative watershed partnerships in Northeast Ohio (one urban and one rural) and discusses the performance of each partnership.

The article “From implementation towards maintenance: sustaining collaborative initiatives for integrated floodplain management in the Netherlands” (<https://www.tandfonline.com/doi/full/10.1080/07900627.2016.1200962>) analyzes collaboration objectives and structures in river management.

The article “Rethinking a Typology of Watershed Partnerships: A Governance Perspective,” published in *Public Works Management & Policy* in 2014 (https://www.researchgate.net/publication/274186022_Rethinking_a_Typology_of_Watershed_Partnerships_A_Governance_Perspective), describes three types of collaborative watershed partnerships: interagency governance, cross-sector governance, and grassroots governance.

Agriculture in Floodplains

The Farming in the Floodplain Project Resources page (<https://farminginthefloodplain.org/resources/>) includes various reports that may provide a helpful example for how to consider integration of floodplain restoration and agriculture. It also includes a

Literature Review on Agricultural Resilience (<https://farminginthefloodplain.org/wp-content/uploads/2020/05/Final-Lit-Review.pdf>).

The Washington State Department of Agriculture (<https://agr.wa.gov/>) includes a number of agriculture-related resources, including the Agricultural Land Use dataset (<https://agr.wa.gov/departments/land-and-water/natural-resources/agricultural-land-use>), an invaluable resource for locating active agricultural lands. The dataset is not parcel-based and it includes information on what types of crops are grown on each field.

The Agriculture Resilience Plan for Snohomish County (<https://snohomishcd.org/ag-resilience-plan-document>) is a great example of a plan that describes agricultural needs in floodplain areas in a way that can be integrated with flood hazard management and restoration goals and actions. The plan also describes the results of a study of future flood impacts.

Climate Change

The best resource for information on potential climate impacts is the Puget Sound State of Knowledge Report (<https://cig.uw.edu/resources/special-reports/ps-sok/>) prepared by the University of Washington Climate Impacts Group (CIG). CIG's website also includes a number of other resources (<https://cig.uw.edu/resources/>), and CIG can be contacted for further assistance (<https://cig.uw.edu/about/contact-us/>). For Floodplains by Design, CIG prepared a fact sheet on Climate Change Impacts on Puget Sound Floodplains (http://www.floodplainsbydesign.org/wp-content/uploads/2017/07/Climate-Impacts_Floodplains.pdf).

Floodplains by Design also prepared a factsheet on Incorporating Climate Change in Integrated Floodplain Management (<https://tnc.app.box.com/s/3e3zx20jtjf5lrf4i6ccqv2ut4filmcs>). Together, CIG and Floodplains by Design developed a factsheet on How Local Entities are Adapting to Climate Change (http://www.floodplainsbydesign.org/wp-content/uploads/2018/11/FbD_AdaptingToClimateChange-1-Sheet_8.5x11_R5.pdf) with links and examples. They also developed climate change reference guide factsheets for individual watersheds:

- Stillaguamish: http://www.floodplainsbydesign.org/wp-content/uploads/2018/09/FbD_Stillaguamish-climatechange_web.pdf.
- Snohomish: http://www.floodplainsbydesign.org/wp-content/uploads/2018/09/FbD_Snohomish-climatechange_web.pdf.
- Nooksack: http://www.floodplainsbydesign.org/wp-content/uploads/2018/09/FbD_Nooksack-climatechange_web.pdf.
- Dungeness: http://www.floodplainsbydesign.org/wp-content/uploads/2018/09/FbD_Dungeness-climatechange_web.pdf.
- Skokomish: http://www.floodplainsbydesign.org/wp-content/uploads/2018/09/FbD_Skokomish-climatechange_web.pdf.
- Puyallup: http://www.floodplainsbydesign.org/wp-content/uploads/2018/09/FbD_Puyallup-climatechange_web.pdf.

The Climate Toolbox (<https://climatetoolbox.org/>) is a collection of climate change tools related to flooding and many other topics.

The Skagit Climate Science Consortium (<http://www.skagitclimatescience.org/>) has a variety of educational resources (<http://www.skagitclimatescience.org/events/educational-resources/>), including:

- A factsheet (http://www.skagitclimatescience.org/wp-content/uploads/2016/07/FINAL_CaseStudy_Hourglass.pdf) and an infographic (<http://www.skagitclimatescience.org/wp->

[content/uploads/2016/07/FINAL_INFO_Hourglass.pdf](#)) describing how climate impacts will combine to increase flood risk in the Skagit Valley.

- A factsheet (http://www.skagitclimatescience.org/wp-content/uploads/2016/07/FINAL_CaseStudy_Sediment_2.pdf) and an infographic (http://www.skagitclimatescience.org/wp-content/uploads/2015/09/Sediment_InfoGraphic.pdf) on sediment.
- A factsheet (http://www.skagitclimatescience.org/wp-content/uploads/2015/09/SeaLevelRise_BriefOverview.pdf) and an infographic (http://www.skagitclimatescience.org/wp-content/uploads/2015/09/SeaLevelRise_InfoGraphic.pdf) on sea level rise.
- An infographic on rising sea levels, groundwater, and storm surge (http://www.skagitclimatescience.org/wp-content/uploads/2015/09/SeaLevelRise-Groundwater_InfoGraphic.pdf).
- An infographic on changes in hydrology (http://www.skagitclimatescience.org/wp-content/uploads/2021/01/FINAL_ChangesHydrology2068.pdf).
- Flooding visual simulations (http://www.skagitclimatescience.org/wp-content/uploads/2015/11/FINAL_Photo_VisualSim.pdf).
- An interactive webmap on potential flood impacts in the Lower Skagit Watershed (<http://www.skagitclimatescience.org/flood-scenario-map/>).

In 2015, the Technical Mapping Advisory Committee published a report on Future Conditions Risk Assessment and Modeling:

https://www.fema.gov/sites/default/files/documents/fema_tmac_2015_future_conditions_risk_assessment_modeling_report.pdf.

NOAA has published an online Sea Level Rise Viewer that shows potential coastal flooding impact areas and relative depth: <https://coast.noaa.gov/slr/>.

Diversity, Equity, and Inclusion and Environmental Justice

The Washington State Environmental Justice Task Force published a set of recommendations for prioritizing environmental justice in 2020

([https://healthequity.wa.gov/Portals/9/Doc/Publications/Reports/EJTF%20Report_FINAL\(1\).pdf](https://healthequity.wa.gov/Portals/9/Doc/Publications/Reports/EJTF%20Report_FINAL(1).pdf)).

The Healthy Environment for All (HEAL) Act, or Senate Bill 5141

(<https://app.leg.wa.gov/billsummary?BillNumber=5141&Initiative=false&Year=2021>), which was passed by the Washington State Legislature in 2021, includes new requirements to implement the report of the Environmental Justice Task Force.

Federal Executive Orders related to environmental justice include Executive Order 12898 (<https://www.archives.gov/files/federal-register/executive-orders/pdf/12898.pdf>) and Executive Order 13166 (<https://www.govinfo.gov/content/pkg/FR-2000-08-16/pdf/00-20938.pdf>).

Resources to identify vulnerable and overburdened communities include:

- The United States Census (<https://www.census.gov/>).
- The United States Census' American Community Survey (<https://www.census.gov/programs-surveys/acs>).
- The Washington Environmental Health Disparity Map (<https://fortress.wa.gov/doh/wtnibl/WTNIBL/>).

- The Washington State Office of Superintendent of Public Instruction Data & Reporting, Report Card for schools and districts (<https://washingtonstatereportcard.ospi.k12.wa.us/>).
- EPA's EJSCREEN (<https://ejscreen.epa.gov/mapper/>).

An informative video on targeted universalism ("Targeted Universalism by the Othering & Belonging Institute) is available at <https://www.youtube.com/watch?v=a0At2xbQB7w>.

The Government Alliance on Race & Equity developed a Racial Equity Toolkit (https://racialequityalliance.org/wp-content/uploads/2015/10/GARE-Racial_Equity_Toolkit.pdf) with guidance for local governments in consideration of environmental justice.

The article "After the Storm: The Importance of Acknowledging Environmental Justice in Sustainable Development and Disaster Preparedness" by Brie Sherwin (<https://scholarship.law.duke.edu/delpf/vol29/iss2/2/>).

The Harris County Flood Control District in Texas has developed an innovative Prioritization Framework (<https://www.hcfcd.org/Activity/2018-Bond-Program/Prioritization-Framework>) for the "equitable expenditure of funds" for flood hazard management capital projects. The Prioritization Framework includes a social vulnerability index.

Some local governments in Washington State have developed resources for social justice and equity that provide a framework and resources for community engagement and/or environmental justice evaluation. Examples include:

- King County Equity Impact Review Process (https://kingcounty.gov/~media/elected/executive/equity-social-justice/2016/The_Equity_Impact_Review_checklist_Mar2016.ashx?la=en).
- King County Community Engagement Guide (<https://kingcounty.gov/~media/elected/executive/equity-social-justice/documents/CommunityEngagementGuideContinuum2011.ashx?la=en>).
- King County Community Engagement Worksheet (<https://kingcounty.gov/~media/elected/executive/equity-social-justice/documents/CommunityEngagementWorksheet.ashx?la=en>).
- City of Everett Mayoral Directive on Community Engagement and Inclusion (<https://everettwa.gov/DocumentCenter/View/13110/Directive-2018-03?bidId=>).
- City of Renton Equity Lens Process (https://rentonwa.gov/UserFiles/Servers/Server_7922657/File/City%20Hall/Executive/Public%20Affairs/Inclusion/Documents/Renton%20Equity%20Lens%20Process%20&%20Examples%203-6-19.pdf).
- City of Seattle Racial Equity Toolkit (https://www.seattle.gov/Documents/Departments/RSJI/RacialEquityToolkit_FINAL_August2012.pdf).
- City of Tacoma Equity Index (<https://www.cityoftacoma.org/cms/One.aspx?portalId=169&pageId=175030>).
- Seattle Public Utilities Equity Planning Toolkit (<https://mrsc.org/getmedia/f611a2b4-5600-4823-b651-25a8c8cd2a04/s42spuEquityPlanningTools.pdf.aspx>).

King County has also conducted work to better understand environmental justice and community composition, including:

- An Equity and Social Justice Strategic Plan (<https://aqua.kingcounty.gov/dnrp/library/dnrp-directors-office/equity-social-justice/201609-ESJ-SP-PolAG-RegCOL.pdf>).
- Development of an Equity and Social Justice map tool (<https://kingcountydownstream.org/2017/08/02/new-esj-imap-tool-brings-together-community-and-capital-projects-for-employees/>).
- An analysis of floodplain demographics described in a conference presentation (<https://asfpm-library.s3-us-west-2.amazonaws.com/Website/CON/A2-Paine.pdf>).
- An equity and social justice map folio included as Appendix J in the 2013 King County Flood Hazard Mitigation Plan (<https://your.kingcounty.gov/dnrp/library/2013/kcr826-2013.pdf>).

EJnet.org includes a page of resources on environmental justice and environmental racism (<http://www.ejnet.org/ej/>).

Many resources have been developed to guide environmental justice analyses for transportation projects. While there are many differences between transportation projects and flood hazard management, these resources include methodologies and approaches that could be adapted for flood hazard management. Resources include:

- The Washington State Department of Transportation Environmental Justice webpage (<https://wsdot.wa.gov/environment/technical/disciplines/social-and-land-use-effects/environmental-justice>).
- The Federal Highway Administration Environmental Justice webpage (https://www.fhwa.dot.gov/environment/environmental_justice/).
- The American Association of State Highway and Transportation Officials Environmental Justice webpage (<https://environment.transportation.org/education/environmental-topics/environmental-justice/>).
- The U.S. Environmental Protection Agency document “Promising Practices for EJ Methodologies in NEPA Review” (<https://environment.transportation.org/education/environmental-topics/environmental-justice/>).

Habitat

WDFW’s Priority Habitats and Species program is a resource for identifying and planning for habitat in the floodplain. The program includes the following resources:

- Priority Habitats and Species maps: <https://wdfw.wa.gov/species-habitats/at-risk/phs/maps>.
- Riparian Ecosystems, Volume 1: Science Synthesis and Management Implications (2020): <https://wdfw.wa.gov/publications/01987>.
- Riparian Ecosystems, Volume 2: Management Recommendations (2020): <https://wdfw.wa.gov/publications/01988>.

Ecology provides guidance for the Frequently Flood Areas chapter of Critical Areas Ordinances (<https://ecology.wa.gov/Regulations-Permits/Guidance-technical-assistance/Guidance-for-floodplains-Critical-Areas-Ordinanc>).

In 2010, FEMA developed guidance for floodplain habitat assessments and mitigation (https://www.fema.gov/pdf/about/regions/regionx/draft_mitigation_guide.pdf).

The Puget Sound Partnership maintains a webpage with links to local watershed salmon recovery plans (<https://www.psp.wa.gov/salmon-recovery-watersheds.php>). The regional Recovery Plan for Puget Sound Chinook Salmon was published in 2007 (<https://www.fisheries.noaa.gov/resource/document/recovery-plan-puget-sound-chinook-salmon>).

Integrated Floodplain Management

Floodplains by Design links to a number of resources on its website (<http://www.floodplainsbydesign.org/work/>), including:

- A 2014 report on Integrated Floodplain Management (<http://www.floodplainsbydesign.org/wp-content/uploads/2017/07/FbD-FINAL-REPORT-Sept2014.pdf>).
- A 2016 report on Integrated Floodplain Management (<http://www.floodplainsbydesign.org/wp-content/uploads/2017/07/FbD-Vision-and-Strategies-2016-report.pdf>).
- A 2016 white paper on Advancing Integrated Floodplain Management at the Local Level (http://www.floodplainsbydesign.org/wp-content/uploads/2017/07/Advancing-Integrated-FP-Mgmt_final-7-15-16.pdf).
- A report on lessons learned from the multi-benefit Fisher Slough floodplain restoration project (http://www.floodplainsbydesign.org/wp-content/uploads/2017/07/Fisher_Lessons-learned_NOAA-ARRA-report_April-2013.pdf).

The Puyallup Watershed Floodplains for the Future program website (<https://floodplainsforthefuture.org/>) includes a number of resources on Integrated Floodplain Management, including:

- The Shared Monitoring Plan, which tracks progress toward shared goals for Integrated Floodplain Management (https://floodplainsforthefuture.org/wp-content/uploads/2018/02/FFTF-Shared-Monitoring-Plan_Final_20Feb2018.pdf).
- Monitoring Plan Annual Reports for 2018 (https://floodplainsforthefuture.org/wp-content/uploads/2021/01/FFTF_AnnualReport_2018.pdf) and 2019-2020 (https://floodplainsforthefuture.org/wp-content/uploads/2021/01/FFTF_AnnualReport_20192020.pdf), which report results for the tracking program.

Tribal Rights

The *Treaty Rights at Risk* report (<https://treatyrightsatrisk.org/>) is a key resource for understanding treaty rights and salmon recovery.

The Northwest Treaty Tribes website (<https://nwtreatytribes.org/>) has many helpful resources, including:

- *Climate Change and Our Natural Resources: A Report from the Treaty Tribes in Western Washington* (<https://nwifc.org/downloads/climate-change-and-our-natural-resources/>).
- *gʷə̀dʷ adad: Teaching of Our Ancestors, Tribal Habitat Strategy* (<https://nwtreatytribes.org/habitatstrategy/>).

The Northwest Indian Fisheries Commission (<https://nwifc.org/>) also has many resources and publications, including:

- State of Our Watersheds reports (<https://nwifc.org/publications/state-of-our-watersheds/>).
- Understanding Tribal Treaty Rights in Western Washington (<http://nwifc.org/w/wp-content/uploads/downloads/2014/10/understanding-treaty-rights-final.pdf>).