EXECUTIVE SUMMARY

The Comprehensive Flood Hazard Management Plan (CFHMP) for the Ahtanum and Wide Hollow basins covers two urbanizing flood-prone basins in the cities of Yakima and Union Gap, and Yakima County to the north of the Yakama Nation boundary. The Ahtanum-Wide Hollow Comprehensive Flood Hazard Management Plan is the third flood hazard plan to be developed in Yakima County by the County-wide Flood Control Zone District (FCZD). The FCZD develops flood hazard management plans to prioritize flood hazard mitigation actions, support County and City staff in the floodplain communities, and develop partnerships across the various agencies and jurisdictions on projects within floodplains.

The purpose of a CFHMP is to propose a suite of actions that will reduce identified flood hazards over both the short and the long term. A CFHMP is a policy and planning document which contains recommended policy changes and flood actions, including projects that reduce flood hazard. Answers to the questions "What types of actions will be effective?" and "Why will these actions be effective?" are the critical components of an implementation strategy contained in the plan. The Plan provides a basis for flood hazard risk management by the jurisdictions in the Ahtanum and Wide Hollow basins. Flooding is a natural phenomenon, frequently exacerbated by human practices, that cannot be entirely prevented. There are many approaches to protect lives and property while protecting the environment and natural resources of the community. The recommendations of this Plan sought to find the *greatest public benefit at the least cost over the short and long term*.

A citizen and agency Advisory Committee was formed and 48 meetings held to assess hazards, develop the CFHMP goals and objectives, and to develop the CFHMP alternatives and recommendations. In addition, there were four public workshops, providing extensive local contribution to the flood knowledge, potential solutions and plan development by citizens, the two cities, Yakama Nation and all affected public agencies.

Approval by the Washington State Department of Ecology and endorsement by FEMA will allow local jurisdictions who adopt the plan to become eligible for state and federal funds for flood emergency response and non-emergency activities to reduce property loss and threats to human life. Infrastructure modification or replacement projects identified within a CFHMP are eligible for funding through disaster grants. Without a plan, infrastructure is normally replaced or repaired to pre-flood conditions and may fail again. With the plan, infrastructure can be modified or replaced in a manner that produces overall reduction in flood hazards to the structure and surrounding area.

The plan contains twelve chapters and supporting appendices. The chapters are divided into four sections; Chapters 1 and 2 delineate plan process and community involvement, Chapters 3 through 6 provide the physical and regulatory setting, Chapters 7 and 8 concentrate on flooding characteristics and Chapters 9 through 12 provide the plan alternatives, recommendations, funding and strategy.

Basin Flood Impacts

In 1974 the Ahtanum and Wide Hollow basins experienced a 200-year flood, as estimated from Ahtanum Creek stream records. In 1996, the Ahtanum basin experienced an 80-year flood while the flooding on Wide Hollow Creek was less severe. These two major flood events, only twenty-two years apart, may turn out to be more frequent than the above probability estimates would indicate.

The flood damages in 1996 were more severe than in 1974 since the basin and floodplains had undergone more urban development. Total County-wide damages in 1996 were $18 million with severe public and private damages in these basins. In response the County engineer designated these basins as flood prone and requires higher drainage standards that the cities have also adopted. The continued conversion of land use from rural to urban during the intervening period has increased flood risk exposure. This has been demonstrated in recent economic analyses for federal flood hazard grants that are noted in the plan.

Floodplain Land Use and Channel Conversion Impacts

The communities of Yakima, Union Gap, Ahtanum, Wiley City, and Gromore were located near these creeks due to productive soils available for agricultural and easy access to groundwater. These areas were settled before extensive flood experience had been accumulated. The City of Union Gap is located at the Yakima River confluence of these two creeks and encountered historic flooding and related development constraints. The City of Yakima, protected by levees from the Naches and Yakima rivers built after World War II, has more recently expanded into flood prone areas as a result of westward annexations. Prior to the expansion, much of Yakima was located west of 16th Avenue on high ground. A high proportion of the remaining developable land within the Urban Growth Areas of Yakima and Union Gap is low lying former agricultural land with high groundwater, in or near the floodplains.

Agriculture is very productive in the flat valley bottoms of these basins. With the advent of large scale irrigation systems many channels were moved to the higher valley side slopes. In this location, channels and ditches could be used to irrigate the adjacent lower farmland. In other cases creeks were covered over or directly converted to ditches. The designers of early irrigation systems took advantage of the geologic tilting of these flat valleys to create irrigation systems extending across broad expanses of the valley in both basins. These systems designed for irrigation also route flood waters. This increased the number of flow paths and extent of shallow flooding over natural conditions. These flood paths are only rarely active, and therefore the flood risks associated with these areas are not easily recognized by the public, private institutions, and public agencies, until after a flood occurs. Where flood paths remain in agricultural use, only minimal damage occurs. When land is converted to higher density urban use significant damage can, and has, occurred.

The use of the creeks to convey irrigation flows has led to “artificial hydrographs” and the proliferation of vegetation in the channels that obstruct flow, trap sediment and reduce channel capacity. Management of the irrigation systems themselves is also increasingly difficult as large parcels are broken up through the urbanization process.

This change reduces the frequency of maintenance and types of maintenance approaches for irrigation channels. Both the increases in vegetation and changes in the level of maintenance tend to reduce the capacity of irrigation channels, which include both artificial channels and highly modified "natural" channels such as Wide Hollow, Bachelor and Hatton Creeks. This increases the frequency and severity of "nuisance flooding" in these drainages.

Urban road infrastructure also tends to exacerbate flooding, especially when located across relocated channels that promote flood overflow paths. Flood waters may be dammed or routed by roads or along roads. As the density of the road system has increased to meet urban needs, more bridges have been required. There are the over 80 public bridges plus a larger number of private bridges in the basins that have the capacity to deflect flow. Most of the road infrastructure was constructed and sized prior to the 1974 flood.

Because of the above conditions, minor changes to the topography (road, fence, large buildings, fill, and beaver dams) can, and often do, change how flood waters are routed across the floodplains. The 100-yr flood maps and history of flooding show the redirection of flood flows across extensive tracts of land, that present a large flood hazard. These channel flow redirection concerns were addressed in the development of alternatives and recommendations. Economic implications of this progressive land use change are also considered in the plan.

A compilation of flood location data is presented in Chapter 2.

Plan Scope and Process

The plan is comprehensive as it incorporates the entire watershed, as much community input as possible and practical, and because it aims at short and long term solutions that have been prioritized by the Advisory and Steering Committee. The structural flood hazard solutions frequently chosen in the past to protect current development have constrained the river at great community expense and exacerbate the extent of flooding over the long term, or have impacted development downstream. Through a comprehensive plan these effects are well understood before flood control actions are taken that could worsen the situation through redirection of flows.

The CFHMP is guided by a Department of Ecology process that identifies flood vulnerabilities and risk, and provides recommendations to mitigate community flood impacts. The CFHMP process seeks to involve a broad spectrum of local citizens / stakeholders and interests in the development of a plan and allows the community to carefully consider and prioritize alternatives for flood hazard management. Recommendations include both traditional structural solutions, such as channel realignment, and non-structural solutions, such as regulations or elevation of homes, to reduce flood exposure. CFHMPs address flood hazard only and review the current community GMA and related mechanisms effecting flood management and regulation within the plan geographic extent (see Chapter 8). The non-structural CFHMP recommendations can be incorporated in the Growth Management Act (GMA) Comprehensive Plans, including capital facilities plans, through inclusion of Hazard

goals (see Table 1.1 in Chapter 1) and through modification of planning requirements and ordinances for development within floodplains.

CFHMP Goals and Objectives

Defining goals and objectives provides the framework for carrying out the CFHMP. The goals and objectives were generated by the Advisory Committee following the inventory of physical conditions, are provided in Table ES-1 below.

Goals reflect the broadest expression of the community's desires in preparing the plan; objectives target specific results that fulfill the intent of the goals.

Table ES-1. GOALS AND OBJECTIVES FOR AHTANUM-WIDE HOLLOW CFHMP

Goals (to be achieved through objectives)	Objectives
1. Identify flood areas and flood processes	• Identify the location of critical conveyance channel locations • Identify stream reaches which have lost flood conveyance capacity due to changes in streamside vegetation or by human activities • Assess existing roads, bridges and culverts for barriers to flow-through and potential abatement of flood damage • Identify past erosion and stream migration processes and monitor after storm events • Understand and protect the natural function of the system to reduce flood hazard • Determine risks and potential mitigations for hollows
2. Reduce flood damages to citizens, property and infrastructure while maintaining natural functions of stream and floodplain systems	• Identify structural and non-structural actions for reducing flood hazards that recognize the corridor as a resource and are consistent with long-term river corridor functioning • Develop flood hazard management alternatives and strategies to reduce long-term damages • Develop short-term flood hazard reduction alternatives consistent with long-term strategies • Prefer mitigation recommendations that provide benefit for multiple problems and/or locations or enhance the value of the stream corridor as an asset to the community • Improve predictability of channel response to flood events • Evaluate impacts of present management of flood control and irrigation diversion structures during flood events, such as the flood gate on Spring Creek in Union Gap • Create inundation maps for flood evacuation preparedness • Conduct training at first responder and jurisdiction level using Flood Response Plan • Facilitate coordination with Emergency Management and Public Works Agencies before, during and after floods (Flood Response Plan) • Complete flood forecasting and warning projects in the basin and integrate with Emergency Response
3. Work within the physical and biological processes in the floodplain	• Protect existing, or enhance where possible, fish and wildlife habitat • Protect the natural function of the system to reduce flood hazard • Evaluate the use of setback dikes to allow for a more naturally functioning floodplain • Restore creeks to more natural channel (i.e. instream projects to address 90 degree angle corners and channels "perched" high on landscape) • Consider mitigation at watershed level or at a minimum reach level across jurisdictional boundaries

Table ES-1. GOALS AND OBJECTIVES FOR AHTANUM-WIDE HOLLOW CFHMP	
Goals (to be achieved through objectives)	**Objectives**
4. Achieve land use practices that respect floodplain functions	• Use best available flood hazard data for regulation of land development and permitting • Show critical areas and floodplain areas on plat maps corresponding to short/long plat developments (see City of Yakima regulations) • Conduct restudies of FEMA floodplain maps • Ensure that land use plans and regulations protect floodplain functions • Evaluate and ensure County/City enforcement of land use regulations • Coordinate with Yakama Nation on enforcement of land use regulations • Evaluate other development requirements that may impact flood hazard management, such as septic systems and water well siting • Ensure consistency of floodplain regulations within jurisdictions and investigate increasing the consistency between jurisdictions. • Identify and implement incentive program for bioengineered structural solutions to flood hazard mitigation • Work with existing permitting agencies (such as, Fish and Wildlife, USACE, Yakima County Shoreline, Ecology, and the Yakama Nation Water Code Administration) on identifying ways to streamline project permitting process • Encourage coordination and cooperation among all regulatory agencies • Work in creative ways to streamline the regulatory process
5. Emphasize the value of stream corridors as an asset to the community	• Encourage innovative development techniques where natural systems and floodplain function exists • Educate the public and development community on the value of allowing floodplain and stream function to properties- investigate Smart Growth concepts • Encourage open space planning and acquisition, through incentives such as leases, easements, acquisition, etc.
6. Quantify hazards in our floodplain	• Identify erosion and stream migration hazards and evaluate mitigation options as necessary • Create and submit FEMA floodplain map for Shaw Creek • Sustain the mapping program • Compile varied available mapping data into a comprehensive database/library resource that can be used to address future assessments • Identify changing flood condition areas to support new floodplain mapping work • Identify draws that are prone to flash flooding • Avoid contaminating land uses in the floodplain • When designing a flood overflow area, make sure it is not a contaminated area • Minimize impacts of septic systems and other critical facilities on water quality

Table ES-1. GOALS AND OBJECTIVES FOR AHTANUM-WIDE HOLLOW CFHMP	
Goals (to be achieved through objectives)	**Objectives**
7. Ensure a sustainable flood plan through public and agency awareness, acceptance, involvement, and education	• Communicate and coordinate with local governments and community groups on flood issues/hazards • Provide documented examples of positive steps being taken • Highlight projects that will educate the public on sustainable flood hazard mitigation • Ensure an ongoing educational program that keeps up with current understanding, science, and changes in the watershed • Participate in the CRS (Community Rating System) program • Flood safety preparedness education • Determine where large numbers of animals may be kept during a flood event and distribute information to the public • Develop a stream corridor improvement program consistent with this plan • Increase public awareness and understanding of flooding issues and floodplain functions
8. Ensure the implementation of the flood plan in a timely manner for both the short and long term	• Seek grant funding • Investigate possible cost savings through coordination with other multiple objective projects • Determine possible areas for flood control sub-zones • Address the causes of problems as opposed to the symptoms • Identify and utilize complementary Plans • Consider flood related recommendations from large scale plans such as the Ahtanum Watershed Assessment • Integrate flood hazard reduction into ongoing planning, management programs, and capital facilities plans • Understanding how the landscape is managed • Create and implement educational efforts to inform other organizations about flood risks, plans, and possible mitigation approaches

These flood hazard goals and objectives are achieved by the plan development process and subsequent implementation of the plan recommendations.

FEMA 100-Yr Floodplain Remapping

During the development of the CFHMP the FEMA Flood Insurance Study (FIS) revised the flood insurance rate maps (FIRMs). The accuracy of the old FIRMs for Ahtanum and Wide Hollow Creeks had been under question following the 1996 flood. The previous FIRMs were generated in the late 1970's and published in 1985. Remapping of these two creeks was initiated under the nation-wide FEMA Map Modernization program starting in 2004.

As part of the CFHMP the combined Steering and Citizens Advisory Committee, along with the FCZD, municipalities and citizens, came forward to contribute to the accuracy of the new FIRMs flood maps through direct input on historic flooding. A major focus was the identification of overland flow paths.

This process also assisted in the development of the CFHMP. The flooding impact of various factors such as vegetation, bridge sizing, sediment buildup at bridges and agricultural infrastructure could be evaluated using the FEMA hydraulic models. The

draft CFHMP was initially delayed to allow the Advisory Committee to view the preliminary FIRMs in order to refine CFHMP alternatives and recommendations.

The FIS Preliminary Maps for the new Wide Hollow Creek FIRMs were released to the cities of Yakima and Union Gap in October 2010, followed by Ahtanum Creek FIRMS in October 2011. The maps will be finalized in 2011 or 2012, respectively, depending on the appeals process. The hydraulic models for both basins are available from the FCZD and can be used for future studies and proposed or revised infrastructure**.**

Use of the FEMA models to evaluate sediment management at bridges revealed that modifying the existing bridges would not resolve the overflow path problems for 100-yr floods, as originally hoped. A stronger non-structural approach than originally envisioned during goals and objectives formulation, and one that addresses more frequent floods at, or less than, the 25-year flood, would be required in order to protect future development.

Flood Hazard Management Recommendations

The plan recommendations focus on damage prevention to future and existing development in order to reduce costs, including flood insurance fees. Many of the recommendations will provide relief for both future and existing development. The plan recommendations contained in Tables ES-2 and ES-3 were designed to incorporate parallel objectives of multiple parties to facilitate implementation and maximize benefits.

Partners have been added to the recommendations as a separate column in recognition of the need to coordinate ongoing activities across agencies, to leverage funding, and conduct long term planning of new and replacement infrastructure.

Priorities provided in the tables were based on issues of flood benefits, threat and expediency. The jurisdictions and agencies will determine their final priorities in this regard.

As priority does not fully convey the capability to implement, an onset timeline for implementation was designated and added to the recommendations. The use of this designation also provides an initial strategy for community implementation of the plan. Actions completed by the FZCD are denoted “C” for “completed” and contained in Chapter 10 and the Appendices. Actions already underway, usually by the FCZD (see Chapter 10), are denoted IP for “in progress”. Actions recommended to be initiated shortly after Plan adoption are denoted S for “short term”, while L is for “long term”, again referring to start date. Actions recommended within the next cycle of regulatory update, such as Comprehensive Plan or Ordinance updates are denoted as AU for “awaiting update”. Actions recommended to be initiated as part of upcoming projects or opportunities are denoted O for “opportunity”.

To guide implementation, recommendations were grouped into categories. Recommendation categories indicate the work nature and main partners required for implementation. The categories are: Inventory and Study, Planning and Regulatory, Maintenance and Management, Structural, Public Outreach, and Flood Response. For example, the FCZD cannot take the lead for Planning and Regulatory, a role that belongs to the jurisdictions. The FCZD can facilitate Maintenance and Management for facilities and lands that belong to landowners and jurisdictions. The FCZD has already taken a major role in Public Outreach and Flood Response. Implementation of Public Outreach recommendations will require an ongoing, coordinated approach to planning, regulatory, structural, and maintenance actions and programs over the long term.

The flood hazard definition and mitigation recommendations are summarized in tables ES-2 and ES-3, respectively. Inventory and Study recommendations within Table ES-2 will fill information gaps and may refine flood hazard mitigation recommendations within Table ES-3. Many of these Inventory and Study recommendations are currently in progress, and those complete are noted and included in the appendices. Additional details on these recommendations and estimated costs are provided in Chapters 9 and 10, respectively. The largest proportion of costs is for structural recommendations; the high priority structural recommendations are estimated at approximately $5 million dollars.

ES-2 Recommendations for Further Flood Hazard Definition

INVENTORY AND STUDY			
Description	**Onset**	**Priority**	**Partners**
IS-1 Establish technical work groups and pilot programs on a reach by reach basis for channel, vegetation and sediment maintenance (including Wide Hollow coarse sediment budget), to develop criteria and enable appropriate larger scale maintenance programs which meets flood and habitat needs. (See Appendix J)	IP	H	FCZD/WDFW Irrigation Districts, Landowners, Jurisdictions
IS-2 Establish cleanout guidelines and a pilot program bridge sediment removal & maintenance. (See Appendices G & H)	C	H	FCZD/ Roads, Plan Depts
IS-3 Inventory problematic bridges, roads and infrastructure impacts and sediment buildup to generate action plan for removals, etc. This includes areas of ponding.	IP	H	FCZD/ Roads Depts
IS-4 Inventory flooding impacts for existing and abandoned irrigation structures.	IP	H	FCZD/ Irrigation
IS-5 Modify bridge crossing design to reduce flooding and maintenance on case to case basis – wider spans, wider easements upstream and downstream for channel design and cleanout, deeper footings, to enable for scour, etc. (See Appendix G)	IP	H	Roads/ Plan Depts
IS-6 Wapato dam impact assessment for Union Gap.	IP	H	FCZD
IS-7 Provide 10 and 25 year flood extent maps to show chronic flooding areas where actions such as infrastructure sizing and siting, proposed development and redevelopment can be designed to guide flood hazard reduction. (See Appendix J)	C	H	FCZD

INVENTORY AND STUDY (cont)			
Description	**Onset**	**Priority**	**Partners**
IS-8 Provide 10 and 25 year flood damage estimates using established federal methods to guide economic and environmental decisions.	IP	H	FCZD
IS-9 Study to identify Ahtanum avulsion scenarios and existing flood issues at Mission.	S	H	FCZD
IS-10 Establish historical flooding areas –e.g. Wiley City & Ahtanum-as special study areas to include all infrastructure.	S	H	FCZD/Plan Depts
IS-11 Establish historical map and identity flood risks in Hollows.	S	H	FCZD
IS-12 Identify & prioritize emergency response access routes during 10, 25 and 100 year floods to incorporate into emergency transportation and planning.	S	H	City & County Roads/YVOEM
IS-13 Resolve run-off issues presented by DIDs.	S	M	Jurisdictions
IS-14 Document floods including aerial photos, high water marks, etc.	S	M	FCZD
IS-15 Identify high flood risk stream reaches where man-made changes or proposed projects effect channel processes or flooding including roads, perched channels and other alterations	S	M	FCZD/ WDFW
IS-16 Design bridges and irrigation infrastructure to reduce potential for accumulation of debris and sediment and creation of un-natural overflow channels/paths.	L	M	Roads/FCZD Plan Depts, WDFW
IS-17 Study use of ring dikes to protect St. Joseph's Mission property.	IP	L	Landowners
IS-18 Consider major levee construction on Mission property to alleviate headcuts, this may not be needed if Recommendations A & B in Hatton section are successfully implemented.	IP	L	FCZD
IS-19 Perform an Emma Lane flood study, and develop design guidance on acceptable flood protection levels. (3-2). Address Ahtanum Creek flood conveyance downstream of 42nd and Ahtanum Rd.	IP	L	FCZD
IS-20 Develop a Coordinated Resource Management Group to develop joint priorities for resource management (e.g. Wenas working group).	L	L	NYCD/WDFW
IS-21 Investigate and recommend increased maintenance and debris cleanout of culverts and ditches on public roads (coordinate with road maintenance crews to optimize ditch cleaning for flood purposes).	L	L	Roads
IS-22 Monitor effects of urbanization and land use intensifications to the characteristics (runoff, time of concentration, water quality) of the watershed over time. Take action to mitigate for negative watershed scale effects.	L	L	FCZD
IS-23 Map non –mapped Channel Migration Zones (and other hazards) (15G-4, 15D-3). Identify areas that are at risk for channel migration in addition to identified CMZ, i.e. N.F. Ahtanum, below the Narrows, at the Mission, Shaw Creek, etc.	O	L	FCZD/ plan Depts
IS-24 Alter drainage systems and easements, based on Emma Lane floodplain remap study.	O	L	FCZD

Key: ONSET: C – Completed; IP – In Progress; S – Short Term; L – Long Term; AU – Awaiting Updates; O – Opportunity
PRIORITY: H – High; M – Medium; L – Low

INVENTORY AND STUDY (cont)			
Description	**Onset**	**Priority**	**Partners**
IS-25 Inventory of private roads acting as levees.	O	L	FCZD
IS-26 Private road culvert inventory.	O	L	FCZD
IS-27 Investigate funding sources or incentives for private drainage infrastructure.	O	L	FCZD

ES-3 Recommendations for Flood Hazard Mitigation

PLANNING & REGULATORY			
Policy Development *To be implemented in the policy processes associated with the broad scale Growth Management Act processes such as County-Wide Planning Policies, Comprehensive Plans, Capital Facilities Plan Elements, and UGA expansion.*			
Description	**Onset**	**Priority**	**Partners**
PR-1 Ensure drainage infrastructure is properly sited, sized and designed to minimize flood effects from stormwater run-off. This includes establishing the relationship between flooding and stormwater and determining detention/retention and other stormwater standards.	IP	H	RSPG/Stormwater Utilities
PR-2 Petition State Noxious Weed Control Board to list hybrid willows as invasive species as designated in other states.	IP	H	FCZD
PR-3 Incorporate floodplain and economic impacts into SEPA for subdivision layouts floodplain development (losses, damages, safety, insurance, response and recovery) from the planning to the project level, especially in urban and urbanizing areas.	S	H	Plan Depts/FCZD
PR-4 Establish policies, such as a flood hazard audit and hazard element using the flood problem inventory in this plan, within County-wide planning policies and comprehensive plans in flood hazard areas to direct preferred locations for new infrastructure such as arterials, water and wastewater distribution mainlines, regional stormwater facilities, parks and greenbelts. o New major arterials should be located outside of floodplains where possible. If in floodplain, design to minimize flood impacts.	AU	H	Plan Depts/FCZD
PR-5 Retain and provide Open Space land use in all jurisdictions using zoning easements, acquisitions and incentives within floodplains to provide multiple public benefits such as preserving space for flooding, greenbelts and trails.	AU	H	Plan Depts/ FCZD
PR-6 Provide open space incentives that target general floodplain function, riparian and storage recommendations.	AU	H	Jurisdictions /Plan Depts., Interest Groups, FCZD
PR-7 Decide upon, designate (in flood response, transportation and capital facilities plans) and maintain critical access routes at 10, 25 and 100 year events.	S	H	Roads/YVOEM
PR-19 Develop flood abatement policies for high risk flood prone areas of existing dense development in the floodplain. o Design drainage to meet multiple objectives including flood alleviation, in flood-prone areas, esp. in Wiley City and Ahtanum.	O L	M	Plan Depts/ FCZD FCZD/Plan Depts
PR-20 Identify areas that are "islands" surrounded by floodplain and develop standards to limit density, provide emergency access and consider transportation networks within the context of surrounding area.	L	M	FCZD/Plan Depts

PLANNING & REGULATORY (cont)			
Description	**Onset**	**Priority**	**Partners**
PR-21 Seek land use examples for flood-prone areas from other similar communities.	L	M	FCZD/Plan Depts
PR-22 Ensure existing flood policies in the Yakima Urban Area Comprehensive Plan are implemented through ordinances and local jurisdiction land use decisions. Planning for flooding is supported in Objective E7 (5.7.A [13A-4])	O	M	Plan Depts.
PR-23 Incorporated principle of floodplain planning into infrastructure & similar facilities plans (5.4.D [8C-2, 12H-2])	L	M	Plan Depts.
PR-24 Preserve natural drainage including draws and mitigate identified hollows that provide natural flood flow paths but are not identified as FEMA floodplains. Implementation is through drainage requirements within stormwater, County/City drainage, grading, and long and short subdivision ordinances.	S	M	Plan Depts
PR-25 Consider development moratoriums or high standards of proof in place where development is outpacing flood knowledge or tools available to keep the public safe (i.e. the area has not been mapped, or conditions have changed since the last mapping).	O	M	Plan Depts
PR-26 Maintain open areas near the mouth of Ahtanum Creek for flooding such as Fulbright Park.	O	M	Plan Depts
PR-30 Take larger scale effects to the watershed into account when designing new transportation systems: Minimize number of roads – maximize efficiency and design roads in a manner to minimize flooding.	AU	L	Roads / Plan Depts
PR-31 Assess the cumulative effect of road policies and standards for new roads within the transportation element of the comprehensive plan that act as dams or conveyances.	AU	L	Roads /Plan Depts
PR-32 Limit future development in the Emma Lane floodplain area if structural alternatives not implemented.	AU	L	Plan Depts
PR-33 Place controls on building in the flood-prone areas in and around Emma Lane (e.g. using zoning, utility hook-ups, etc.).	AU	L	County Plan Dept
PR-34 Investigate geologic hazard area standards for applicability to high flood risk hazard categories such as channel migration zones and alluvial fans to address potential regulatory gaps.	L	L	FCZD/ Plan Depts, Bldg Officials
PR-8 Ensure all new development and redevelopment within identified FEMA floodplains are adequately reviewed for NFIP compliance and overall environmental (SEPA) impacts through the use of additional review procedures which may include; at minimum a public notice (type 2 for the County); a signed checklist for all floodplain items; a floodplain development permit independent of other required permits; or establishing a floodplain overlay zone covering the above concerns.	AU	H	Plans Depts/ FCZD
PR-9 Establish work groups to formalize regulatory applicability of man-made and natural courses.	S	H	Plans Depts/ FCZD

Key: ONSET: C – Completed; IP – In Progress; S – Short Term; L – Long Term; AU – Awaiting Updates; O – Opportunity
PRIORITY: H – High; M – Medium; L – Low

PLANNING & REGULATORY (cont)			
Description	**Onset**	**Priority**	**Partners**
PR-10 Ordinance increase for residential to at least one foot above BFE for future development to reduce community costs and damage.	AU	H	Bldg Officials/ Plan Depts
PR-27 Work for consistency in zoning and development standards across jurisdictions for developments and buildings within floodplains. Determine gaps in the regulatory scheme.	AU	M	Plan Depts
PR-28 Reduce risks through subdivision development standards to minimize new structures in harm's way. o Integrate protection of floodplain functions improvement/flood hazard reduction into subdivision platting process. o At a minimum, require a buildable area outside of the floodplain including standards for lot size and housing location.	O O	M	Plan Depts Plan Depts
PR-29 This includes special land use standards for industrial uses relating to hazardous materials, storage, use, disposal and flood-proofing for non-residential structures, including elevating to make existing structures less flood damage prone. Jurisdictions should adopt Appendix G of IBC.	SU	M	Plan Depts/ Bldg Officials
PR-35 Adopt and implement stricter building standards in Emma Lane area-flood-proofed homes, buildings.	AU	L	County Plan & Bldg Officials
PR-36 New traffic generating developments should be located outside of floodplains (see also Bridges & Roads).	O	L	Jurisdictions, Plan & FCZD
PR-11 Improve compliance with NFIP on all new and replacement bridges and culverts.	IP	H	Bldg Officials
PR-12 Based on the 10 and 25-year flood mapping, consider them, for design requirement of land use designation decisions in future floodplain development to minimize frequent damages and economic impact.	S	H	Plan Depts/WDFW
PR-13 Use SEPA and Comprehensive Plan Policies and Goals to address flood issues/impacts associated with larger scale proposed developments where current zoning, subdivision or building standards are not sufficient to mitigate flood risk.	S	H	Plan Depts
PR-14 Implement NPDES Regional stormwater to limit run-off up to 100-yr flood.	IP	H	Local Jurisdictions
PR-15 Fully utilize new FEMA models and maps, and locally developed 10 and 25-yr map products, including loss data, for alternative analysis and infrastructure and land use decision making, by providing models and mapping free of charge.	S	H	Plan Depts/ Roads
PR-16 Consolidate access for floodplain crossing to minimize flood impacts.	AU	H	Plan Depts/ Roads
PR-17 Ensure floodplains and floodways are identified on final plat maps – included would be text identifying effective map date and disclosure regarding fact that the maps will change over time. Also consider including identification of riverine Critical Areas buffer on plats.	AU	H	Plan Depts
PR-18 Increase flood code enforcement through adequate funding mechanisms 6.3.A.	S	H	Code Enforcement
PR-18 Increase flood code enforcement through adequate funding mechanisms 6.3.A.	S	H	Code Enforcement

PLANNING & REGULATORY (cont)			
Description	**Onset**	**Priority**	**Partners**
PR-37 Improve drainage throughout the entire Emma Lane area – culverts, roads, etc.	IP	L	Roads
MAINTENANCE & MANAGEMENT			
Continuous and stable Channel and Riparian Management			
MM-1 Program for sediment and debris removal, invasive species control, replacement species in plantings, sediment & bank stabilization.	IP	H	WDFW/FCZD Plan Depts, NYCD
MM-2 Beaver management.	IP	H	WDFW/Landowners
MM-3 Riverine Infrastructure Management – debris and sediment maintenance.	IP	H	Jurisdictions/ Irrigators
MM-4 Riparian restoration, mitigation and protection to reduce flood impacts.	S	H	FCZD/WDFW Jurisdictions
MM-5 Land acquisition in problem areas prior to development (Emma Lane/Cottonwood/Shaw Creek/Union Gap, etc.).	IP	H	FCZD/ Jurisdictions Landowners/ Interest groups,
MM-6 Apply appropriate range management standards to elk in confined feeding operations near riverine environment.	S	H	WDFW
MM-7 Obtain landowner access permission for problem bridge channel maintenance.	IP	H	FCZD/ Jurisdictions
MM-8 Coordinate opening irrigation diversion gates for flood relief, based on forecasts, channel maintenance needs, and impact to diversion facility.	IP	H	FCZD/Irrigators YVOEM
MM-9 Separate irrigation conveyances from streams as practical and based on priority.	L	H	Irrigators/ Jurisdictions
MM-10 Consolidate irrigation diversions and remove as become obsolete.	L	H	BOR/BPA/ Irrigators, Jurisdictions
MM-11 Community adoption of Community Rating System to reduce insurance rates through CRS activities.	L	H	Jurisdictions
MM-12 Investigate irrigation infrastructure changes such as flood gates or siphons to reduce flood routing through irrigation systems.	L	M	Irrigators
MM-13 Modify drainage standards for existing roads in overflow areas to minimize flood impacts (i.e. Emma Lane area).	AU	M	Roads/FCZD
MM-14 Ensure replacement of damaged infrastructure reduces future flood damage risks.	O	M	Roads
MM-15 Explore additional funding methods for mitigation or reduce environmental effects (including flooding) from existing roads or other infrastructure.	O	M	Roads
MM-16 The Spring Creek floodgate should generally be closed except for habitat or flow enhancement for a limited time period (see alternative F below also).	IP	L	Union Gap/FCZD
MM-17 Review DID management in relation to flood hazard over the long term as land use changes.	L	L	DIDs (County)
MM-18 Investigate funding for enforcement and cleanup of illegal dumps on private ground.	O	L	SW, DOE & Health Dist
MM-19 Improve stormwater system on Ahtanum Road to limit Emma Lane overflows into the airport area, and downstream to 16th (which floods the intersection at Ahtanum Road).	O	L	City of Yakima

Key: ONSET: C – Completed; IP – In Progress; S – Short Term; L – Long Term; AU – Awaiting Updates; O – Opportunity
PRIORITY: H – High; M – Medium; L – Low

MAINTENANCE & MANAGEMENT (cont)			
Continuous and stable Channel and Riparian Management			
Description	**Onset**	**Priority**	**Partners**
MM-20 Investigate methods for the following: - Research how other communities deal with dumping in floodplains, particularly concrete, fill, etc. - Research measures to deal with illegal/contaminated dumps (meth labs, etc.) - Examine statewide laws relating to dumping and streams to establish authorities.	O	L	SW, FCZD, Jurisdictions
MM-21 Utilize fence designs that prevent floodwaters from backing up on fences, such as: o Breakaway fence panels in locations that flood frequently. o Suspension fences, which consist of steel pipe or cable hung high above the creek, and hanging lighter materials down from the cable. This works as a fence, but is not lost during floods. Fence setbacks – hold fences back some distance from the creek (loss of traditional land usage).	O	L	NYCD/FCZD Bldg Officials, Plan Depts
STRUCTURAL			
Projects in Urban Growth Areas			
Description	**Onset**	**Priority**	**Partners**
ST-1 Property acquisitions and home elevations for repetitive loss properties.	IP	H	FCZD/ Jurisdictions
ST-2 Emma Lane channel improvements.	IP	H	FCZD/ Jurisdictions
ST-3 Bachelor Bridge at Ahtanum Rd. & Ahtanum Creek & 16th Avenue bridge replacements	O	H	County Roads/ Plan Depts
ST-4 Wide Hollow flooding between 64th and 101st – channel improvements and acquisitions – recommendations include those for Shaw Creek, plus regional retention	IP	H	FCZD/ Jurisdictions
ST-5 Resolve Shaw Creek relocation/overflow to remove community damages and insurance	S	H	FCZD/ Jurisdictions, Plan Depts.
ST-6 Wide Hollow relocation or overflow channel incorporated in future development and proposed infrastructure design in Union Gap	O	H	DOT/ Jurisdictions
ST-7 Improve grade for Spring Creek East to reduce flooding in Union Gap	O	H	DOT/ Jurisdictions
ST-8 Mill structure – Develop shelf ready open channel bypass design for grant application on, lower channel	O	H	FCZD/ Jurisdictions
Projects in City of Union Gap			
Projects in areas which route floodwaters overland			
ST-9 Reduce catastrophic flow captures at Mission (infrastructure and town impacts – Rutherford Road) and preventing avulsions into Hatton and capacity issues	S	H	FCD/Irrigators landowners, Plan Depts
ST-10 Flood design for John Cox diversion (new)	L	H	FCZD/Irrigators
ST-11 Make infrastructure improvements in Emma Lane area: o Remove abandoned fill and infrastructure in Emma Lane area to increase flood capacity and reduce redirection of flood flows o Widen bridge at 42nd Ave.	IP IP	M	FCZD/ Landowners Roads
ST-12 Evaluate not filling in the existing Ahtanum channel so it can be used for habitat if the creek is relocated near Emma Lane	IP	M	FCZD/ Landowners

STRUCTURAL (cont)			
Projects in City of Union Gap			
Projects in areas which route floodwaters overland			
Description	**Onset**	**Priority**	**Partners**
ST-13 Perform a cost-benefit analysis for stream relocation near Emma Lane	IP	M	FCZD
ST-14 Improve flood conveyance and predictability by reconfiguring modified or "perched" streams and establishing overflow channels if relocation is not feasible such as Shaw, and Emma Lane	L	M	FCZD
ST-15 Maintain Wide Hollow flood mitigation methods in Union Gap by retaining an overflow path along railroad right of way and encouraging development of an O & M agreement among appropriate parties for flood and fish structures the Mill	O	M	City of Union Gap
ST-16 Consider the following structural alternatives where changes in the channel threaten homes, businesses, agricultural land, or infrastructure. o Levees, armor, buffers, CMZ (channel migration zones) o Structural flood control measures either by individuals or government o Utilize "softer" solutions for bank stabilization, bio-engineering. o Levees constructed along perched channels (i.e. Cottonwood Grove)	L	L	FCZD/ Plan Depts
ST-17 Expand diking along Shaw Creek to protect new and existing development	L	L	Add Insurance Costs
ST-18 In some locations, add wood to stream to "catch" wood debris – this accomplishes multiple objectives – would benefit habitat as well as reduce the volume of woody debris that accumulates on bridges, diversions, and other structures.	O	L	FCZD
ST-19 Armoring: - Provide armoring of roads with act as levees (Ahtanum/Cottonwood Canyon Rd., etc.). - Armor road ditches where road fill is going to contribute to excess bedload and to protect road prism.	O	L	FCZD
ST-20 Culverts: - Recognize the limitations of culverts as flood conveyance structures - Replace old culverts with higher capacity culverts based on flood risk	O	L	FCZD & Jurisdictions Roads
ST-21 Identify sources of funding for removal of abandoned irrigation structures	O	L	FCZD & Agencies
ST-22 Preserve and restore natural floodplain in places that retain some of the floodplain function. Prioritization - allow for flexibility while identifying critical locations, based on CFHMP and mapping.	O	L	FCZD
ST-23 Install a remote control floodgate that could be opened some times of year, closed at others (on Spring Creek floodgate)	O	L	City of UG

Key: ONSET: C – Completed; IP – In Progress; S – Short Term; L – Long Term; AU – Awaiting Updates; O – Opportunity
PRIORITY: H – High; M – Medium; L – Low

STRUCTURAL (cont)			
Projects in City of Union Gap			
Description	**Onset**	**Priority**	**Partners**
ST-24 Protect natural floodplain functions in Shaw Creek's watershed, especially before it is mapped.	O	L	FCZD
PUBLIC OUTREACH			
PO-1 Information to public and local governments on New FEMA Maps	IP	H	FCZD/ Jurisdictions
PO-2 Outreach to public regarding flood hazard related to regulatory changes	IP	H	FCZD / Plan Depts
PO-3 Provide flood risk & regulatory constraints at beginning of development process	S	H	Plan Depts
PO-4 Outreach to Realtors, lenders, etc. about flood risks	S	H	FCZD
PO-5 Provide information to the general public and property owners to enhance their understanding of: specific flood risks, beneficial functions of floodplain, and aesthetic values of streams and floodplains for development	L	H	FCZD / Plan Depts
PO-6 Work with landowner assistance programs to improve appropriate streamside vegetation and provide information about flood resistant fencing	S	M	FCZD
PO-7 Utilize meetings and other methods of notification to inform developers and current and prospective residents about flood risks for Shaw Creek	IP	M	FCZD
PO-8 Encourage residents and property owners who are at high risk for flooding to purchase flood insurance even if they are not in a mapped floodplain	IP	M	Jurisdictions
PO-9 Provide public notice/disclosure/consultation about planned flood projects	O	M	Jurisdictions/ FCZD
PO-10 Provide information for the public about culvert maintenance and sizing	S	M	FCZD/Roads
PO-11 Yakima County Flood Control Zone District to provide technical assistance and comments regarding flood hazards and infrastructure design	IP	M	FCZD
PO-12 Encourage volunteer flood-watchers program to provide information	S	M	FCZD
PO-13 Cooperate with other agencies to support or develop public education programs, such as stream cleanup programs and volunteer monitoring.	IP	L	FCZD
PO-14 Encourage citizens to report dumping in streams (public outreach).	L	L	FCZD
FR-1 Designation of evacuation routes and notification of the public and first responders	S	H	YVOEM/Roads
FR-2 Implement and participate in activities for the Flood Response Plan	S	H	YVOEM/ Jurisdictions
FR-3 EOC environmental coordination	L	H	EOC/WDFW
FR-4 Determine where large numbers of animals may be kept during a flood event and distribute information to the public. Work with Emergency Management and Red Cross to establish animal food and shelter contingencies – discussions may include Central Washington State Fairgrounds, farm feed stores,	L	H	Conservation Authorities
FR-5 Coordination between Emergency Management and the Irrigation Districts such as AID and Yakima Valley Canal, for management during floods. Include Irrigation Districts in communications with the EOC	O	H	YVOEM/AID YVCCo

FLOOD RESPONSE			
Description	**Onset**	**Priority**	**Partners**
FR-6 Public and agencies coordinate flood fight and post flood actions with recommendations identified in the Ahtanum-Wide Hollow CFHMP to provide a good basis for decision whether to take emergency action	S	M	YVOEM
FR-7 Install gages on North Fork Ahtanum and Wide Hollow Creeks, including telemetry	O	M	FCZD
FR-8 Develop warning systems including mass media	L	M	YVOEM
FR-9 Identify known problem locations so information is available for first responders and include in the Flood Response Plan (if appropriate)	S	M	YVOEM/ FCZD
FR-10 Provide special flood phone line for public to call in and provide information about current flooding – EOC & FCZD cooperate/coordinate	L	M	YVOEM/ FCZD
FR-11 Improve access to Bachelor diversion during floods without diverting flood waters or making flood problems worse	L	M	Irrigators/ BOR
FR-12 Improve communication, coordination and information dissemination between various agencies and emergency management office during flood emergencies	IP	M	YVOEM
FR-13 Coordinate between jurisdiction procedures in place for expedited permit issuance during and period after a flood event under State and County regulations.	O	L	OEM, Jurisdictions, Agencies, FCZD
FR-14 Outline emergency response to ice jams in the Flood Response Plan. - Alert residences at risk. (new) - Blast ice jams – (normally only done on very stable ice jams) Facilitate regulatory approval by Ecology and Fish & Wildlife and local jurisdictions due to short time frame. (new)	O	L	FCZD/Agencies
FR-14 Outline emergency response to ice jams in the Flood Response Plan. - Alert residences at risk. (new) - Blast ice jams – (normally only done on very stable ice jams) Facilitate regulatory approval by Ecology and Fish & Wildlife and local jurisdictions due to short time frame. (new)	O	L	FCZD/Agencies

Key: ONSET: C – Completed; IP – In Progress; S – Short Term; L – Long Term; AU – Awaiting Updates; O – Opportunity
PRIORITY: H – High; M – Medium; L – Low

Mapping Tools

The recently released (2011) Preliminary FIS maps for the 100 year flood increase awareness of flood hazard. From the extent and nature of the flooding portrayed on the FEMA maps it is evident that, despite the implementation of this plan, infrequent flood events such as the 100 year (1% chance of annual flooding) event will continue to affect large areas, causing substantial damage and economic disruption. Frequent floods, from a five year interval up to the 25 year flood, produce the majority of property damage and economic disruption to the community over time. As part of this plan, 10 and 25 year flood maps are provided that can serve as guidelines for future infrastructure planning.

Preferred Implementation Order for Recommendation Categories

The Inventory and Study recommendation category should be implemented first as the topics they cover increase awareness of flooding problems, problem causes and locations, and may amend other recommendations. In particular the high priority recommendations have been pursued by the FCZD to facilitate other recommendations.

The inventory results may change the focus of, or add to, some of the Planning and Regulatory, Maintenance, and Structural recommendations, so that maximum public benefit can be attained at reduced costs. Several of these inventories, including problem bridges, and the effects of Drainage Improvement District facilities (DIDs) will improve management of floods and allow tracking of changes to the basin into the future.

Recommendations to minimize future damages for new development require Planning and Regulatory recommendations due to the widespread flooding nature (generally shallow) of major floods (i.e., in the order of the 100 year), the general inability of structural measures to remove such large affected areas from flooding, the relative effect of minor changes to the landscape (fences, roads, emergency flood berms) on flood routing and potential flood damage, and the impracticality of halting development or re-development on large tracts of land.

For existing development floods between the 10 and 25-year return period frequency will cause the majority of long term property damage and economic disruption to the community. For these floods, which are more frequent than the 100-year flood, which generally occur in the areas adjacent to stream and river channels, versus the overflow paths, the Maintenance and Management plus the Structural recommendations will provide the highest return. The plan has developed and provided flood maps for 10 and 25 year flood levels in Appendix J and sediment removal guidelines in appendix G to enable the communities to guide these recommendations.

Reducing future and current damages across the range of flood events will require a combination of modified design guidelines and standards, land use zoning, related planning methods, flood response and channel maintenance.

Cornerstone to these mitigation recommendations is community involvement and a cooperative approach involving agencies and the public. Recommendations for this element are contained in the Public Outreach.

Implementation Strategy

The purpose of a CFHMP is to propose a suite of actions that will reduce flood hazards over both the short and long term. In order to develop a long term strategy it was necessary to understand the underlying causes and obstacles to overcome. The most relevant new understanding attained during development of this plan, apart from the large extent of flooding, was the pervasive and historic nature of floodplain and channel modifications to suit agricultural practices and the legacy that alteration presents for future urbanization of the floodplains.

The greatest return on investment is to increase flood hazard awareness. Public Outreach recommendations, including distribution of this Plan, will extend the awareness of past and future floodplain changes. Development of the Plan increased awareness of information needs to fill data gaps, therefore, the Inventory recommendations received the highest implementation priority.

Answering what and why certain actions will be effective are the critical components of an implementation strategy for the plan. The answers to these questions differ for new and existing development. For new development, a higher priority is placed on Planning and Regulatory recommendations. For existing development, a significant specific issue is channel sediment and invasive vegetation, and the need for a maintenance program to manage their effects. Studies to quantify the impacts of sediment at bridges and in the channels have been initiated as a result of this Plan (Appendix G) so that Maintenance recommendations can be more effective.

Recommendations for structural alternatives primarily act to route more water into the main channels and transfer flow capacity issues from one location to another, where channel capacity should be higher and impacts less. Many of the recommended structural projects are located in the Urban Growth Areas and should be implemented sooner rather than later – before development precludes the opportunity for these structural alternatives and flood hazard conditions are fixed in place. Some of the structural recommendations in the plan address critical locations in these watersheds where overflow paths for large floods originate. These overflow points are usually activated during frequent floods. Once identified, the projects focus on these locations to reduce the frequent chronic, wide spread flooding.

Other structural recommendations are located in already urbanized areas, and will be implemented in conjunction with planned infrastructure or redevelopment activities as the opportunity arises.

The most economic action after the provision of selected Inventory recommendations is to translate the new awareness into design and planning guidelines and building restrictions that mitigate flood effects. Jurisdiction planning measures should acknowledge the legacy of agricultural conversion of floodplains to more flood-prone development. Building code revisions that reduce future economic burden to the citizens through flood insurance reduction should be pursued to avoid subsidizing other more flood prone communities.

The next most economical action is to address existing flood issues specific to a cause through wider actions such as channel maintenance.

The most expensive category is to address existing flood issues specific to a location. Structural projects are typically very expensive; however, projects should be addressed as soon as practical before the land is overdeveloped or under urbanization development pressures. Structural projects, such as levees, also require maintenance that is a continual commitment of resources, making them the least financially attractive. In most cases the structural measures are more suited to 10 and 25–yr floods as they encompass the majority of the community losses, as determined through economic analysis.

A Funding Strategy is presented in Chapter 12.