APPENDIX: CHANNEL MIGRATION RISK REDUCTION

Contributed by Jesse K. Noone of the DLCD

TABLE OF CONTENTS

LIST OF FIGURES

1.0 INTRODUCTION

1.1 Purpose

The purpose of this appendix is to identify community-driven strategies for reducing risk associated with future channel migration. DOGAMI's and DLCD's intention is that these strategies will aid the CTUIR; Umatilla County and the Cities of Echo, Hermiston, Pendleton, Stanfield, and Umatilla officials and staff; the Umatilla County Soil and Water Conservation District; the McKay Creek Partnership; the Middle Umatilla River Coalition; other groups, community leaders, and residents or other individuals in using the CMZ maps published in this report. Knowing where channel migration is likely to occur allows communities and landowners to make land use and development decisions within CMZs to avoid loss of life, reduce risk to property, and care for the health of the river and watershed.

For the purposes of this report, the term "partners" refers to those entities listed in the previous paragraph and others who become involved in channel migration risk reduction projects with them. Other project partners may include, but are not limited to, the Umatilla Basin Watershed Council, the Umatilla Water Control District Collaborative, landowners, irrigators, associations, and other organizations.

1.2 Channel Migration Risks and Benefits

To develop strategies for reducing risk from channel migration, we must first understand what risks channel migration poses as well as the benefits it bestows. Undertaking channel migration risk reduction strategies that interfere with, or nullify, its benefits would constitute an imprudent use of scarce resources.

1.2.1 Channel Migration Risks

Although channel migration is a type of flood hazard, its impacts differ from those caused by floodwaters inundating land and structures. As the river changes its course, areas potentially impacted by flooding also change. Common risks include:

- **Loss of land:** Fluvial erosion is the natural process by which soil, vegetation, and sediment along the bed and banks of a river are worn away by flowing water. This process may unfold gradually over decades or occur rapidly during floods, when the river exerts greater force. Human activities, such as channel straightening and removal of woody riparian vegetation, increase the erosive power of the river and decrease bank strength, which can increase the rate of erosion locally or downstream of the modified area.
- **Damage to homes, businesses, and industries:** Channel migration can impose significant costs on individuals and communities when homes are undercut by bank erosion making them uninhabitable; transportation routes are impassable, stopping schools and commerce; agricultural lands are lost to erosion; and irrigation and other infrastructure is damaged. Protecting floodplain development from erosion through revetments or other bank stabilization measures can also be costly.
- **Damage to critical infrastructure:** Channel migration can cause damage to roads, culverts, bridges, water treatment facilities, utility lines, and other critical infrastructure, which can pose a major risk to human and environmental safety. Evacuation routes may be cut off during a flood; power and communication lines may be disabled; and contaminated water can enter the river.

These impacts increase vulnerability and prolong effective recovery. Limited funding delays permanent fixes to critical infrastructure, stifling economic recovery and reducing social resilience. Debris and sewer pipeline breaks create public health hazards. Other utilities that are constructed underneath or along the banks of rivers, such as gas pipelines or communication cables, may also be vulnerable to channel migration.

- **Damage to critical facilities and lifelines:** The continued operation of, and access to, critical facilities is essential for maintaining public health, safety, and welfare during and after a flood. Channel migration can damage critical facilities and lifelines, such as hospitals, shelters, and evacuation routes, putting more people in danger and hampering a community's ability to recover quickly. Areas serving vulnerable populations, such as schools and assisted living facilities, should be assessed for channel migration risk, as these populations will need additional time and resources to reach safety during a flood.
- **Loss of life:** Channel migration rarely directly causes a loss of life. However, when a river erodes through a road or levee, or the channel rapidly avulses, evacuation routes can be cut off, which may strand people in dangerous locations and put them at greater risk of drowning. Development within the High EHAs and AHAs are at greatest risk of these impacts. During the 2020 Umatilla floods, one person lost their life after being swept away by floodwaters; however, no fatalities were directly caused by channel migration.

1.2.2 Channel Migration Benefits

While channel migration presents numerous risks, it can also provide significant benefits, particularly for local ecology, flood management, and the overall health of the river, floodplain, and surrounding communities.

- **Ecological benefits:** Channel migration can increase habitat complexity. It does so by recruiting gravel and woody debris to the river, promoting vegetation succession, and reconnecting old or creating new channels, pools, and wetlands across the floodplain. These features provide essential spawning and rearing habitat for salmonids. Water flowing through floodplain gravels and alluvial aquifers contributes cooler water to the main channel, benefiting aquatic species. Additionally, channel migration removes existing riparian vegetation and allows for the succession of new growth in areas previously occupied by the channel, which supports dynamic and diverse ecosystem processes.
- **Flood mitigation:** Channel migration increases the connection between water in the channel and on the flood plain. During a flood, in areas with high floodplain connectivity, water can spread out across the floodplain, which slows the flow. By both allowing a river to access the floodplain and to dissipate energy through erosion and avulsions in upstream reaches, areas downstream will experience reduced channel migration and flooding.
- **Floodplain benefits:** Flooding and channel migration allows new nutrient-rich sediment to be deposited across the floodplain that fertilizes the soil and enhances farmland. Further, it can improve water quality by trapping pollutants and fine sediments on the floodplain.
- **Financial benefits:** Understanding and mapping CMZs allows landowners and local government, state, Tribal, and federal decisionmakers to plan for appropriate uses; setbacks and buffers; and facilitate best practices to conserve and restore the local ecology. Implementing appropriate land use and restoration practices will reduce the costs of repairing or replacing damaged structures. Using this knowledge in planning future development will significantly reduce the costs of channel migration risks by reducing exposure.

1.3 Methods

Umatilla County has a long and well-documented history of flooding and channel migration; residents are not unfamiliar with the repetitive nature of floods and river erosion and avulsion. Umatilla County, the City of Pendleton, and the CTUIR have developed numerous reports and action plans over the years addressing flooding and development in the floodplain. To begin developing recommendations for ongoing CMZ risk reduction, DLCD compiled and reviewed information from the following published reports:

- DOGAMI Channel Migration Zone Maps for Eastern Lane County, Oregon, McKenzie and Middle Fork Willamette River, (Appleby, 2024)
- Oregon Solutions and Sliver Jackets, Channel Migration Zone Regulatory Guidance Report, (Sclafani and Babcock, 2019)
- DOGAMI Channel Migration Zones StoryMap (2023)
- Birch Creek Action Plan (CTUIR, 2016)
- City of Pendleton McKay Creek Basin Study (Environmental Science Associates, 2024)
- CTUIR Hazard Mitigation Plan (Integrated Solutions Consulting, 2021)
- CTUIR Transportation System Plan (TSP) (2023)
- CTUIR Umatilla River Assessment and Action Plan (2025b)
- CTUIR Umatilla River Vision (Jones and others, 2008)
- Meacham Creek Watershed Assessment and Action Plan (Andrus and Middel, 2003)
- Meacham Creek Watershed StoryMap (CTUIR, [n.d.a])
- Report of Flood Fight Potential Sites in Umatilla County, Oregon (Gardenhire, 2000)
- Strategic Action Planning for Ecological Restoration Partnerships (OWEB, [n.d.a])
- Umatilla County Bank Restoration and River Resiliency Guidebook (UCSWCD, 2024)
- Umatilla County Natural Hazards Mitigation Plan (Umatilla County, 2021)
- Umatilla County Flood Insurance Study (FEMA, 2010)
- Umatilla County Flood Mitigation Plan (University of Oregon Community Planning Workshop, 1997)

In addition to reviewing these reports and their recommendations, DOGAMI and DLCD visited the study area to make direct observations (river, tributaries, topography, land use, built environment, etc.) improving their understanding of the physical context for channel migration risk and risk reduction.

During their visit, DOGAMI and DLCD held two small-group meetings, one with local government officials and the other with CTUIR officials to discuss their experiences with flooding and channel migration; their previous and current efforts to reduce risk; obstacles to reducing risk; and how those obstacles might be overcome. Local officials in attendance included the City of Pendleton's City Manager and the City of Echo's City Administrator; Umatilla County's Community Development Director/Floodplain Manager and Planning Division Manager; and the District Manager of the Umatilla County Soil and Water Conservation District. CTUIR's Senior Planner, Water Quality Specialist, GIS Manager, Fisheries Program Manager, and GIS Analyst from the Departments of Planning, Natural Resources, and Information Technology attended. The ODEM's Risk MAP Coordinator also attended.

DLCD followed these small-group meetings with three one-on-one interviews with the Umatilla County Emergency Manager, CTUIR Senior Planner, and the CTUIR DNR Habitat Conservation Project Leader.

DLCD also attended two meetings of the McKay Creek Partnership, a multi-agency collaborative group with representation from landowners, CTUIR, federal agencies (U.S. Army Corp of Engineers, National Marine Fishery Service, USBR, NWS, United States Fish and Wildlife Service, and the USDA Natural

Resources Conservation Service); state agencies (Department of State Lands, Oregon Department of Fish and Wildlife, Oregon Emergency Management, OWRD, and Oregon Watershed Enhancement Board); and local governments (City of Pendleton, Umatilla County, Umatilla County Soil and Water Conservation District, Lower McKay Creek Water Control District, and Inter-Mountain Education Service District).

"The partnership's goal is to balance three obligations: (1) the City of Pendleton's obligations to reduce flood risk to residents; (2) the U.S. Bureau of Reclamation's (USBR) contractual obligations to operate the McKay Reservoir for water rights holders; and (3) regulatory obligations to improve instream habitat for aquatic species. Findings from the McKay Creek Basin Study identified potential short-term and long-term solutions that would improve the security of city residents along lower McKay Creek from flood risk while addressing the need for water for irrigation and fish" (Environmental Science Associates, 2024, p. 1).

The first (in part) and third obligations refer to the limited ability of the Water Control District to continue regularly dredging a channelized portion of Lower McKay Creek due to its federal designation as critical habitat. Controlled flows from McKay Dam contribute sediment to this portion of the stream continuously. Without regular dredging, the sedimentation effectively raises the riverbed, resulting in reduced streamflow capacity and causing more frequent flooding.

DLCD and DOGAMI presented the completed CMZ maps with the content in this appendix at two final meetings, one virtual with CTUIR and one in person with local government officials and staff, and other involved parties.

1.4 Findings

During the group and individual meetings, participants identified habitat restoration, levee repair and removal, revegetation, strategic response stationing, better warning signage, and community awareness as potential projects. They shared concerns about the geographic scales and time frames for mitigation projects. Some projects might be appropriate at the watershed scale and others at the individual property scale. Some projects would be able to be done quickly, while others would require a much longer period to effect.

Of great importance to CTUIR is that all partners recognize the centrality of the river and the land in Tribal culture, and that caring for both in partnership will benefit all. The CTUIR staff hold deep traditional ecological and cultural knowledge and restoring the river's ecosystem is of paramount importance to their ability to continue to source traditional First Foods that sustain the continuity of the Tribes' culture. The CTUIR's First Foods mission is "To provide proactive planning and policy analysis and development to protect, restore and enhance the First Foods and the exercise of associated rights reserved in the Treaty of 1855" (CTUIR, 2020d).

DLCD provided meeting notes from both the local and CTUIR meetings to all meeting participants so they could review the conversations and identify areas of agreement as well as areas where additional collaboration and cooperation will be needed to reduce channel migration risk. Three common themes emerged:

- **Be good partners:** Continue productive working relationships among the local and CTUIR governments and private landowners. Understand the background of stakeholders and focus on shared interests. Build community through mitigation efforts.
- **Start from the present:** Acknowledge and accept the current built environment in designing mitigation and restoration projects.

- **Healthy streams, healthy communities:** Approach mitigation from ecological, structural, and social angles simultaneously. Mitigation of channel migration impacts must include ecological restoration. The stakeholder groups share the goal of ultimately achieving ecological health.

DLCD finds that these themes characterize the extensive execution of risk reduction projects that are already taking place throughout the Umatilla River's watershed.

DLCD further finds that risk reduction activities in the study area can be categorized into five focus areas. They are:

- Awareness and Education
- Partnership and Collaboration
- Land-Use Planning
- Structural and Nonstructural Mitigation
- Habitat Restoration

In addition, DLCD finds that task forces, action plans, and working agreements have proven to be effective in acquiring funding and accomplishing projects in the study area. Nevertheless, DLCD finds that various groups undertake projects with internal, but not external, coordination and collaboration, leading to a disconnected mix of valuable projects at assorted scales, over diverse time frames, and likely at greater cost.

DLCD's principal and most fundamental finding is that external collaboration and coordination among partners is essential to reducing cost and increasing effectiveness of channel migration risk reduction projects. Determining projects, prioritizing them, securing funding, and scheduling them such that they are located and sequenced to leverage each other would deliver the most effective risk reduction and healthy ecosystem functions with the least investment.

2.0 FOCUS AREA ASSESSMENTS

The purpose of this section is to assist the partners in advancing the channel migration work that they have done and are currently doing in each of the five focus areas: (1) Awareness and Education, (2) Partnership and Collaboration, (3) Land-Use Planning, (4) Structural and Nonstructural Mitigation, and (5) Habitat Restoration. Each focus area assessment begins with a discussion of the work in that focus area and suggests additional resources (as applicable). Next, DLCD identifies obstacles to risk reduction and potential actions for overcoming them, along with funding opportunities.

2.1 Awareness and Education

Community resilience improves when residents and landowners know where to find hazard information and understand how to use it to reduce risk. To increase awareness and education, local officials must provide ongoing updates about regional risk reduction efforts.

2.1.1 Previous and Current Work

In the wake of the 2019 and 2020 floods, community meetings increasingly focused on preparedness and restoration rather than recovery.

Outreach campaigns in the McKay Creek area have included mailers, newsletters, and information booths in McKay Park. Umatilla County, in partnership with the Umatilla County Soil and Water

Conservation District (UCSWCD) hosts open townhalls where residents can learn about recovery programs and receive updates on regional response efforts. UCSWCD, Oregon Department of State Lands, and the United States Army Corps of Engineers (USACE) have also hosted multiple permitting workshops throughout the county for bank stabilization and restoration projects. Additionally, Water Control Districts in the region host educational meetings in each community.

CTUIR and Umatilla County both maintain Emergency Management landing pages that provide preparedness resources and allow residents to sign up for the Umatilla County Emergency Alert System. CTUIR staffs an Emergency Response Team and shares response procedures through the news section on its government website. CTUIR also provides a landing page sharing relevant reports, data, assessments, and metrics related to restoration projects. DOGAMI hosts information on their website specific to CMZs, including past publications.

2.1.2 Key Resources

Key resources for supporting awareness and education include the following:

- DOGAMI Flood and Channel Migration (n.d.b)
- DOGAMI Channel Migration Zones StoryMap (2023)
- Flood Prevention and Response (City of Pendleton, [n.d.])
- Fisheries Habitat Program Reports and Data (CTUIR, 2025c)
- Our Work, Fish Habitat Restoration, (CTUIR, 2025d)
- Upper Sandy River Flood Resources, (Clackamas County, 2025)
- Stream Channel Migration Zones, (Washington State Department of Ecology, [n.d.])
- River Corridor Planning, Department of Environmental Conservation, (State of Vermont, 2025)
- Ready.gov/floods, (U.S. Department of Homeland Security, [n.d.])
- A River's Revival (Blue Mountain Land Trust, 2024)

2.1.3 Obstacles to Risk Reduction

One of the biggest challenges for maintaining public engagement is waning interest over time. Public attention is typically highest immediately following a hazard event. New landowners may be unaware of channel migration risks on their property without proactive communication from county, city, and CTUIR officials. They may also be uninformed about nearby risk reduction initiatives or the responsibilities of maintaining private bridges or crossing abutments.

Administrative capacity for continued outreach and fieldwork is limited without designated staff. High turnover within agencies can disrupt working relationships among CTUIR, local, state, and federal partners. This is particularly problematic when working with complex projects and agreements.

2.1.4 Strategies to Overcome Obstacles to Risk Reduction

The county, cities, special districts, and CTUIR governments may use the new CMZ maps in their outreach to show which areas are at risk from channel migration and flooding at the neighborhood scale. Small-scale, ongoing public engagement through open houses, school events, listservs, or phone updates can build community understanding of channel migration, its impacts and benefits, and how they can take action to mitigate their risks.

Awareness and education campaigns raise the visibility of successful risk reduction projects within the study area. Regular open houses where task groups provide updates, solicit voluntarism, and showcase progress will encourage public feedback, foster dialogue, and maintain focus on risk reduction.

Demonstrating how governments secure funding is a vital step in community education. A special district, such as the UCSWCD or the emerging Umatilla Water Control District Collaborative, could create a centralized website that houses all plans, studies, funding resources, and upcoming projects. This could mirror CTUIR's model of a landing page (Confederated Tribes of the Umatilla Indian Reservation Fisheries Habitat Program, 2025b) as well as the associated pages for their projects, assessments and action plans, (CTUIR, 2025b), and the Umatilla River Basin Fisheries Habitat Program mapping (CTUIR, 2025d). Alternatively, CTUIR and Umatilla County could collaborate to develop a public-facing GIS mapping interface of channel migration hazard areas and project progress.

2.1.5 Potential Funding Sources

Potential funding sources for supporting education and awareness include the following federal and state agencies, nonprofit organizations, and private foundations:

- Federal Flood Risk Management Resources (Silver Jackets, 2025)
- Oregon Silver Jackets (Silver Jackets, [n.d.])
- Readiness and Emergency Management for Schools (REMS) Technical Assistance Center (Department of Education, [n.d.])
- FEMA Continuing Training Grants (CTG) (2025c)
- Association of State Floodplain Managers (ASFM) Education and Outreach (2025)
- Community Emergency Response Team (CERT) Program (ODEM, [n.d.])
- ASFM Reduce Flood Risk (2022)
- National Coalition for Arts Preparedness and Emergency Response (NCAPER) (2025)
- Our Resilient Places, Meyer Memorial Trust (MMT) ([n.d.])
- National Association of Flood and Stormwater Management Agencies (NAFSMA) ([n.d.])
- Oregon Watershed Enhancement Board (OWEB) Engagement Grants ([n.d.b])

2.2 Partnership and Collaboration

According to Greenwood, Singer, and Willis (2021), one of the hallmarks of collaborative governance is its ability to cross jurisdictional boundaries to serve the needs and interests of all parties. It is designed to support participants in achieving shared goals. When used as a guiding principle in strategic action planning, collaborative governance encourages intergovernmental partnerships to pursue three key processes:

- Agreement seeking
- Collective action
- Collaborative systems

A Strategic Action Plan (SAP) succinctly communicates key information: vision, goals, geographic and temporal scope, ecological and social settings, strategies, and theory of change (Oregon Watershed Enhancement Board, [n.d.a]). An SAP serves as the blueprint for a partnership's work. Effective partnership among governments and community members requires cooperation and the identification of joint interests.

2.2.1 Previous and Current Work

Local and CTUIR governments in the Umatilla Basin have successfully developed task forces to implement SAPs for Birch Creek, Meacham Creek, Helix-Greasewood Creek, and McKay Creek. Common themes

across these SAPs include water restoration, enhancement of ecological processes, floodplain reconnection, fish habitat improvement, geomorphic stability, subirrigation improvement, and protection of adjacent landowner properties.

The McKay Creek Watershed Partnership's forthcoming McKay Creek Watershed Action Plan will support future grant applications and align with other SAPs in the Umatilla Basin. Project goals include two short-term design projects to protect local landowners by increasing flood control, as well as a 10-year vision plan to enhance flood resiliency in accordance with OWEB guidelines.

Following the 2020 flood recovery, the Middle Umatilla River Coalition (MURC) was formed as an association of concerned property owners in Echo and Reith. MURC collaborates with county, state, and federal agencies to protect property from future high-water events. One of MURC's goals is to streamline the permitting process by encouraging agencies to develop a unified set of regulations for instream work (McDowell, 2020). Their efforts have already resulted in a $200,000 FEMA Hazard Mitigation Grant Program award for a feasibility study from Reith to Highway 202, in coordination with CTUIR's Umatilla River Assessment and Action Plan (2025b).

CTUIR has demonstrated exceptional success with intergovernmental agreements, regularly partnering on projects involving cultural resources, habitat restoration, and floodplain management. In addition to working with Umatilla County, the City of Pendleton, and the ODOT on CTUIR lands, CTUIR's broad portfolio of executed projects reflects its diplomatic approach to building relationships for multi-benefit solutions. The development and implementation of the Birch Creek and Meacham Creek Action Plans represent successful collaboration with landowners and agricultural producers.

2.2.2 Key Resources

Key resources for supporting partnership and collaboration include the following:

- Strategic Action Planning for Ecological Restoration Partnerships (OWEB, [n.d.a])
- The Clackamas Partnership (2025)
- Columbia Basin Fish Accords (Three Treaty Tribes and FCRPS Action Agencies, 2008; Bonneville Power Administration, [n.d.])
- Umatilla Sub-Basin 2050 Water Management Plan (Umatilla County Critical Groundwater Task Force, 2008)
- Clackamas Basin Action Plan (Bauer and others, 2005)
- Harney Watershed Strategic Plan (Graham, 2021)
- John Day Basin Partnership - Strategic Action Plan (2018)
- Grande Ronde Assessment and Action Plans (Grande Ronde River Basin, 2025)
- Birch Creek Action Plan (CTUIR, 2016)
- Meacham Creek Watershed Assessment and Action Plan (Andrus and Middel, 2003)
- Meacham Creek Watershed StoryMap (CTUIR, [n.d.a])

2.2.3 Obstacles to Risk Reduction

A lack of comprehensive funding creates discontinuity between projects. Limited administrative resources hinder the ability to implement multiple initiatives simultaneously, resulting in gaps in project management and grant writing. The presence of numerous funding streams can also strain staff capacity and reduce overall effectiveness.

Building strong relationships between staff from different agencies takes time. Employee retention is critical to maintaining these working relationships and supporting complex intergovernmental agreements. Securing formal agreement on action plans requires alignment across multiple agency

missions, and the work must be significant enough to justify the effort needed to develop interagency agreements.

The cost of inaction, however, can be exponential, both in terms of future financial investment and continued exposure to disaster. The financial merit of executing projects when they are first identified often outweighs the cost of delays. For example, David Evans and Associates identified the Thornhollow Bridge as structurally deficient in its 2001 Transportation System Plan (TSP), with an estimated replacement cost of $36,000. Despite support from Umatilla County, the Bureau of Indian Affairs (BIA), and CTUIR, no action was taken (David Evans and Associates, 2001). The bridge was ultimately washed out during the 2020 floods. Reconstruction began in 2025 with an estimated cost of $5.3 million and is expected to be completed in 2026 (Oregon Department of Transportation, 2025).

2.2.4 Strategies to Overcome Obstacles to Risk Reduction

The region recognizes the need to synthesize strategies that deliver multi-benefit solutions for both fish habitat and channel migration protection. CMZ mapping will help prioritize areas where channel migration risk reduction strategies are most needed.

Risk reduction strategies outlined in published action plans and NHMPs facilitate or establish eligibility for grant funding. Agencies that collaborate on planning efforts enhance their capacity and technical expertise. Further, funders often prioritize project awards to collaboratives rather than to individual entities. Memoranda of Understanding and Intergovernmental Agreements foster coalition building through joint ownership of problems, balanced participation, and a shared willingness to address conflict (Greenwood and others, 2021).

The McKay Creek Watershed Action Partnership is a current example of a collaborative model that can be replicated for long-term partnerships. Focused Investment Partnership (FIP) Implementation Grants provide up to $12 million over six years for high-performing partnerships with an existing SAP and readiness to implement projects.

Oregon Solutions has proven to be an asset in collaborative problem solving in the region. Their involvement in SAP planning and project development could unlock greater state support and funding opportunities. Oregon Solutions assists with project formation, identifies financial contributions from each party, and supports implementation by providing a dedicated project manager. The Greater Eastern Regional Solutions Team is designed to bring together representatives of different sectors to respond to emerging local needs through collaborative governance.

A project champion is essential to moving projects forward. Individual leadership fosters trust and continuity among agencies. Umatilla County could collaborate with CTUIR to establish joint leadership in collaborative governance. A clearly defined mission and goals paired with strategies that reflect stakeholder values will motivate joint participation and sustained engagement.

2.2.5 Potential Funding Sources

Potential funding sources for supporting partnership and collaboration include the following federal and state agencies and programs:

- OWEB Focused Investment Partnerships (FIP) Grants ([n.d.c])
- FEMA Cooperating Technical Partners Program (CTP) (2021)
- FEMA Hazard Mitigation Assistance Grants (HMA) (2025d)
- U.S. Fish and Wildlife Service North American Wetlands Conservation ([n.d.])
- Oregon Solutions (Portland State University, 2025)
- Greater Eastern Regional Solutions Team (Office of Oregon Governor, [n.d.])

2.3 Land-Use Planning

CMZ maps are nonregulatory and are not shown on FEMA's FIRMs. FIRMs are the basis for flood risk ratings and flood insurance policies under the National Flood Insurance Program (NFIP). However, CMZ maps clearly highlight where the river has migrated beyond the regulatory floodplain boundaries shown on FEMA's FIRMs. Using both the FEMA FIRMs and the CMZ maps in land-use planning would enable government entities to protect people, property, and the river ecosystem from harm by locating appropriate landuses, especially critical facilities, outside of the floodplain and CMZs.

2.3.1 Previous and Current Work

Umatilla County and CTUIR have a strong history of conducting flood studies and implementing mitigation measures. The county, its incorporated cities, and CTUIR all participate in the NFIP and maintain active NHMPs that assess flood risk and vulnerabilities of critical facilities. The 1997 Umatilla County Flood Mitigation Plan emphasized the need to identify and prioritize areas across the county for a range of mitigation efforts on a watershed scale. The 2023 CTUIR TSP identifies flood remediation for critical facilities along Confederated Way as a high priority that may include building a levy, raising the roadway, creating water retention areas, and rerouting the roadway.

Watershed planning supports floodplain management. CTUIR provides the basis for a comprehensive management approach through its Umatilla River Assessments and Action Plan. The 2024 McKay Creek Basin Study was the catalyst for the formation of the McKay Creek Watershed Action Partnership.

2.3.2 Key Resources

Key resources for land-use planning include the following:

- Channel Migration Regulatory Guidance Report (Sclafani and Babcock, 2019)
- A Framework for Delineating Channel Migration Zones (Rapp and Abbe, 2003)
- State of Vermont River Corridor Protection – Regulatory Approaches (Kline and others, 2007)
- The Community Rating System, (FEMA, 2025a)

2.3.3 Obstacles to Risk Reduction

The financial burden of flood damage is significantly worse for those who are uninsured (Amornsiripanitch and others, 2024). However, participation in the NFIP is declining in Oregon and over a quarter of claims from 1978–2024 have come from owners of properties located outside the floodplain (Reed College, 2025). CMZ maps highlight risks beyond FEMA's floodplain mapping and assist homeowners and county officials in addressing the protection gap.

To perform any work below the ordinary high water mark, an individual or entity must obtain permits from at least four different federal, state, and local agencies along with their local jurisdiction for most fill and removal projects (UCSWCD, 2024, p. 5-1). Within CTUIR reservation boundaries, additional permitting requirements apply. The complexity of agency approvals and administrative processing delays project implementation and increases costs.

Conflicting requirements between irrigation needs and fish habitat protection have increased flood risk for landowners throughout the study area. In lower McKay Creek, chronic bank erosion and sediment deposition have occurred, but sediment removal is restricted due to the designation of critical habitat (Environmental Science Associates, 2024, p. ES-1). This reduction in channel capacity heightens flood risk for adjacent landowners. All waterbodies in Umatilla County, except the reaches of Cold Springs and

McKay Creek above their respective dams, are designated as Essential Fish Habitat (UCSWCD, 2024, p. 5-1).

2.3.4 Strategies to Overcome Obstacles to Risk Reduction

For the past 50 years, FEMA has determined and mapped floodplain boundaries for publication on FIRMs. While the NFIP addresses riverine flood risks, it does not account for erosion or channel migration hazards. The partners could use these CMZ maps together with FEMA's FIRMs to obtain a more realistic understanding of the current river dynamics in the study area.

Because channel migration can undercut riverbanks and destabilize structural foundations, the NFIP's required elevation standards are insufficient to reduce risk from channel migration. Actions that limit exposure to channel migration and clearly communicate the associated hazards, particularly when addressing existing or nonconforming structures within CMZs, would be much more effective (Sclafani and Babcock, 2019).

Further, the partners could determine whether undertaking channel migration risk reduction activities would justify participation in the NFIP's Community Rating System (CRS). The CRS is a voluntary incentive program that offers discounted flood insurance premiums to those who have NFIP insurance policies in communities that implement certain flood risk reduction measures beyond the minimum required by the NFIP. Communities may earn insurance rate discounts of 5–45 percent based on their CRS classification, averaging $162 annually per policyholder (FEMA, 2025b). These discounts apply uniformly to all NFIP policies, whether the insured structure is located within a regulated floodplain or not.

CMZ maps support refinement of development ordinances and codes, inform the placement of conservation easements and transfer of development rights, and help prioritize areas for land acquisition, conservation, and restoration. This study will provide the basis for strengthening flood risk assessments for both Umatilla County and CTUIR in their next NHMP updates and for supporting associated revisions to land-use policies and development regulations.

Umatilla County Soil and Water Conservation District's (UCSWCD's) *Bank Restoration and River Resiliency Guidebook* (2024) outlines application processes and regulatory contacts for various project types. Local governments, CTUIR, and individual landowners could consolidate permits for specific CMZ and flood mitigation projects. CMZ maps will help identify high-risk areas, pinpointing the agencies and landowners involved and identifying the appropriate permitting pathways.

Finally, the government partners could establish a river corridor within which the channel is allowed to freely migrate, store floodwater, and naturally reduce velocity and peak flood heights.

2.3.5 Potential Funding Sources

Potential funding sources for supporting partnership and collaboration include the following federal and state agencies and programs:

- OWEB Focused Investment Partnerships (FIP) Grants ([n.d.c])
- FEMA Cooperating Technical Partners Program (CTP) (2021)
- FEMA Hazard Mitigation Assistance Grants (HMA) (2025d)
- U.S. Fish and Wildlife Service North American Wetlands Conservation ([n.d.])
- Oregon Solutions (Portland State University, 2025)
- Greater Eastern Regional Solutions Team (Office of Oregon Governor, [n.d.])
- Technical Assistance Grants, DLCD ([n.d.])
- Emergency Watershed Protection, Natural Resources Conservation Service ([n.d.a])
- Land and Water Conservation Fund, Oregon Parks and Recreation ([n.d.])

- Planning Assistance to States, USACE ([n.d.])
- Agricultural Conservation Easement Program – Oregon Natural Resources Conservation Service ([n.d.b]

2.4 Structural and Non-Structural Mitigation

Structural mitigation includes the relocation of buildings, transportation routes, utility lines, and other infrastructure out of the CMZ; bank protection and stabilization (armoring, sheet piling, boulder or root wad revetments, engineered rock groins, live cribwalls, toe protection, etc.); channel modification (straightening, channelization, grade control structures); levee, road, culvert, railroad embankment, or bridge abutment maintenance, removal, or relocation; and drainage systems. Employing certain structural channel migration mitigation strategies may cause unintended consequences downstream.

In addition to the other focus areas (Awareness and Education, Partnership and Collaboration, Land-Use Planning, and Habitat Restoration), nonstructural mitigation includes land and riparian vegetation conservation (including easements), zoning, CMZ policy, insurance, and emergency preparedness.

2.4.1 Previous and Current Work

The Umatilla Watershed Council participants are strong contributors to mitigation projects in the region (Umatilla Basin Watershed Council, 2024). The Umatilla Watershed Council has been involved in the following structural and nonstructural mitigation actions:

- Levee removals in Birch and Meacham Creeks
- West Birch Creek and Stanley Creek fish passages
- Westland Irrigation District and Umatilla County Infrastructure Modernization Project (Farmers Conservation Alliance, 2021)
- Business Oregon Echo Levy Project (UCSWCD, 2025)
- Culvert repair and removal
- Homer Diversion Dam removal
- Reith Dam removal
- Revegetation in lower Umatilla River and the Oxbow Property

2.4.2 Obstacles to Risk Reduction

Following the 1964–1965 floods, the USACE was authorized to construct levees along the Umatilla River near Echo using emergency funding. However, because of the way these levees were funded, long-term maintenance responsibilities fell to adjacent property owners, and USACE was no longer authorized to maintain them (McDowell, 2020). Levees that are not maintained cannot be accredited by FEMA and therefore are incorporated into flood models (FEMA, 2006). In other words, they are shown on FEMA's FIRMs as areas subject to flooding rather than protected from it. Ensuring levees can be accredited by FEMA is essential not only for reducing flood risk but also for maintaining eligibility for specific funding opportunities.

The USBR is contractually obligated to provide water rights to downstream irrigators at specific flows. Construction on McKay Dam, completed in 1927, supplied water to the Stanfield and Westland Irrigation Districts. The reservoir has an active capacity of 71,534 acre-feet (88,236,000 m^3), of which 6,000 acre-feet (7,401,000 m^3) is used exclusively for flood risk management (Gatlin, 2025).

Since the Umatilla River altered its course in 2020 (McDowell, 2021), erosion has increased, particularly in Echo, where landowners have experienced significant riverbank scouring and land loss. Long-term flood mitigation is needed to prevent losses over time.

2.4.3 Strategies to Overcome Obstacles to Risk Reduction

CMZ maps can highlight levees and areas of concern to guide structural mitigation projects. Local landowners can be consulted on how the river has altered their property and develop appropriate risk reduction strategies. The 2021 Umatilla County NHMP includes long-term flood mitigation strategies such as:

- Identifying responsible parties for operation and maintenance
- Evaluating the condition of levees and prioritizing them for repair or replacement

CMZ maps also identify areas likely to migrate outside FEMA's regulatory floodplain. These areas can be cross-referenced with past flood events to inform short-term emergency preparedness projects, such as:

- Installing high-water mark signage
- Establishing stream gauge alert systems
- Strategically staging sandbags and emergency equipment

Additional actions CMZ maps can support include:

- Completing a detailed risk assessment that identifies buildings, transportation infrastructure, culverts, utility lines, and other infrastructure that are at risk from channel migration. This infrastructure can either be relocated or protected using bank stabilization measures to protect them.
- Adding setback levees to contain floodwaters.
- In areas where the river has been channelized and straightened, reconnecting the river to its original floodplain and reconnecting side channels to improve floodplain connectivity and reduce downstream erosion.
- Installing LWD in the stream.
- Using the inventory of existing berms and levees identified in Yuh and others (2024).

The Oregon Silver Jackets, funded by the USACE, is a state and federal interagency group that partners in nonstructural flood risk management efforts. These include review of CMZ policies, real-time flood assessment tools, and response plan templates. The Oregon Silver Jackets may have resources or information to consider in developing structural and nonstructural mitigation projects.

2.4.4 Potential Funding Sources

Potential funding sources for supporting partnership and collaboration include the following federal and state agencies and programs:

- OWEB Focused Investment Partnerships (FIP) Grants ([n.d.c])
- FEMA Cooperating Technical Partners Program (CTP) (2021)
- FEMA Hazard Mitigation Assistance Grants (HMA) (2025d)
- U.S. Fish and Wildlife Service North American Wetlands Conservation ([n.d.])
- Oregon Solutions (Portland State University, 2025)
- Greater Eastern Regional Solutions Team (Office of Oregon Governor, [n.d.])
- Technical Assistance Grants, DLCD ([n.d.])

- Emergency Watershed Protection, Natural Resources Conservation Service ([n.d.a])
- Land and Water Conservation Fund, Oregon Parks and Recreation ([n.d.])
- Planning Assistance to States, USACE ([n.d.])
- Agricultural Conservation Easement Program

2.5 Habitat Restoration

2.5.1 Previous and Current Work

CMZ maps complement established basin studies, action plans, restoration guides, and river assessments by helping to prioritize projects based on channel migration risk. CTUIR has identified habitat restoration opportunities at the watershed scale, focusing on priority salmonid habitat and historic floodplain areas. A key goal is to transition land out of production and into restoration where feasible. Through land acquisition and conservation easements, tributaries of the Umatilla River are being reconnected to its floodplain. Restoration actions include levee removals, riparian revegetation, LWD additions, restoring a modified channel to its natural location with off-channel and side-channel habitat, and the restoration of ponds and wetlands. The objective is to identify areas with potential for multi-benefit solutions that support landowners, irrigators, and fish habitat. All restoration actions are intended to improve one or more River Vision Touchstones: hydrology, connectivity, geomorphology, riparian vegetation, or native fish (biota) (Jones and others, 2008).

These actions have restored floodplain processes, which in turn have reduced downstream flooding and improved instream habitat for native fish. In addition, this leads to cooler surface water temperatures, increased groundwater and subirrigation, reduced turbidity and streamflow velocity, greater ponding and stream meandering, and greater overall rearing habitat and biodiversity where projects have been executed.

The Umatilla River Vision (Jones and others, 2008) and the Umatilla River Assessment and Action Plan (CTUIR, 2025b) provide place-based strategies for restoring floodplain function, water quality, and First Foods for subsistence as a cultural strategy for natural resource management. The Action Plan further provides a template for successful complex collaboration of numerous agency stakeholders and local representation.

In Umatilla County, the CTUIR Fisheries Habitat Program has improved approximately 1,200 miles (1,900 km) of streamflow and restored 690 acres (2.8 km^2) of floodplain (CTUIR, 2025a). Since 2006, CTUIR has restored floodplain processes along more than 6.6 contiguous miles (10.6 km) of Meacham Creek, enhancing an additional 3.3 acres (13,000 m^2) of wetlands. Restoration work continues and is showcased in a publicly available StoryMap. The Society for Ecological Restoration recognized the Meacham Creek restoration project as Project of the Year in 2020 (2019).

CTUIR and its Fisheries Habitat Program provide a model resource for maintaining data and reports, housing assessments and action plans, and visualizing project progress in their mapping. Their StoryMap provides accessible information for the public.

2.5.2 Obstacles to Risk Reduction

Key obstacles to habitat restoration include:

- Long project timelines and permitting processes, which can lead to rising costs, reduced landowner interest, and difficulty connecting projects due to constrained resources
- Lack of partnership development, which limits capacity and slows implementation
- High cost of nature-based solutions and the ability to secure funding in a timely manner

- Scattered land ownership and use adjacent to a given river or tributary increases the challenge of coordinating restoration
- The development of the built environment impeding access to reconnect tributaries to the floodplain
- Insufficient communication and outreach with landowners, which can hinder buy-in and delay restoration efforts

These challenges can stall progress and reduce the effectiveness of restoration strategies, especially when projects are not aligned or coordinated across jurisdictions.

2.5.3 Strategies to Overcome Obstacles to Risk Reduction

Strategic action planning through multi-agency partnerships has proven to be an effective approach for implementing researched solutions. Continued outreach and awareness campaigns can help communicate the benefits of habitat restoration to landowners and stakeholders in the study area.

According to the Umatilla River Vision (2008), in the mainstem Umatilla River, habitat restoration efforts should focus on: (1) restoration and maintenance of normative flow regimes (baseflow, peak flow, and flow recession patterns); (2) hydrologic connectivity of the floodplain with the channel, including reversal of past channelization and, where feasible, removal of artificial structures (e.g., dikes and levees) that constrain channel migration; (3) protection of floodplain plant communities; and (4) re-establishment of keystone species, such as beaver, on the floodplain (Jones and others, 2008).

The Umatilla River's tributaries are generally less developed and are prime fish spawning habitat. Focusing restoration efforts on tributaries will increase floodplain capacity, slow flood waters, and improve in-stream, riparian, and terrestrial habitat.

2.5.4 Potential Funding Sources

Potential funding sources for supporting partnership and collaboration include the following federal and state agencies and programs and private trust foundations:

- National Wildlife Federation America the Beautiful Challenge ([n.d.])
- USFWS North American Wetland Conservation ([n.d.])
- The Wildhorse Foundation ([n.d.])
- OWEB Restoration Grants ([n.d.d])
- Oregon Department of Fish and Wildlife Private Forest Accord Grant Program (2024)
- The Freshwater Trust Blue Sky Habitat Fund (2025)

3.0 RECOMMENDATIONS

Consistent with the findings, DLCD commends the partners for the extensive work they have already done and are currently doing to reduce risk and restore ecological health in the study area, including organizing task forces and long-term working groups, developing action plans, formalizing working agreements, and building relationships with individual landowners.

DLCD recommends taking this model to the next level by coordinating the numerous groups working in the study area under a single "umbrella" collaborative. Such a structure would reduce costs and increase the effectiveness of risk reduction and ecosystem health actions by providing a foundation for organizing projects and leveraging funding such that project results are greater than the sum of their parts.

The purposes of the umbrella collaborative would be to (1) coordinate current and future risk reduction and ecological health improvement plans and projects into a single Comprehensive Strategic

Action Plan for Channel Migration Risk Reduction and Riverine Ecosystem Health (CSAP) for the study area and (2) facilitate support among partners for securing funding and completing the plans and projects.

This strategy promotes the partners' agreed principle of achieving multi-benefit solutions, allowing all to succeed. Further, the Umatilla County Council has taken recent actions that support this strategy:

- Formalizing a single point of contact, or Flood Coordinator role, for interagency agreements, plan guidance, and landowner consultation (Umatilla County Council, 2023)
- Supporting a collaboration of regional Water Control Districts—Lower McKay Creek Water Control District, Lower Umatilla River Zone 2 Water Control District, Birch Creek Water Control District, and Milton-Freewater Water Control District—to pool resources for outreach, trainings, and general education (Umatilla County Council, 2025)
- Providing Letter of Support for a General Investigation (GI) study for the Nursery Reach of the Walla Walla River (Umatilla County Council, 2025)

DLCD recommends a two-phase implementation sequence.

3.1 Phase 1: Establish the Umbrella Collaborative

Phase 1 establishes the umbrella collaborative. This process is described in **Figure 3-1**. Oregon Solutions or the Regional Solutions Team could be engaged to assist in recruiting partners and establishing working agreements. Establishing the umbrella collaborative has two steps:

1. Identify at least one "champion" among the partners who is committed to establishing and maintaining the umbrella collaborative and ensuring the successful completion of its selected projects.
2. Ensure the umbrella collaborative has the necessary professional support for success, including:
    - A professional facilitator to work with the partners to produce the CSAP and review and adjust it from time to time as necessary
    - A professional project manager to ensure the CSAP is accomplished on time and within budget
    - A professional land-use planner to ensure coordination of the many partners' plans
    - An official record-keeper to continually document institutional knowledge, minimizing disruption from turnover among partners

Figure 3-1. Phase One: Establish the umbrella collaborative.

3.2 Phase Two: Develop the CSAP

Phase 2 develops the CSAP and is described in **Figure 3-2**. Phase 2 consists of three sub-phases:

1. Coordinate current plans and activities.
    - Partners would identify their current and funded projects and identify opportunities for collaboration and coordination to enhance projects and leverage funding.
2. Identify and prioritize projects.
    - Partners would identify planned and unfunded projects.
    - Partners would identify new projects to enhance and augment current and funded projects and fill gaps for more complete risk reduction and enhanced ecological function.
    - Partners would agree on a final list of projects that are necessary to accomplish.
    - Partners would prioritize current, funded, and new projects together.
3. Identify funding and optimize timelines.
    - Partners would identify potential funding sources for each project and establish timelines for securing funding, from application to receipt.
    - Partners would establish the optimal sequence and timelines for completing each project, not only for ecological health outcomes, but also for leveraging funding and other resources.

DLCD recommends that the CMZ maps produced in this study, the Umatilla County Bank Restoration and River Resiliency Guidebook (2024), and CTUIR Umatilla River Assessment and Action Plan (2025b) serve as foundational documents for identifying and prioritizing the projects in the CSAP for channel migration and riverine ecosystem health.

DLCD also recommends employing focus area assessments in developing the final project list, determining project priorities, and obtaining funding to accomplish them.

Figure 3-2. Phase Two: Develop the CSAP

In terms of funding, DLCD recommends that the umbrella collaborative pursue a Focused Investment Partnership (FIP) through the Oregon Watershed Enhancement Board (OWEB). Established via state statute, OWEB's FIP program supports existing partnerships in enhancing collaboration, developing SAPs, and building community. Applications are solicited once each biennium (two years) and support partnerships over the course of three biennia. Actions that would support an FIP application include:

- Using the focus area assessments to identify and prioritize projects using the foundational documents
- Engaging Oregon Solutions or Oregon Regional Solutions to assist in recruiting members of the umbrella collaborative and formalizing working agreements
- Developing a website with the Umatilla Water Control District Collaborative to showcase the partners' working agreements, projects, and tracking of funding and timelines
- Establishing an awareness campaign with MURC or the Umatilla Watershed Council
- Documenting the progress of the McKay Creek Partnership's Action Plan development and describing how its process can be used to develop a CSAP