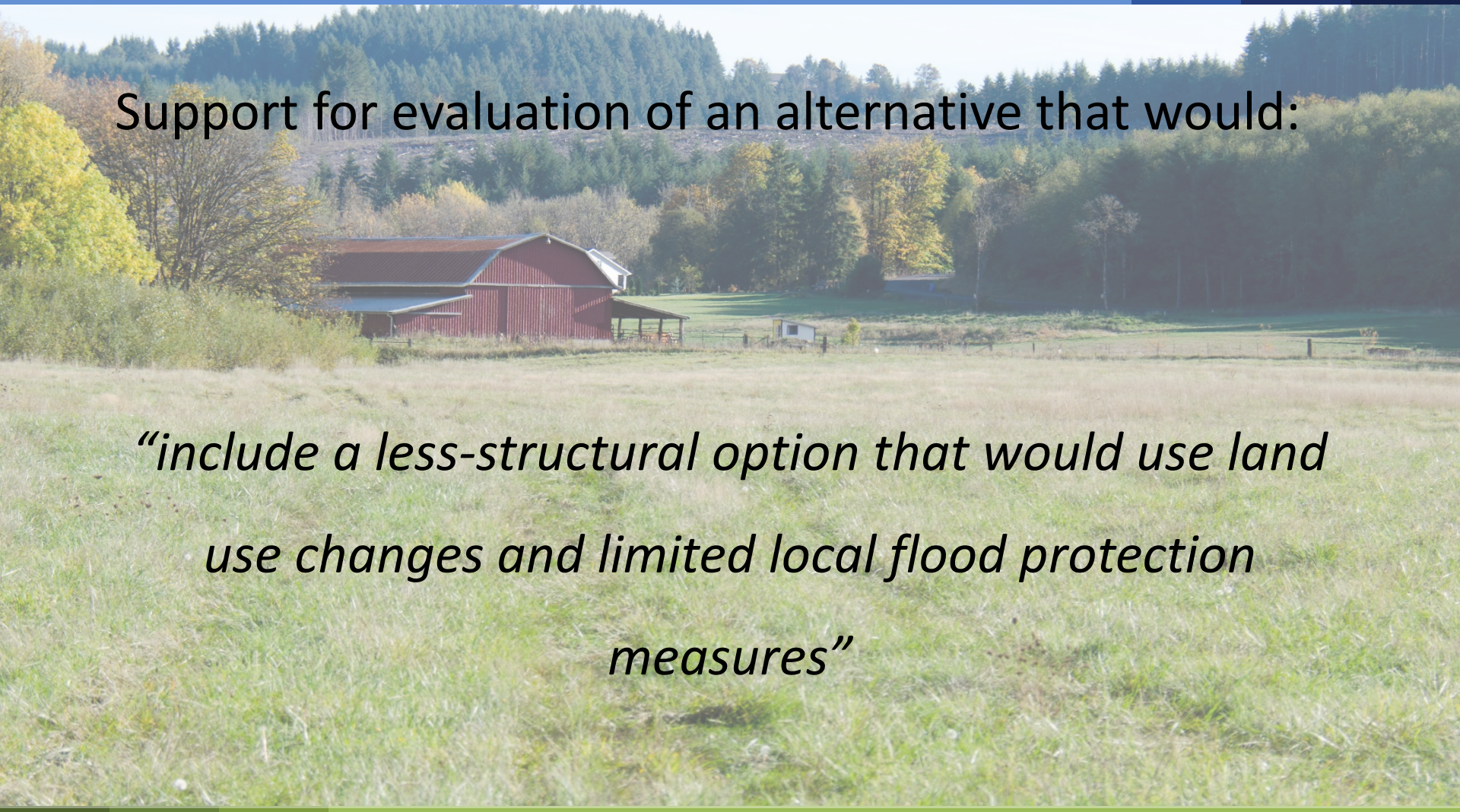
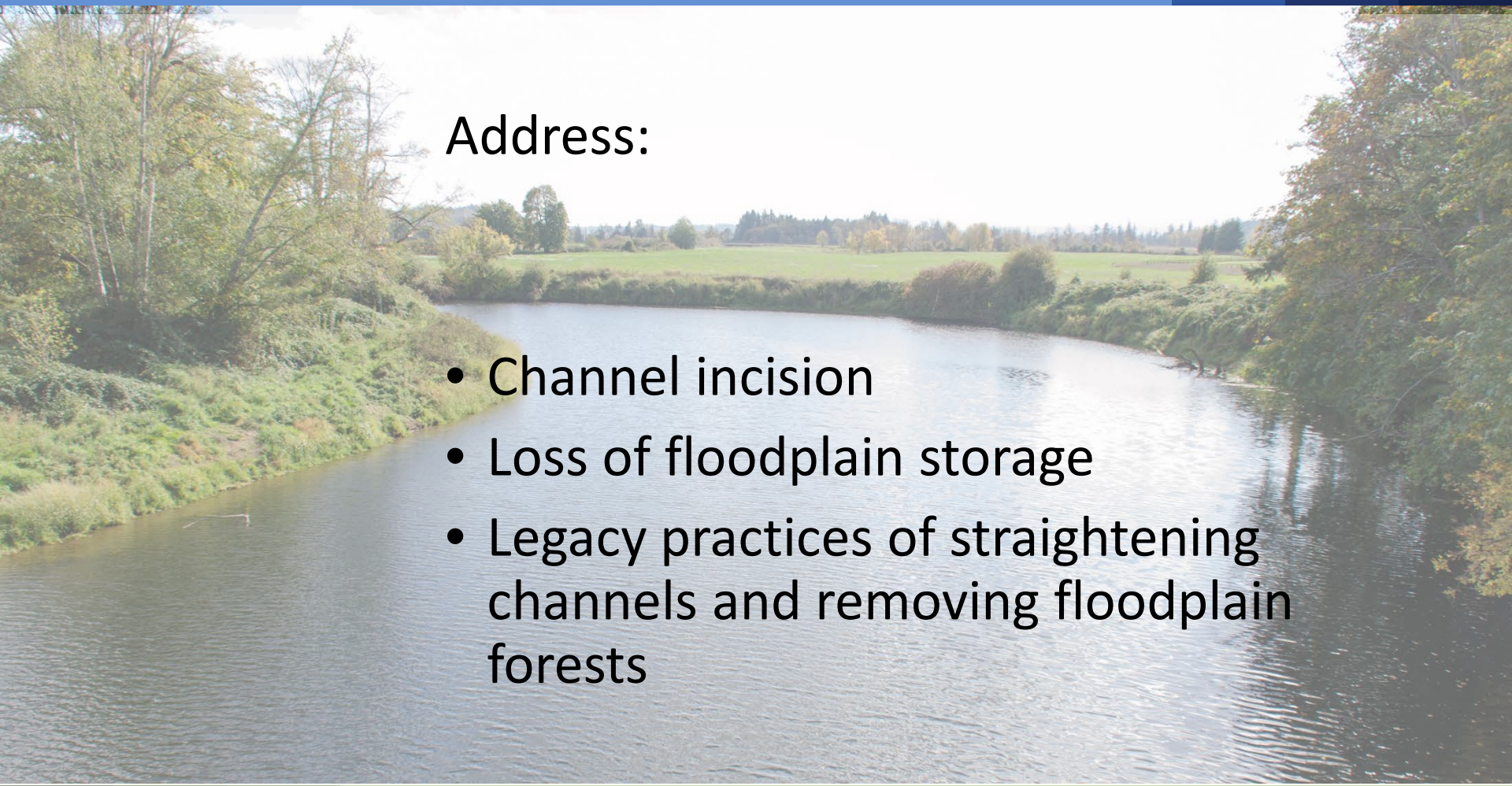
Restorative Flood Protection



Support for evaluation of an alternative that would:

"include a less-structural option that would use land use changes and limited local flood protection measures"

Restorative Flood Protection



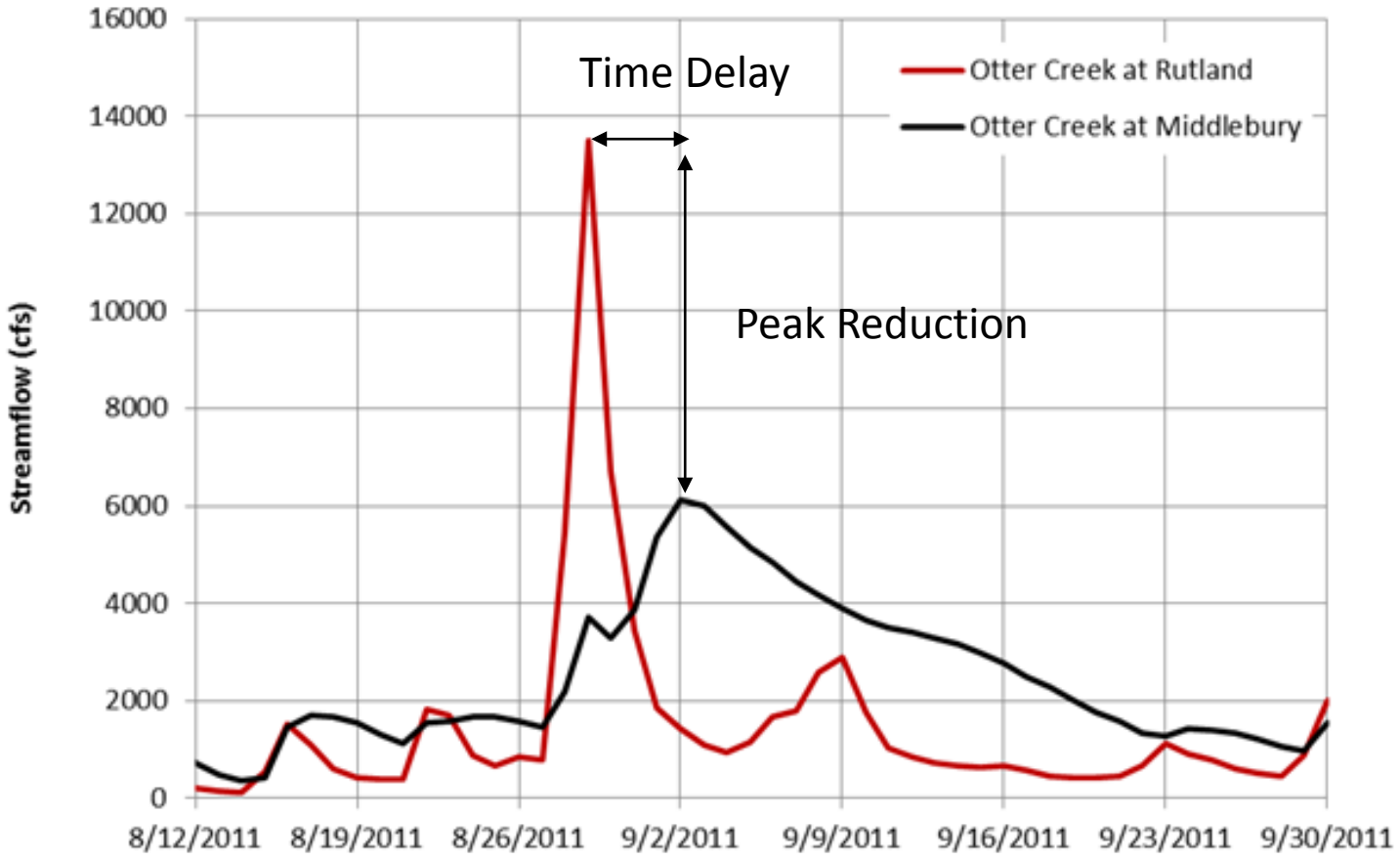
Address:

- Channel incision
- Loss of floodplain storage
- Legacy practices of straightening channels and removing floodplain forests

Restorative Flood Protection

- Works with natural watershed processes instead of trying to control them
- Accepts natural flooding over a larger area instead of concentrated flooding
- Asks humans to adapt by moving away from natural flooding areas
- Economic return on investment using this type of approach validated
- Synergistic with aquatic habitat needs

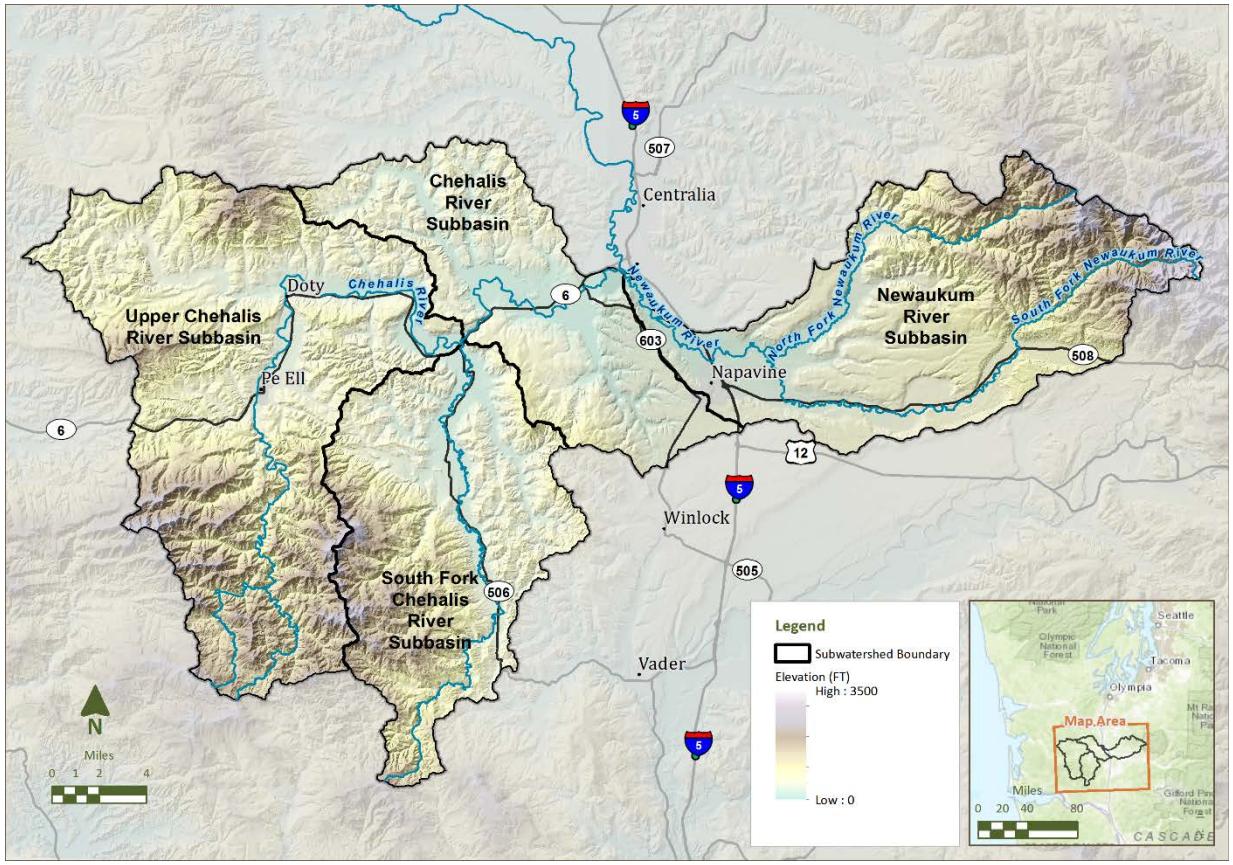
How are floods reduced using Restorative Flood Protection?



Example from Otter Creek, during Hurricane Irene

Completed Feasibility Work in 2017

Assessment Area for Restorative Flood Protection Alternative

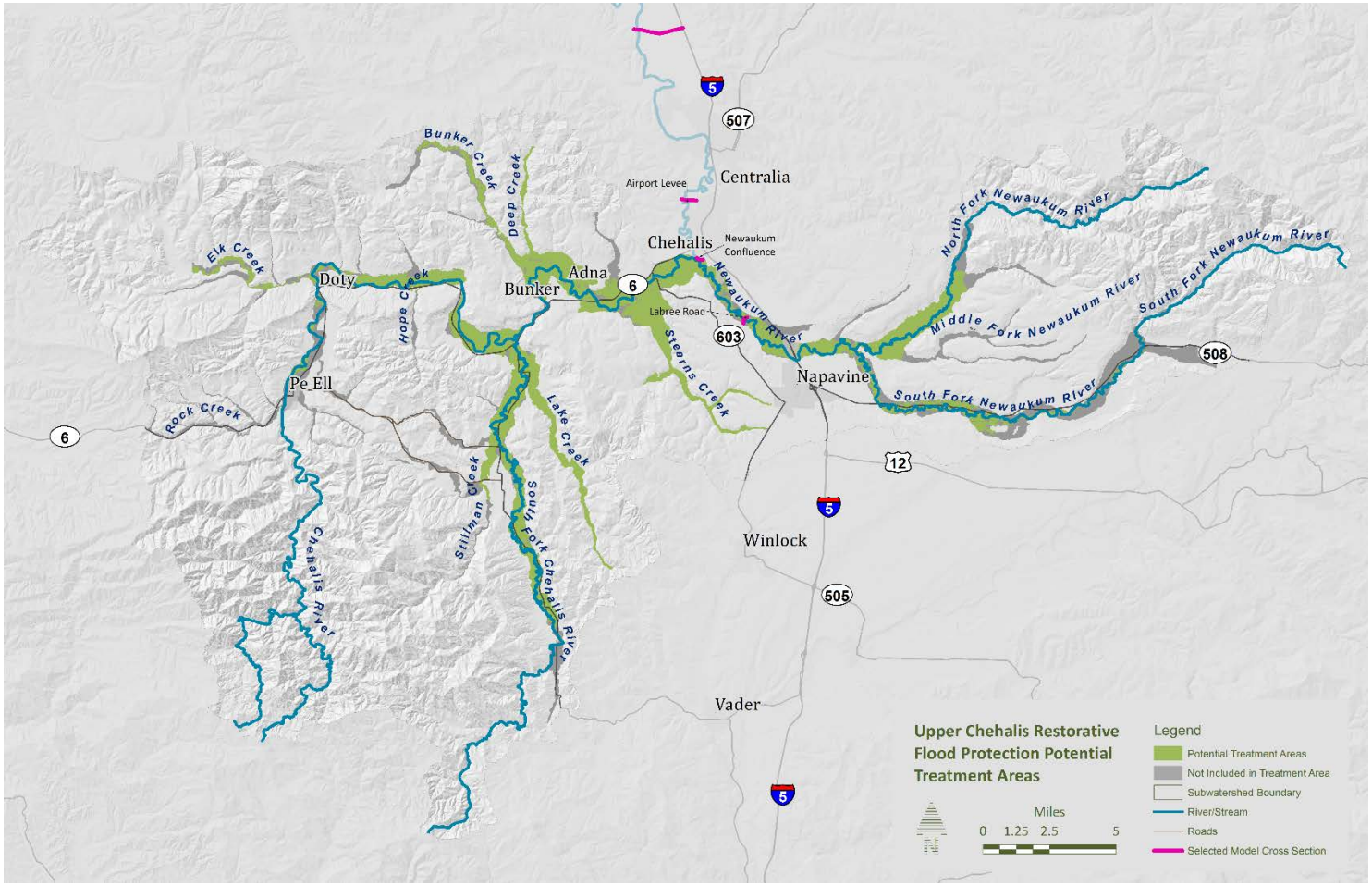


The assessment area encompasses 415,600 acres with 43,400 acres of river valley bottom land.

What areas are suitable for restorative flood protection?

- Low gradient channels
- Broad, cleared floodplains
- Incised but, not too incised (between 3-6 feet)

Restorative Flood Protection Treatment Areas Identified



Modeled 100-year Flood Level Reduction near Centralia/Chehalis

Location	River Mile Cross Section (RM)	100 year Flood		
		Existing Conditions WSE[1] (ft)	Restorative Actions WSE (ft)	Change in WSE (ft)[2]
Labree Road (Newaukum)	RM 4.11	206.4	206.1	-0.3
Newaukum Confluence	RM 75.2	185.2	184.1	-1.0
Along Airport Levee	RM 71.49	180.5	180.1	-0.4

1 - WSE: Water surface elevation, Vertical datum = NAVD88

2 - Note that these flood level results did not include the airport levee improvements, so are not directly comparable to the flood retention facility flood level results.

Restorative Flood Protection Actions

Engineered

- Channel – Install wood and rock to slow streamflow, and cause streamflow to spread out overbank during floods
- Floodplain – Construct wood structures and plant vegetation that will slow and temporarily store streamflow during floods

Restorative Flood Protection Actions

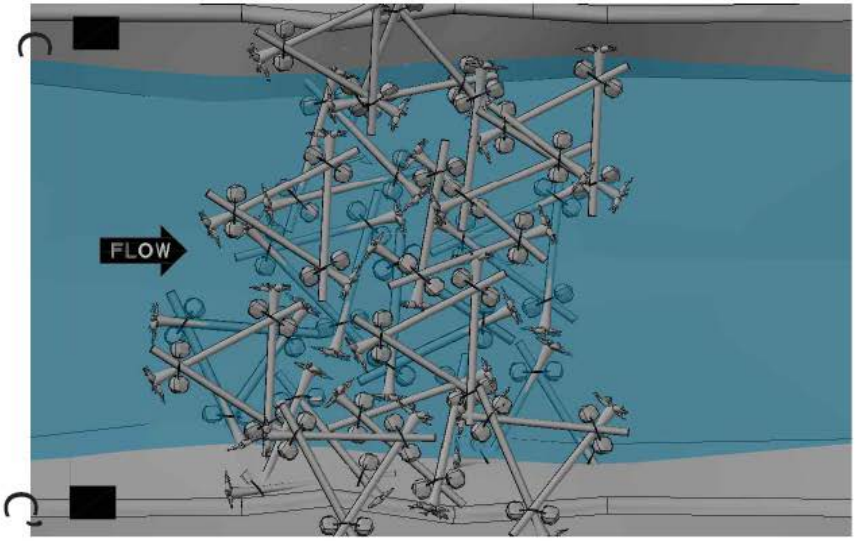
Land Use

- Greenways/River Management Corridors – Designate zones along treated river segments to keep property owners safe and avoid future flood damage and property loss.
- Landowner/Resident Adaptation Assistance –
  - Suite of options for impacted community
  - Invests in local jobs and communities
  - Improves road and bridge infrastructure

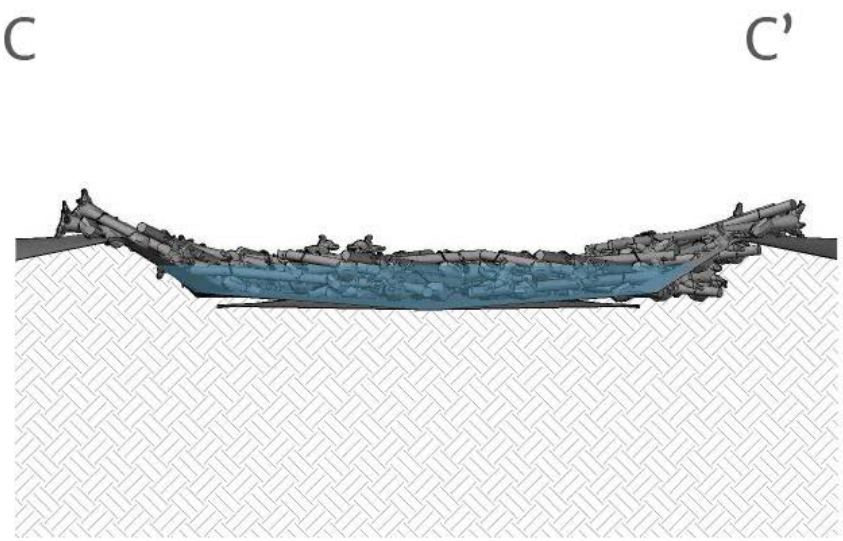
Reference Condition for In-Channel Actions

Engineered In-Channel Log Jam

Plan View

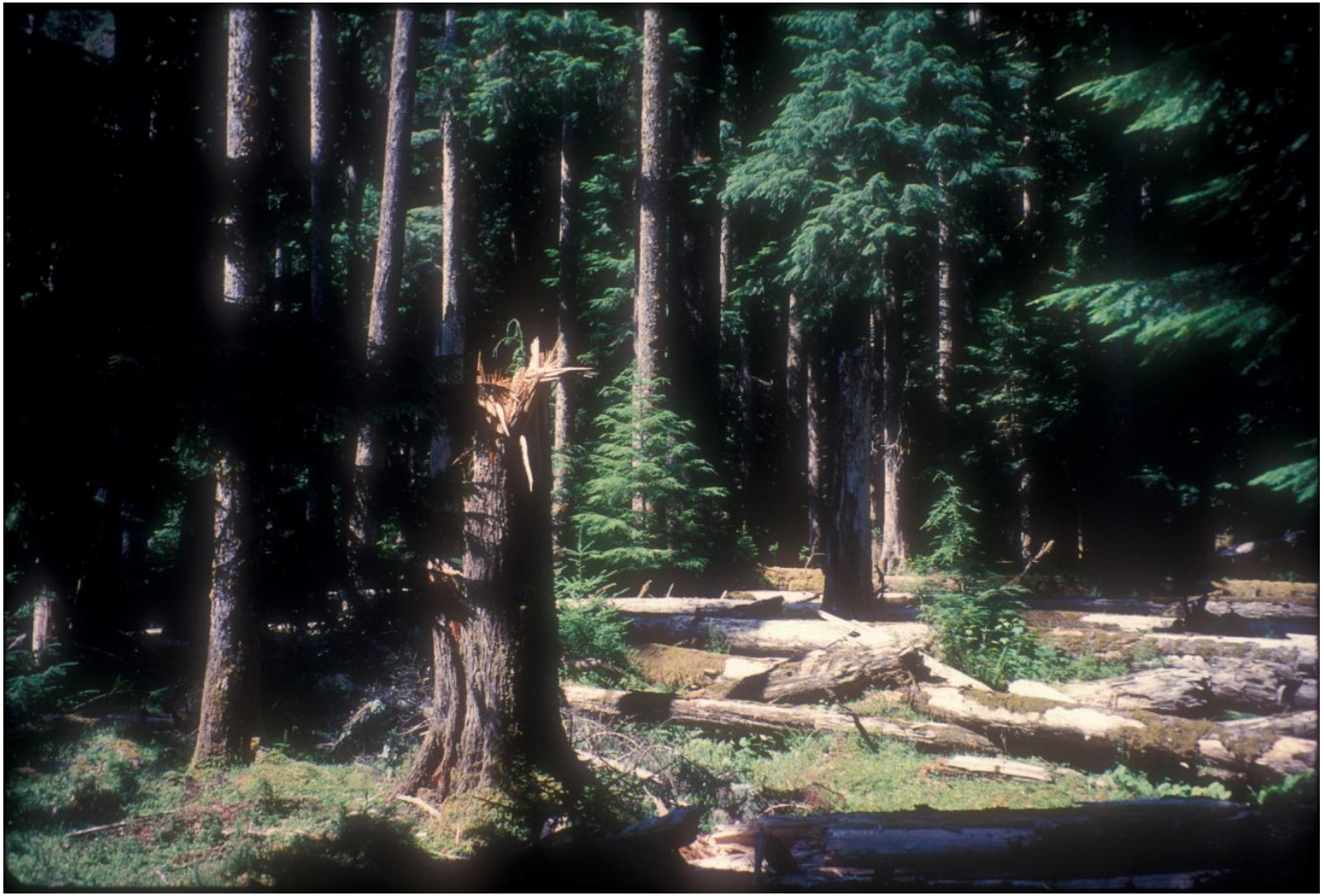


Section View C-C'



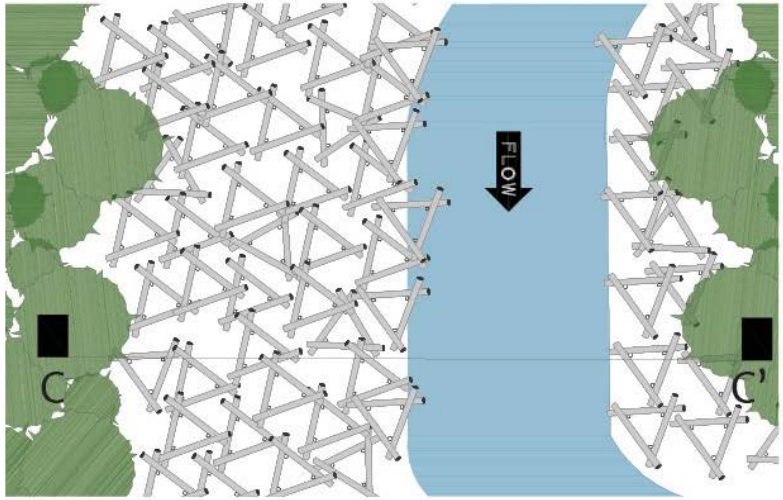
Example of Channel-Spanning Log Jam, Nooksack River

Reference Condition for Floodplain Actions

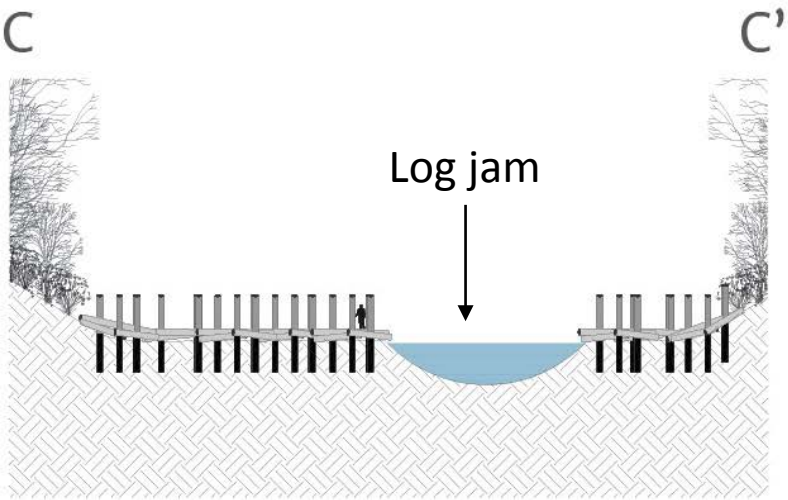


Engineered Floodplain

Plan View



Section View C-C'



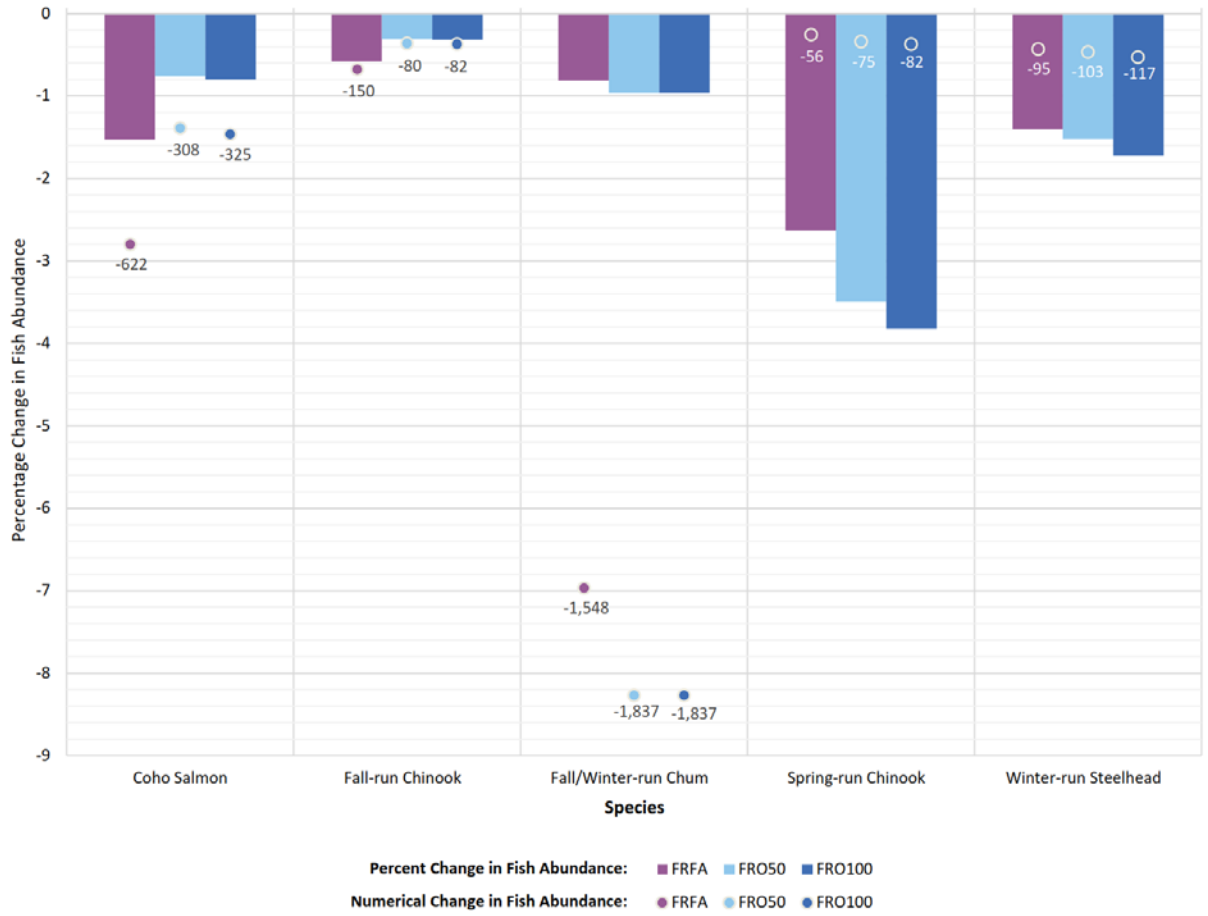
Conceptual Image of Typical Floodplain

Conceptual Image Following Restoration Flood Protection Implementation

Percent Change in Salmonid Abundance with Flood Retention Facilities

Figure 4.2-8

Potential Response in Salmonid Abundance to Habitat Change in the Chehalis Basin from Flood Retention Facility Types

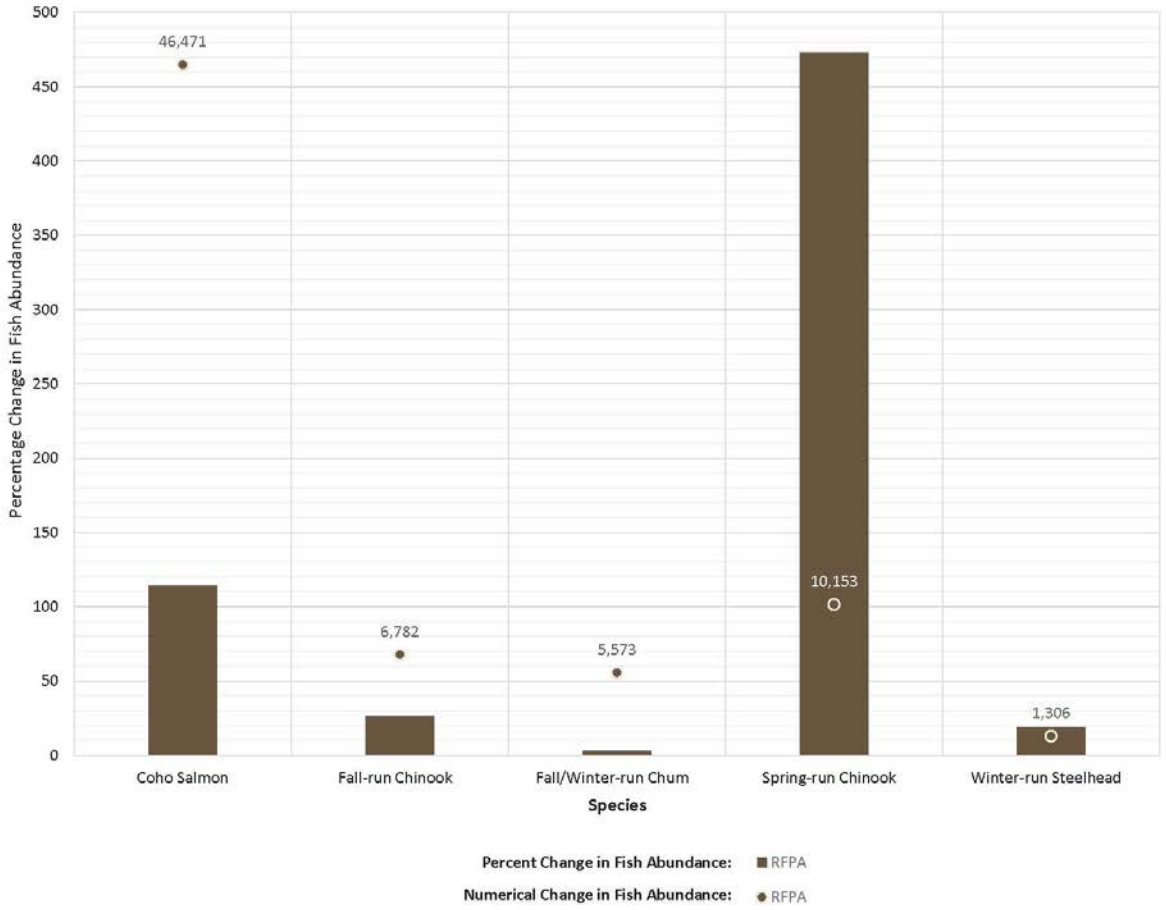


Source: ICF 2016

Percent Change in Salmonid Abundance with RFP

Figure 4.3-2

Potential Response in Salmonid Abundance to Habitat Change in the Chehalis Basin from Restorative Flood Protection



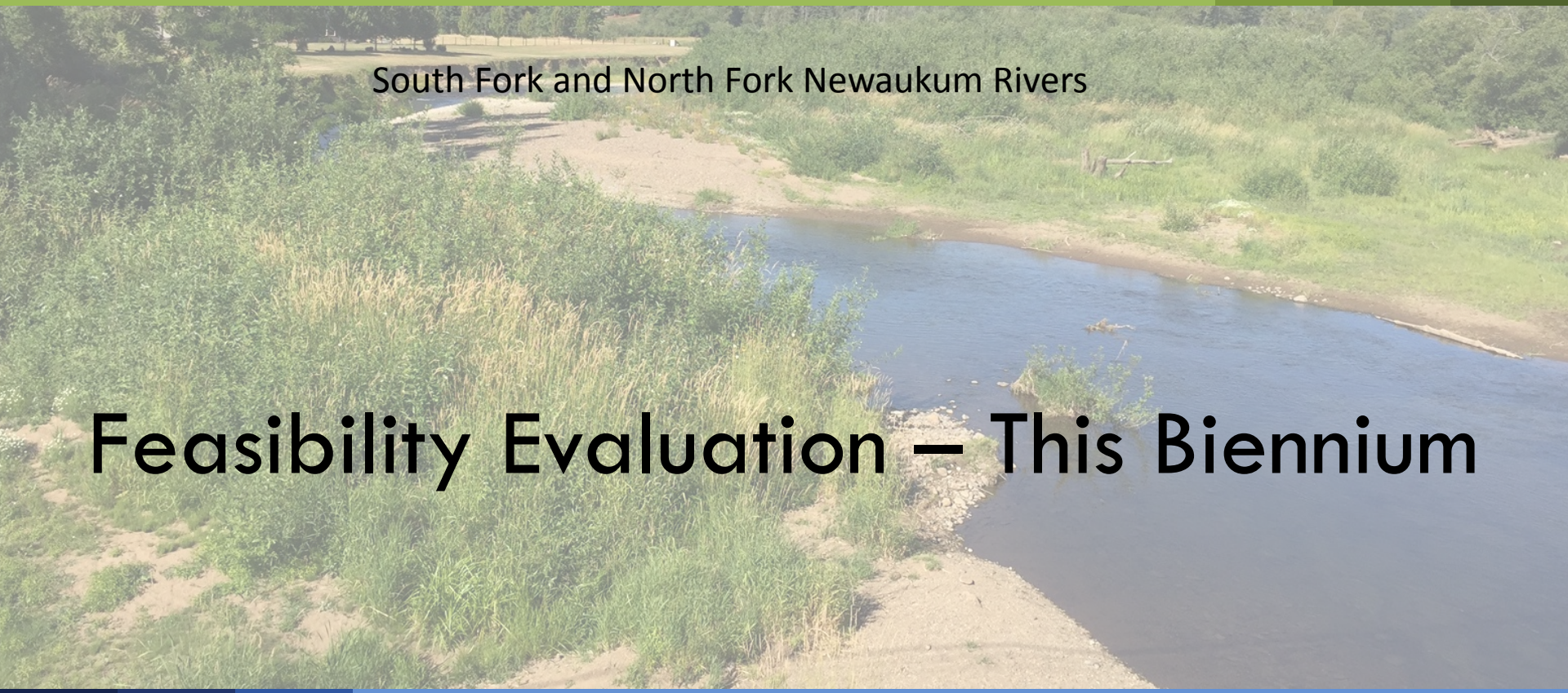
Source: ICF 2016

Cost Estimate Information

Cost Estimate Work Product	Results / Findings / Comments
PEIS Estimate (updated to 2017 dollars)[1]	$973 million to $1.2 billion Included all elements, but no detailed estimating conducted for buyouts, relocation support, and transportation impacts
Case Study - Property and Transportation System Impacts Cost Assessment - South Fork Newaukum River $2017[2]	$58 to $120 million Findings indicate bridge and road improvements are likely to be most costly element. Potential irrigation needs for new farmland are also an uncertainty that could increase cost estimate.

1 - $2016 values increased by 3.5% to account for average annual construction cost escalation

2 - South Fork Newaukum River represents 9% to 15% of total RFP acreage or RM, respectively. Valley-specific variations in current land use, transportation network, topography, and river-condition make it extremely impractical to proportionally scale cost assessment in either direction.



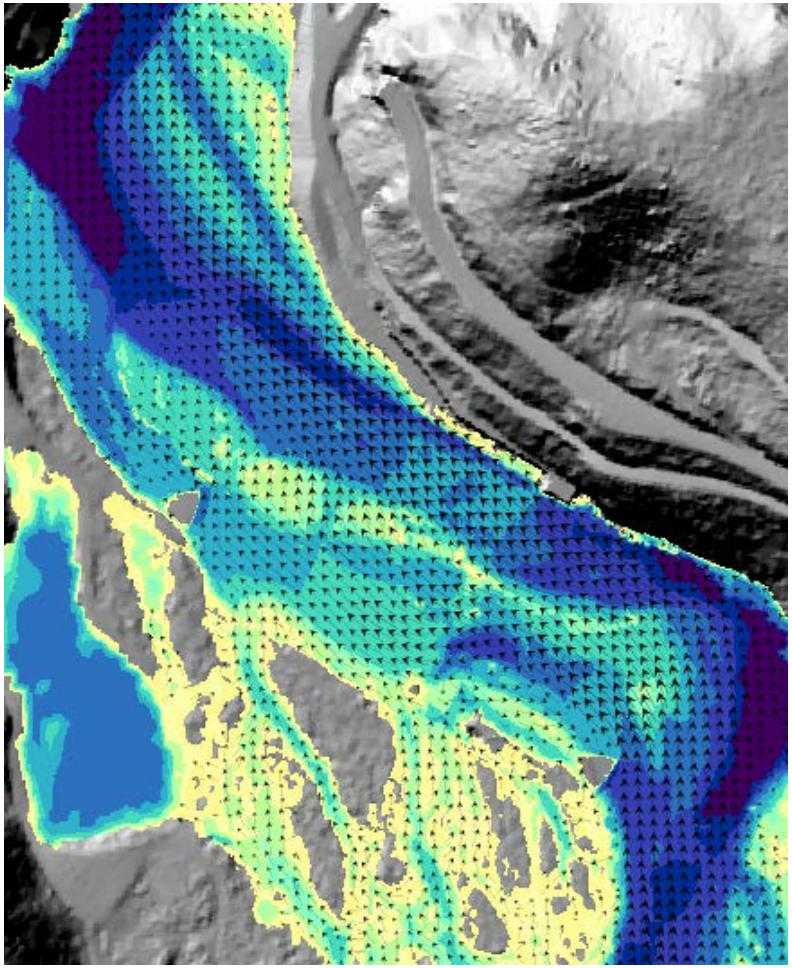
Feasibility Evaluation – This Biennium

Advanced Feasibility Evaluation in Newaukum as Pilot – Why here?

- Showed promising flood attenuation response in initial modeling exercise
- Channel migration/bank erosion is already recognized as a current problem for landowners
- The Newaukum River basin is not protected in proposed dam alternatives; Restorative Flood Protection approach provides help
- Synergistic with ASRP

Advanced Feasibility Evaluation in Newaukum as Pilot – What is it?

- Detailed hydraulic modeling
- Conceptual design at reach scale
- Refine cost estimates for Newaukum Restorative Flood Protection, including transportation and property impacts
- Community outreach and engagement
- Develop model programs to aid impacted property owners
- Analysis for viable transportation system needs – road/bridge improvements, emergency routing



Detailed Modeling and Conceptual Design

1. Iterative modeling to develop "best fit" design
   - Greatest flood benefits
   - Lowest property and transportation impacts
2. Conceptual design at reach-scale
   - Show layout of treatment elements described earlier
   - Provide images to show the public what Restorative Flood Protection would look like
3. Decision point – Advance to preliminary design?
4. Preliminary Design (refines costs and details, but still pre-permit)

Public Outreach and Engagement

1. Provide information and listen to concerns and ideas – focus on one-on-one meetings with affected landowners
2. Use feedback from community to shape conceptual design; continue dialogue with community
3. Work with willing landowners to develop hypothetical site plans

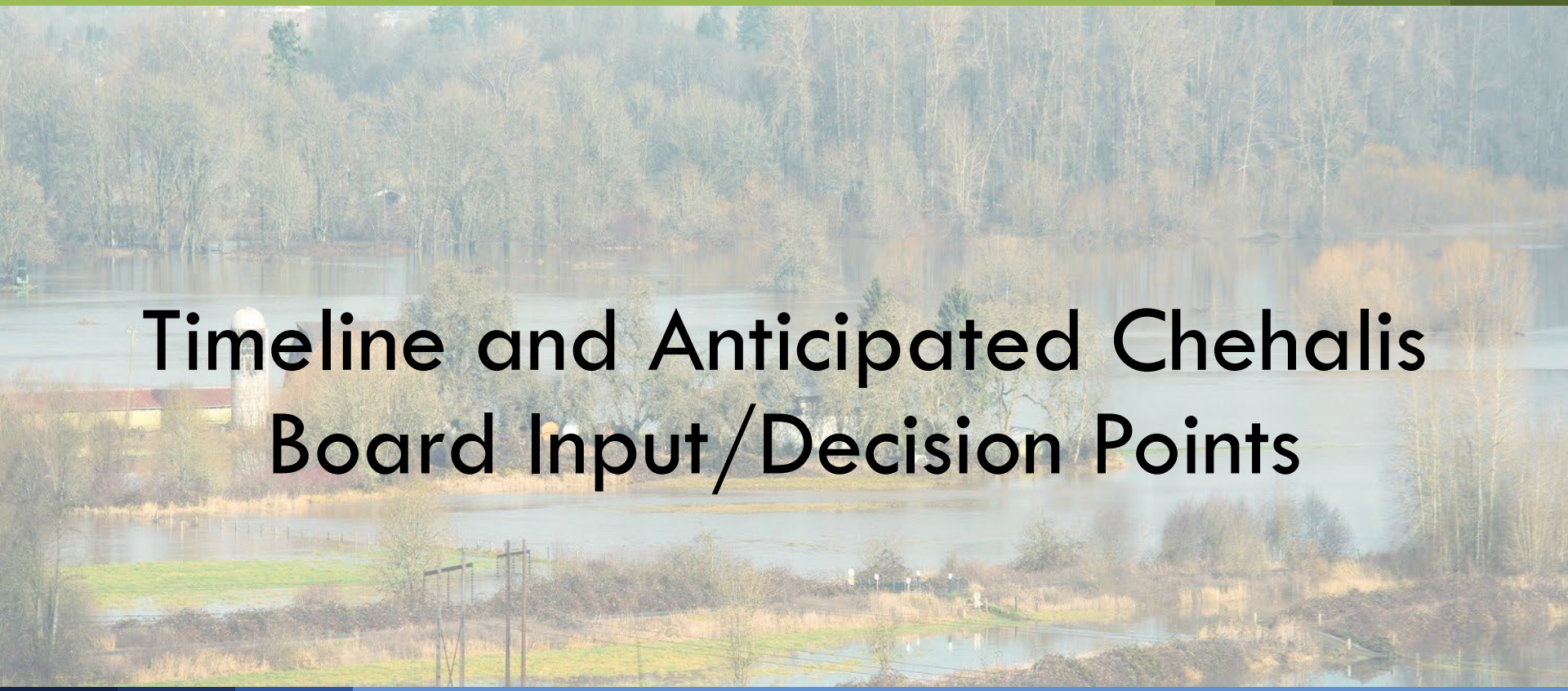
Assistance for Impacted Landowners and Community

1. Stay-in-place assistance
   - Flood easements
   - Alternate crop opportunities
   - Flood proofing
2. Buy-outs
3. Relocation support
   - Viable alternate farmland
   - Infrastructure needs to support relocation to areas away from flood risk

Feasibility Evaluation Refinements for Overall Potential Treatment Area

Transition from 1-dimensional modeling platform to 2-dimensional modeling because,

- 2-D is more accurate for modeling floodplain inundation
- 2-D shows where flood flows leave and re-enter the main river channel



Timeline and Anticipated Chehalis Board Input/Decision Points

Anticipated Schedule

Task	Time Frame
Newaukum feasibility results and conceptual design	August 2017 – April 2018
Outreach / engagement report-outs	August 2017 – June 2019
Property/transportation impacts and technical/programmatic assistance models report-out	January 2018 – April 2018
Decision on whether to initiate preliminary design	April 2018
Biennium summary report	January 2019

Thank you