

DRAFT

Chehalis Basin LAND*

***LOCAL ACTIONS NON-DAM ALTERNATIVE**

Preliminary Recommended Alternative



Chehalis Basin LAND*

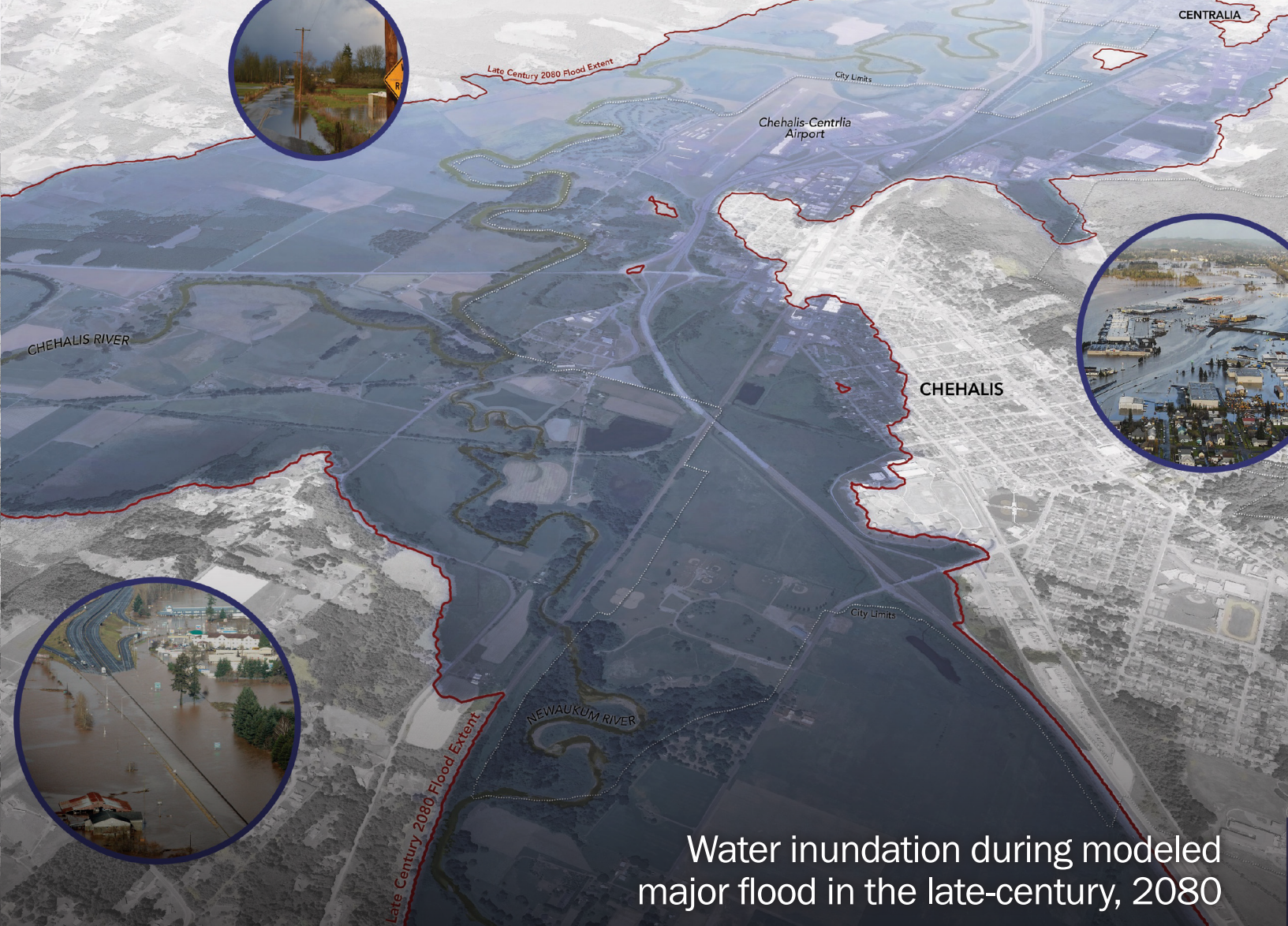
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Chehalis Basin today



Water inundation during modeled major flood in the late-century, 2080

1 Building the Non-Dam Alternative

The Preliminary LAND Alternative proposes a combination of new and extended levees, Chehalis River channel modifications, as well as restoration efforts and policy changes that, together, will reduce flood damage. The Chehalis Basin floods regularly, damaging homes, businesses, and infrastructure—and impeding the movement of people, goods and emergency services. Climate change is now increasing the imminent risk of catastrophic flooding.

The Preliminary LAND Alternative is an alternative to a proposed dam on the Chehalis River near Pe Ell. No decisions about specific elements of the Preliminary LAND Alternative have been made. The Preliminary LAND Alternative was developed by the Chehalis Basin Steering Group, which is composed of nine individuals representing the Chehalis Tribe, Quinault Nation, local communities, economic development, environmental and agricultural interests, with input from the community, that lays out a plan for equitable flood damage reduction, taking into account upstream and downstream impacts resulting from structural interventions. The elements work together to reduce flood damage, while encompassing the shared values and guiding principles the community has agreed on.

Basin residents and businesses that are most affected by flooding often have the least ability to recover after an event. The Preliminary LAND Alternative incorporates a framework that equitably considers potential impacts on all individuals and property owners, as well as the land uses most affected by flooding. All flood damage reductions actions take into account the extent of potential flooding during a major flood event that could occur in the late-century—in the year 2080.

While focusing interventions on the upper Chehalis Basin, the Steering Group found it essential to account for impacts across the entire Basin.



The proposed projects, programs, and policies are designed to generate equitable outcomes for individuals and businesses living and working in all communities throughout the Chehalis Basin. The strategies include:



FLOODPLAIN MANAGEMENT AND RESTORATION actions to reduce the severity and impacts of more frequent, but minor, flood events that still affect homes and businesses.



STRUCTURAL INTERVENTIONS such as floodwalls, levees, daylighting and channel diversions to reduce the impacts of major floods.



A SAFE STRUCTURES PROGRAM to help landowners, residents, renters and businesses reduce flood damage to existing structures in the floodplain.



CHANGES TO LOCAL LAND USE PLANNING and building code programs to direct future development away from the floodplain.



IMPROVEMENTS TO THE TRANSPORTATION SYSTEM that provides vehicle access in the event of a catastrophic event.



RESILIENCY PROGRAMS to speed recovery after an event.



MANAGEMENT AND FUNDING considerations for implementing recommendations.

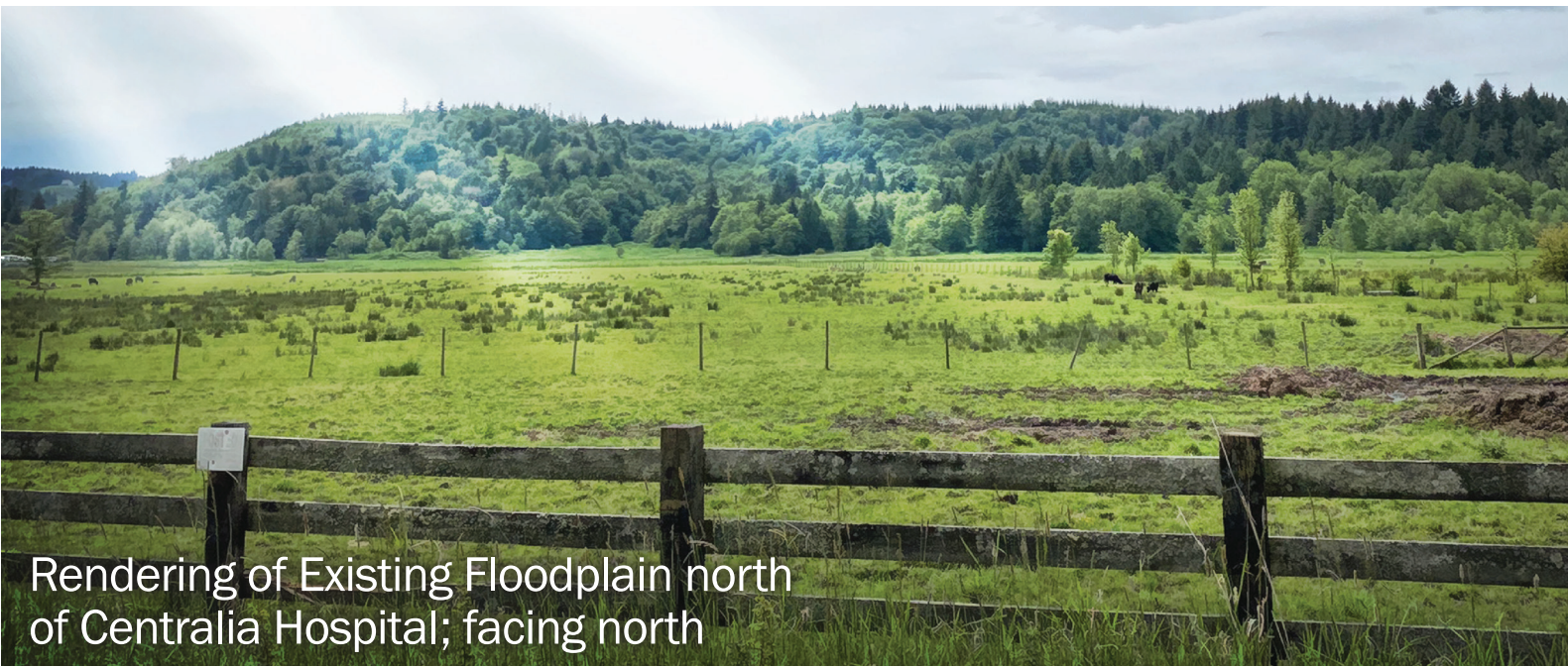


Source: Office of Chehalis Basin

2 Floodplain Management

A key goal is to respect the natural river: wherever feasible, actions will recreate natural floodplains to restore natural geomorphic river flows and increase natural floodplain water storage capacity.

Floodplain management actions can include floodplain storage as well as smaller berms and floodwalls (under 6 feet). They remove human-caused barriers to water flow such as undersized culverts, and reconnects off-channel floodplain channels and side channels. All actions will be coordinated with the Aquatic Species Restoration Plan's goal to restore about 5,000 acres of floodplain.



Rendering of Existing Floodplain north of Centralia Hospital; facing north



Rendering of Floodplain - After Restoration is Complete



Rendering of Floodplain Restoration During Flood Event



3 Potential Structural Interventions

While floodplain restoration and local flood management will reduce flood damage during smaller and more frequent flooding events, structural interventions such as levees and diversions, combined with the non-structural elements, will expand river capacity and reduce damage from a major flood.

West Diversion

This intervention will reduce peak flood elevations by providing another path for flood waters. It would:

- Construct a new 700-foot wide, one-mile long water diversion by excavating approximately 1.3 million cubic yards of soil west of existing Mellen Street.
- Remove the existing Mellen Street Bridge and reconstruct it about 2,000 feet to the south, to connect to Military Road west of the Chehalis River and I-5.
- Remove about 1.3 million cubic yards of soil immediately upstream from the existing Mellen Street Bridge and for approximately 3,000 feet downstream of the existing Bridge to increase the ability of floodwaters to flow through this constricted area.

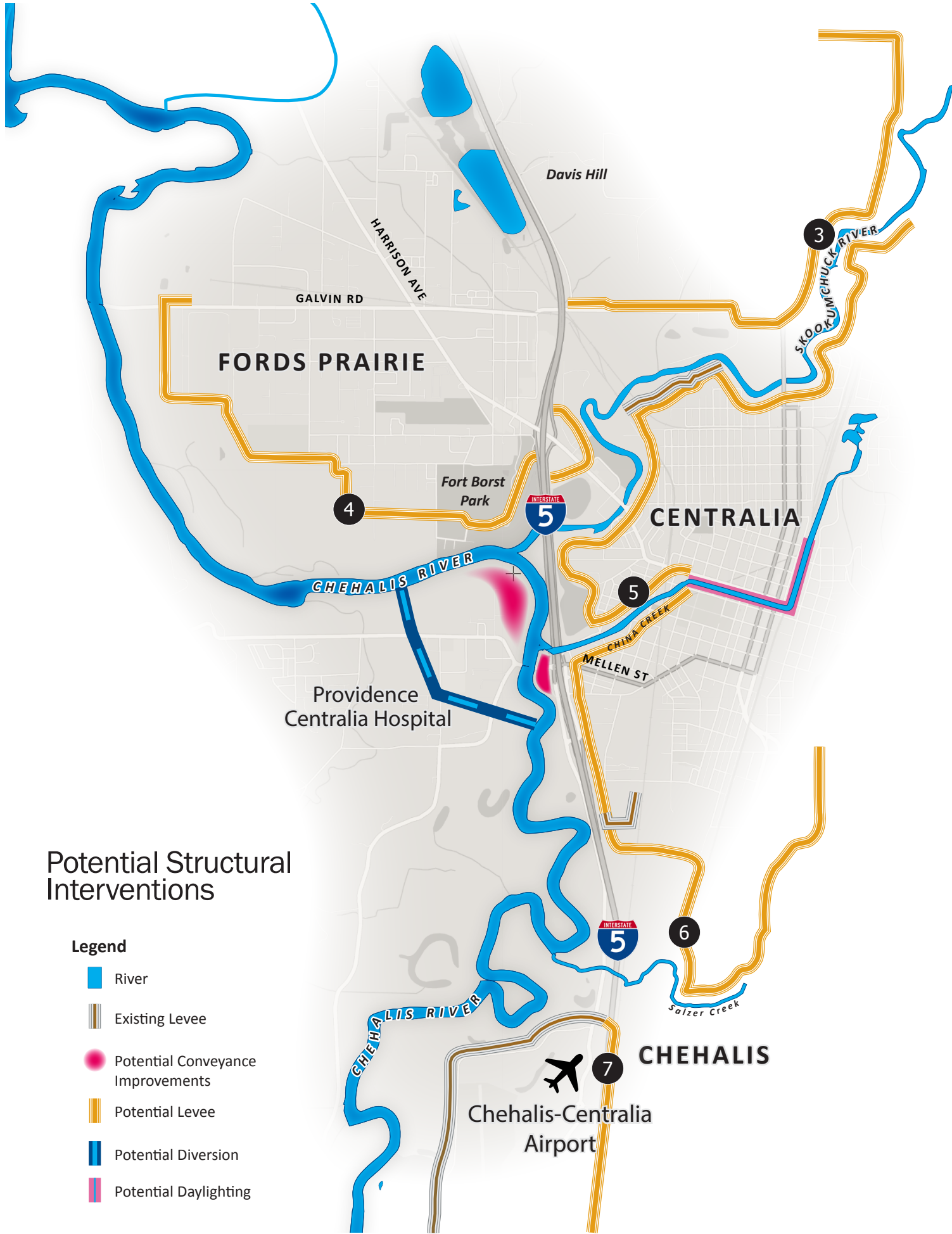
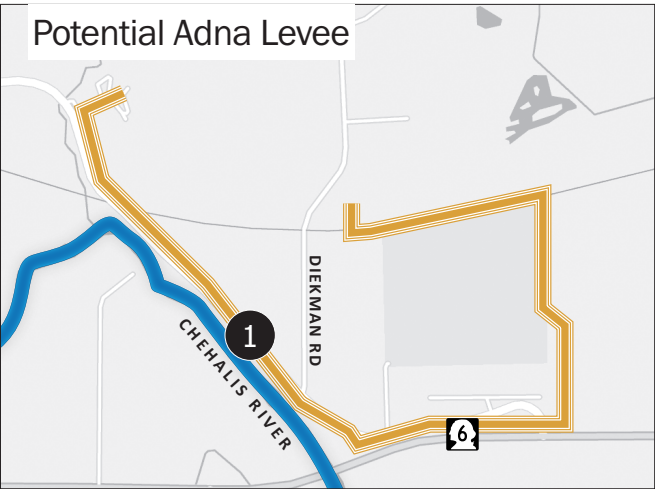
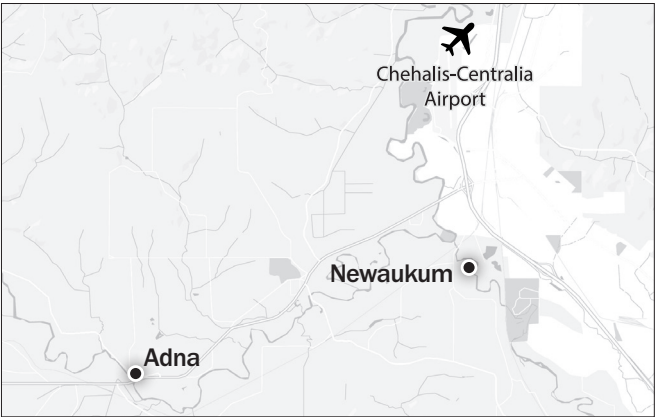


New and Expanded Levees and Floodwalls

Constructing about 22.1 miles of new or expanded levees will help contain floodwaters and reduce flood damage. The majority of the levee and floodwall infrastructure is located next to high concentrations of existing structures that cannot be easily moved. Constructing new or expanded levees would affect some existing structures; the impacts will be dependent on the final size and location of levees, which is still to be definitely determined. Upstream and downstream impacts, such as where there is an increase in flood depth, would be mitigated through the Safe Structures program.

- 1 Construct a new ring levee in Adna around the new high school and commercial area (1.7 miles)
- 2 Construct new levee on the north bank of the Newaukum River east of I-5 (1.2 miles)
- 3 Construct new and expanded levees on the north and south sides of the Skookumchuck River (6.6 miles)
- 4 Construct a new levee on the north bank of the Chehalis River from north of Fort Borst Park downstream to Galvin Road (2.7 miles)
- 5 Construct new levees on the north and south sides of China Creek from I-5 to the railroad tracks (2.3 miles)
- 6 Construct a new levee on the east side of I-5 from China Creek south to Salzer Creek (3.3 miles)
- 7 Expand the levee around the Chehalis-Centralia Airport (4.3 miles)

Levees could be constructed in phases and be combined with road and bridge projects.



Potential Structural Interventions

- Legend
- River
 - Existing Levee
 - Potential Conveyance Improvements
 - Potential Levee
 - Potential Diversion
 - Potential Daylighting

Daylight China Creek

Opening up the underground culvert where China Creek is buried—resurfacing the creek—would both expand flood capacity of the creek and add a community amenity.



Rendering of Existing Conditions



Rendering of Daylighted Creek with New Development



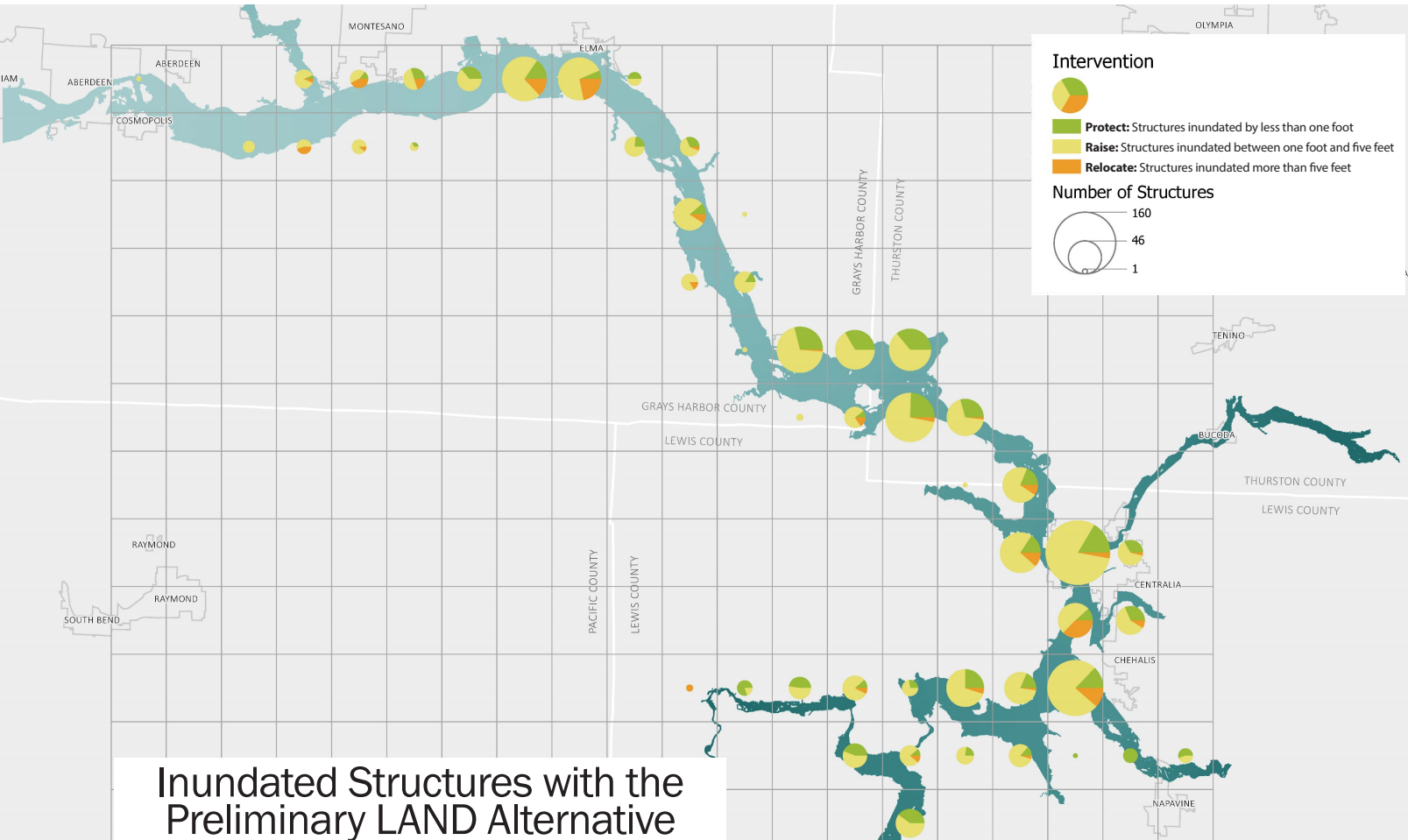
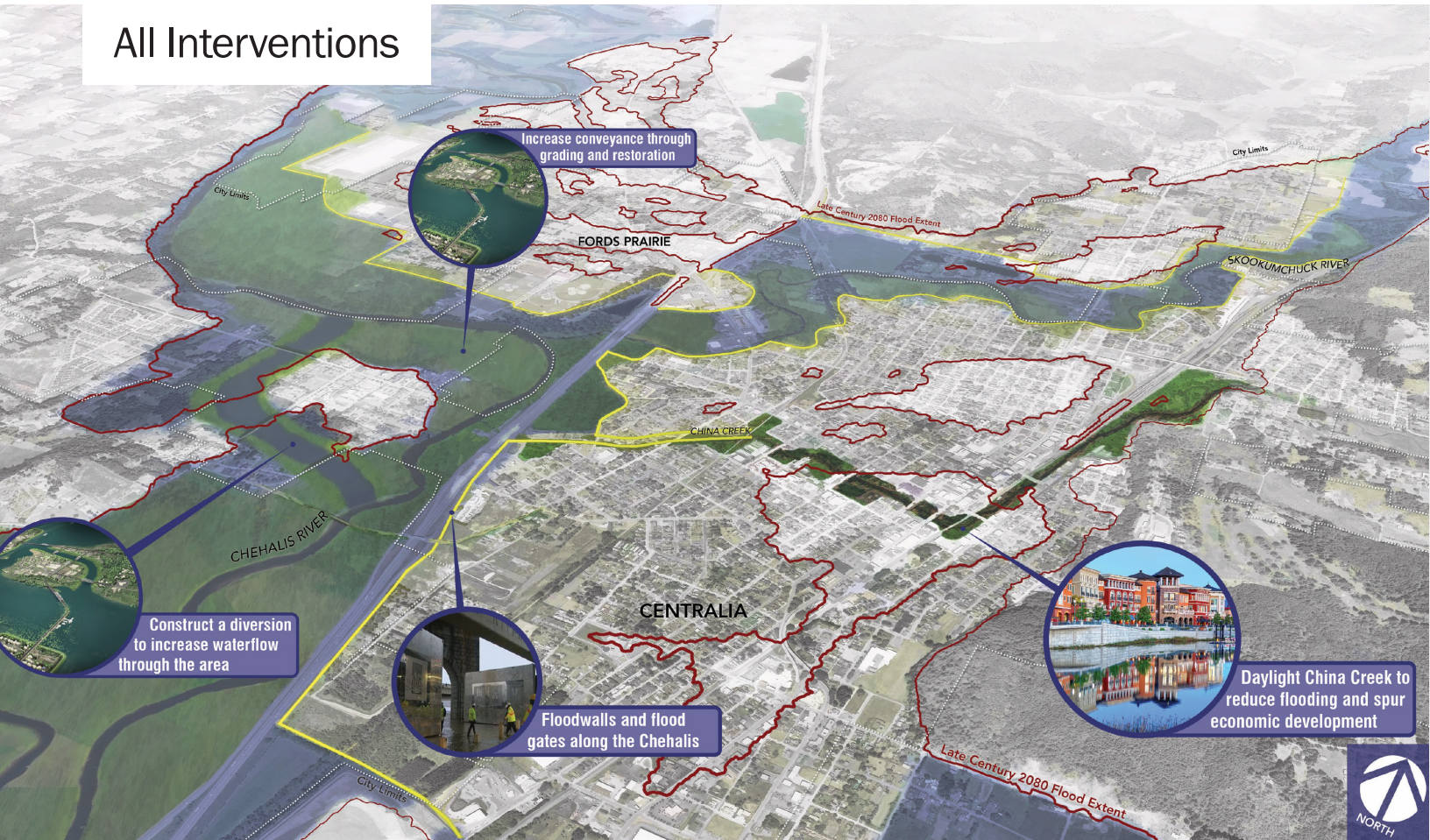
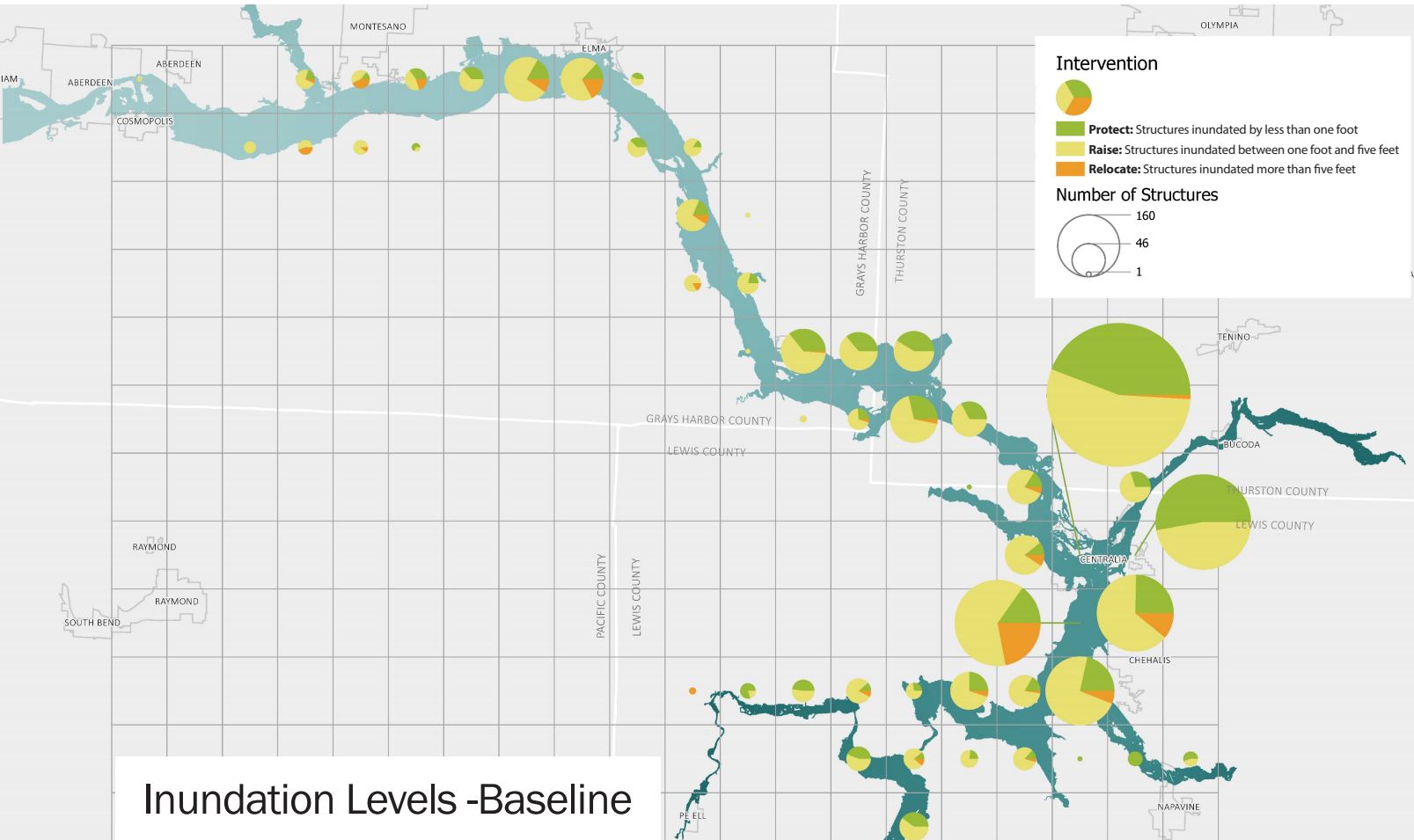
Rendering of Daylighted Creek During Flood

Structural Flood Damage Reduction

Most infrastructure—levees, the diversion channel, conveyance improvements—is located where there are high concentrations of homes, and commercial and institutional buildings (valuable structures) that cannot be moved.

The infrastructure and floodplain management efforts significantly reduce flooding extents with lower height levees. They increase water levels on the Skookumchuck and the Newaukum (less significantly), as well as on the Chehalis downstream of Mellen Street. This also lowers water surface elevation on the Chehalis upstream of Mellen Street and Salzer Creek.

These investments would remove about 1,625 valuable structures from the risk of flooding during a major flood that could occur in the late century, 2080. That leaves an estimated 1,634 structures that would still be vulnerable and require an additional program to reduce potential flood damage (see Safe Structures Program).





Source: Office of Chehalis Basin

4 Safe Structures Program

The proposed Safe Structures Program will offer flood damage protection for the estimated 1,625 existing valuable structures that might remain in danger of flooding, even with the investments proposed in the Preliminary LAND Alternative.

The proposed Safe Structures Program identifies strategies to prioritize and protect valuable structures (residences, schools, businesses, etc.) on an individual basis, without infrastructure such as levees, floodwalls and dams. The program will evaluate and prioritize actions for each of the “valuable” structures but not for “non-valuable” structures (garages, sheds, carports, etc.). While the Office of Chehalis Basin’s Community Flood Assistance and Resilience (CFAR) program is already performing many of the strategies of the proposed Safe Structures Program, it is not at the scale necessary to address the large number of valuable structures in need of flood damage reduction assistance.

The Safe Structures Program would include resources to assist low-income households (both renters and property owners) that are affected by flooding. Resources could take the form of funding assistance, low interest loans and technical assistance to help residents better understand their options for reducing their exposure to flood risk. Buildings behind FEMA-certified levees could reduce or eliminate their flood insurance; buildings in the Safe Structures Program would likely be paying similar rates to what they pay now.

Structure Risk Assessment

The approach to flood damage protection depends on the severity of risk, determining valuable structures that might be in harm’s way and where flooding poses a risk to life and human safety. Desktop evaluation has been done to get ballpark estimates, but on-the-ground evaluations will need to be done in the future to fully implement the program. Each structure will be evaluated using the following primary criteria:



LOCATION of structure on the property



DEPTH OF WATER above the lowest floor of the building



VELOCITY of water



REPETITIVE LOSS/FREQUENCY where the structure has been identified as a repetitive loss property



COST EFFECTIVENESS and if the mitigation measure exceeds the value or condition of the structure

Secondary criteria include whether the property is near other proposed large-scale infrastructure projects, is adjacent to public land, and on each community’s goals and preferences. The program includes five levels of flood damage protection.

Source: Office of Chehalis Basin



Five-Level Mitigation Continuum

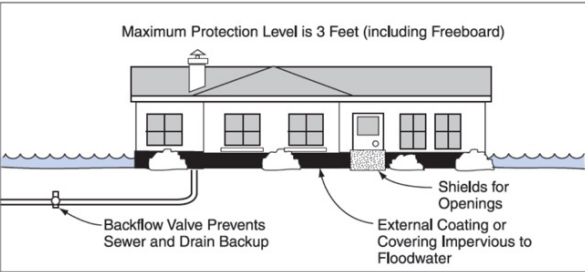
LEVEL 1: INSURANCE

Although not a specific mitigation measure, the first course of action for residential and commercial property susceptible to flooding is obtaining flood insurance as a cost recovery approach to flood damage repairs and restoration.

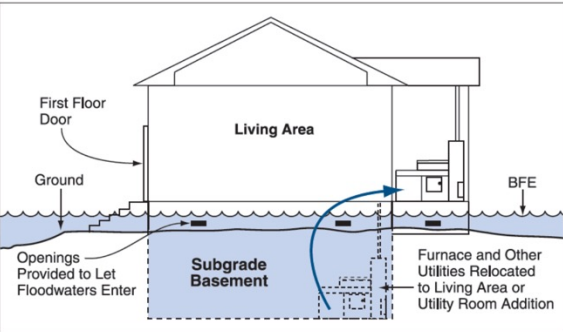
LEVEL 2: RELOCATE UTILITIES

Elevate utilities—including furnaces, air conditioners, appliances, electrical and plumbing systems—above the flood elevation.

LEVEL 3: FLOODPROOF



Floodproofing a structure mitigates, but doesn’t totally eliminate, flood damage. With dry floodproofing, the structure is made watertight and all opening are closed so that water that gets to the building cannot get inside. The building itself is the barrier to the floodwater.



Wet floodproofing allows water to enter an area such as a crawl space to equalize the pressure of water on the building due to the force of gravity.

LEVEL 4: RAISE



Structures in areas the might see more than 1 foot of floodwaters would be raised, using fill material on extended foundation walls, piers, posts, piles and columns.

LEVEL 5: RELOCATE

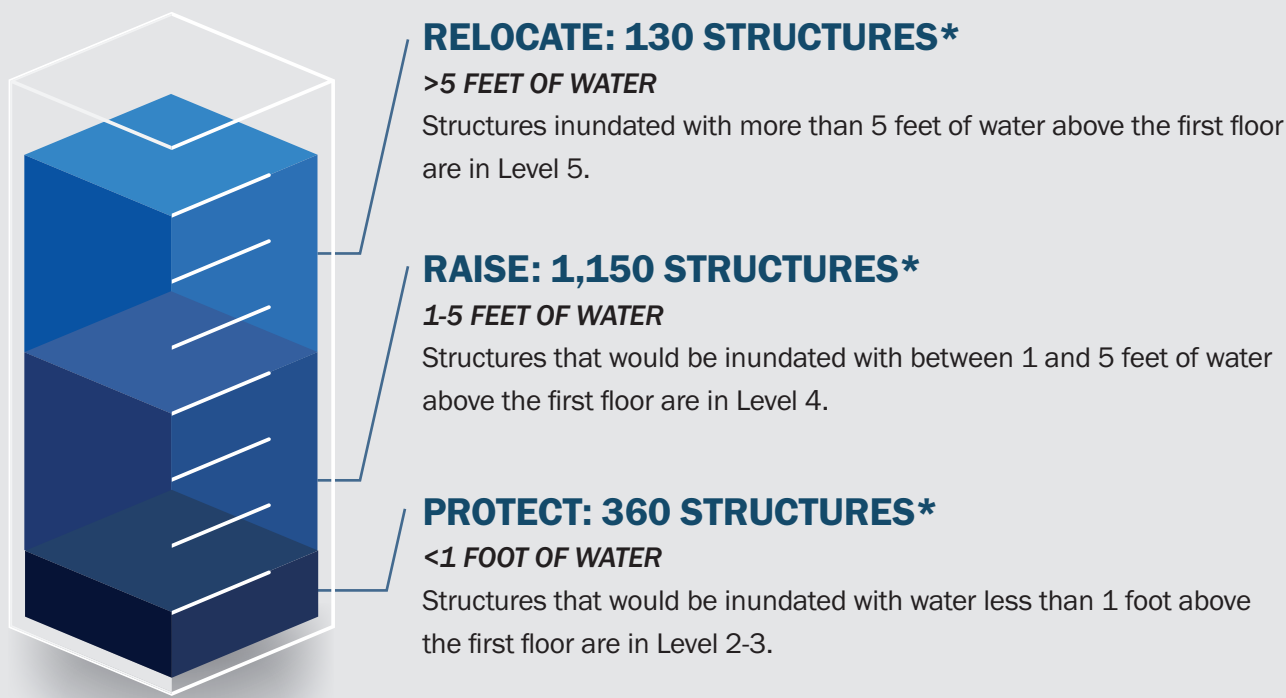
For homes that can’t be raised, property owners could voluntarily participate in a buy-out with fair compensation and relocation assistance. The structure could be demolished and the property owner purchase or construct a new home outside the floodplain. Or the house could be physically relocated outside the floodplain, depending on the home condition and property owner preference. A key element of this program is offering “replacement value” rather than “fair market value,” which can encourage greater voluntary participation.

Applying the Safe Structures Approach

Residential structures remaining in the floodplain have been assigned to flood mitigation levels 2-5, based on desktop evaluations. Residential risks will be confirmed and refined through individual on-site assessments before there is a final determination about appropriate mitigation. All commercial properties and agricultural buildings remaining in the floodplain are assigned to Levels 2-3.

Currently, structural risk is ranked by water level, to develop an order of magnitude determination about the number of structures that need specific mitigation and their potential costs. (It's recommended that an additional 1-3 feet of freeboard be added to each mitigation measure to increase safety.)

Safe Structures Program: Approximately 1,640 Structures*



* Estimated total valuable structures that could participate the Safe Structures Program. Relocation means either physically moving a structure to an area outside the floodplain or demolishing the structure, with owners moving into another structure outside the floodplain. Note that some structures, such as commercial structures, agricultural structures, and slab on grade structures with inundation greater than one-foot and included in the Raise category in this figure would likely still fall in the Protect category because they cannot be raised.

Affected Structures

The number of structures affected by flooding will depend on the structural interventions constructed in the Chehalis Basin. Assuming all recommended structural interventions are constructed, the number of affected structures could be reduced by about half, with the Cities of Chehalis and Centralia seeing the most dramatic reductions.

Location	Without Recommended LAND Interventions*	With Recommended LAND Interventions*
Lewis County		
Centralia	1,339	278
Chehalis	274	158
Adna	100	100
Boistfort	80	80
Pe Ell	21	21
Thurston County		
Rochester	185	202
Grays Harbor County		
Elma	168	173
Oakville	129	136
Montesano	70	70
Satsop	9	9
Aberdeen	4	4
Cosmopolis	1	1
TOTAL	2,380	1,231

*This assumes a 75% participation rate of willing property owners. For example, of the approximately 1,640 valuable structures remaining in the floodplain with the recommended LAND structural projects, 1,231 in total would become part of the Safe Structures Program. Adding the ring levee in Adna could reduce the number of inundated structures; future modeling will determine the number of structures affected by the proposed interventions.

*Estimates of valuable structures are based on the WSE structure database that contains finished floor elevations for valuable structures only. Because updated data is not available for recent development, the dataset does not include all structures in the floodplain; estimates of valuable structures might be low or missing for certain locations. It is possible that more structures than quantified in this table and in additional areas could qualify for Safe Structures interventions.

Relocation/Rental Assistance

Homeowners who choose to raise their homes will likely need temporary housing, while those that relocate will need moving expenses. Renters who are displaced will also need relocation expenses.

If the program is self-funded, relocation assistance can be provided based on the terms created by the agency in charge of the program. If federal or state funding is used, tenant assistance is available under the Federal Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1920. That assistance can include advisory services to find a comparable home and complete paperwork, pay for moving expenses, and replacement house assistance for the occupant to rent or buy (via down payment assistance) a comparable home.

Rough Order of Magnitude Costs

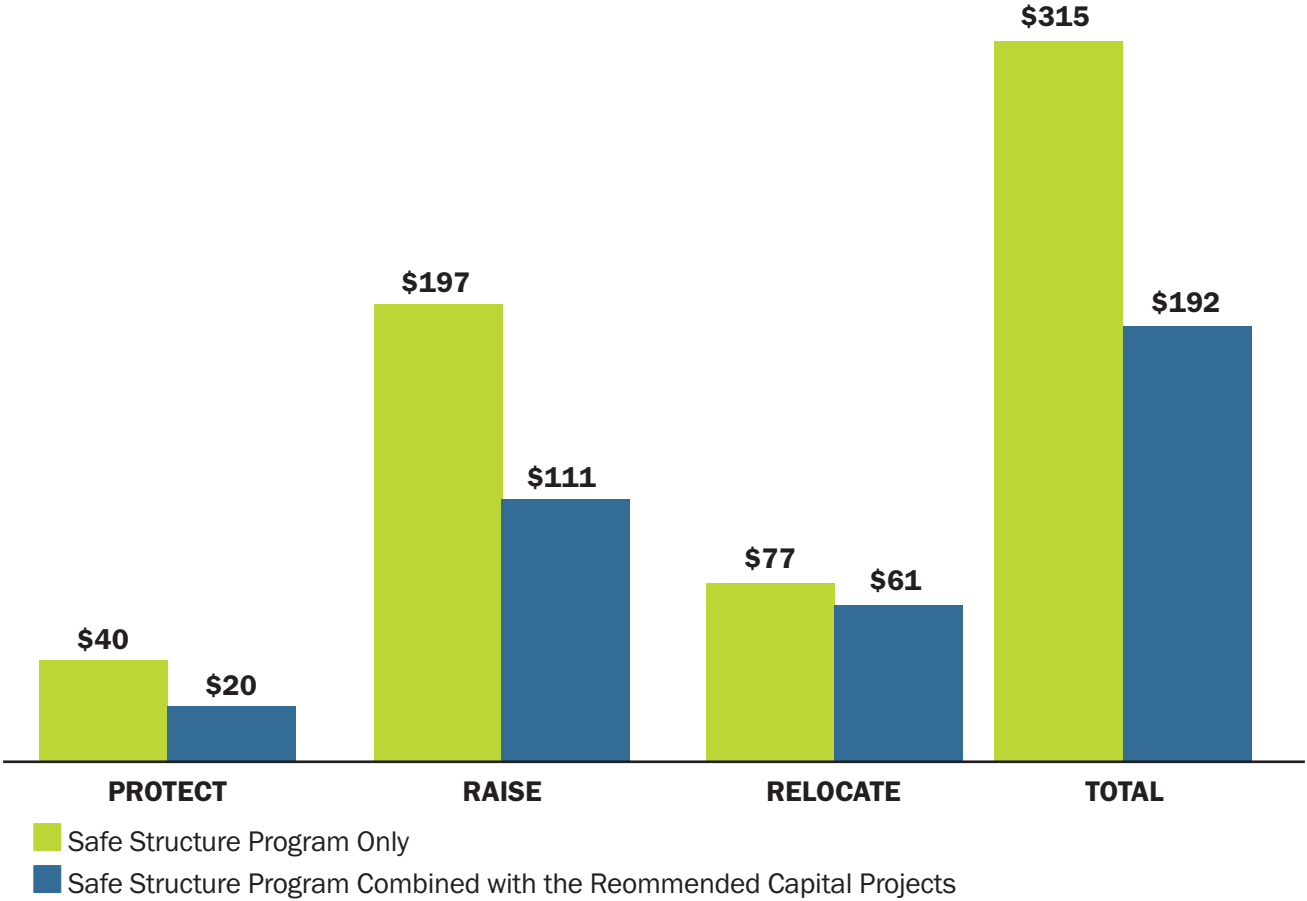
To provide an idea of the potential costs of the Safe Structures Program, the project team developed rough costs, per structure.

Home Utility Relocation/Floodproofing:	\$20,000
Commercial/Agricultural Floodproofing:	\$30,000
Structural Elevation:	\$150,000
Replacement Home:	\$400,000
Relocation/Rental Assistance:	5% of Relocation Costs

At the moment, there is no distinction between costs for building replacement homes versus relocating existing homes. The rough costs for implementing the program on its own are \$315 million. But when combined with capital projects and non-structural programs that take many properties out of the floodplain, the costs drop to \$192 million.

Rough Order of Magnitude Costs

in millions



Cost analysis assumes about 75% of property owners in all levels would voluntarily participate in a Safe Structures Program; but that could be higher with paying “replacement value” and with relocation and rental assistance.

Source: Shutterstock



Source: Larry Workman, Quinault Indian Nation Communications Manager





Source: Office of Chehalis Basin

5 Land Use Policies

Past development in the Chehalis Basin has resulted in thousands of residential, commercial and industrial structures being constructed in the floodplain. Future expansions of the floodplain as a result of bigger storm events being driven by climate change threaten to encompass even more existing structures. Local planning and regulations have not always accounted for potential flooding to properties, but will need to guide growth away from floodplains in the future.

The Basin population is increasing, which will require community conversations about how and where growth occurs, neighborhood design, and costs. While the proposed Safe Structures Program addresses existing structures, other land use actions must address future development related to natural population and housing growth in a way that reduces the damage and cost of future flooding. These actions must:

- Support the voluntary relocation program for existing structures into receiving areas
- Prevent new development from occurring in harm’s way
- Ensure new development accounts for future flooding risks
- Increase coordination between local jurisdictions to reduce development in the floodplain

Receiving Areas

Along with implementing the Safe Structures Program, Basin communities need to identify potential receiving areas—areas within each community that are outside of the floodplain and that can accommodate both residents voluntarily moving out of the floodplain who want to remain in the community, and the needs of future growth. In an era of increased flooding, this is a critical adaptation in land use planning. The success of this program would be driven by a combination of public-sector influenced development policy and regulations, and private market-driven forces and dynamics.

The project team considered 6 elements in identifying potential receiving areas.



THE CAPACITY FOR THE AREA TO DEVELOP to relocate existing residents away from the floodplain along with natural future population and housing growth



LAND LOCATED OUTSIDE the 100-year late century 2080 floodplain, but within the existing urban growth boundary



AREAS THAT ARE CURRENTLY ZONED for or have a future residential land use designation



VACANT LAND OR UNDERUTILIZED LAND that might have reduced barriers to development



LAND THAT'S NOT CONSTRAINED by critical barriers to development, such as wetlands, priority habitat areas or steep slopes

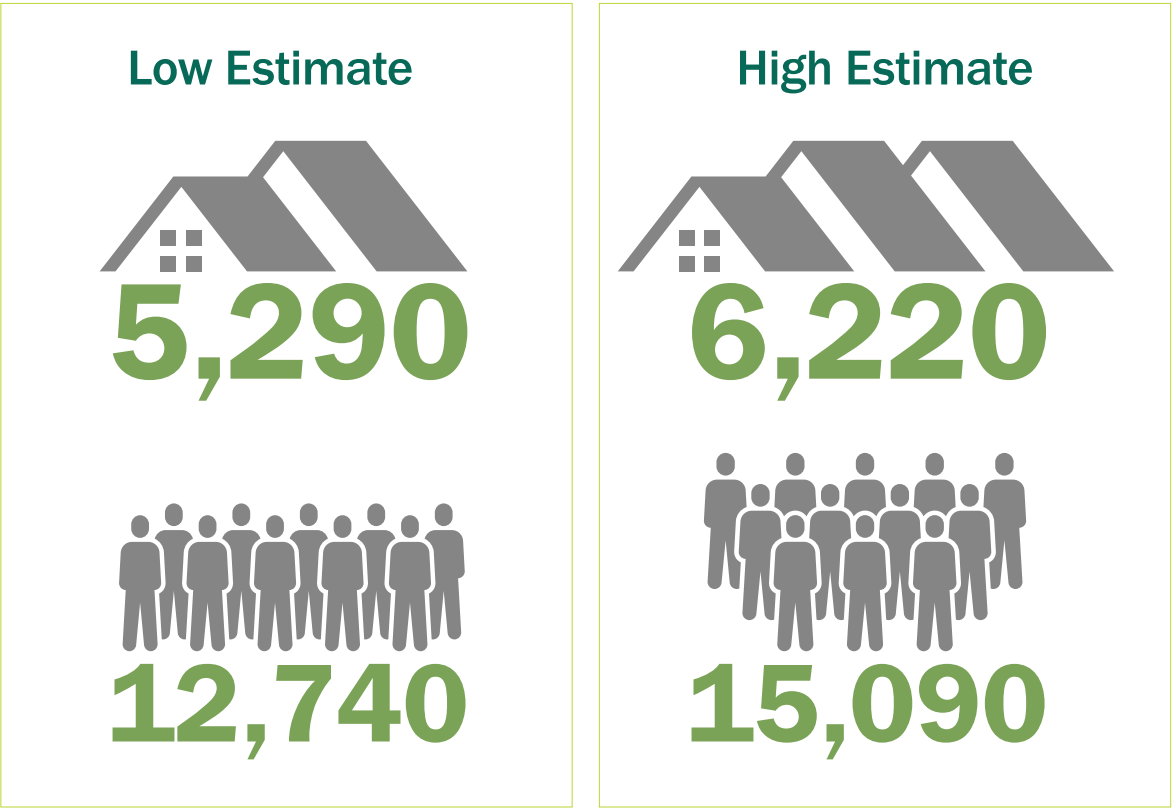


LAND WITH THE POTENTIAL for future infrastructure development

Growth in Receiving Areas

The project team identified nearly 4,500 acres of unconstrained land that would be available within the receiving areas. Areas will need to accommodate an estimated 130 houses to be built or relocated to accommodate participants in the Safe Structures Program. As projected natural population growth in the study area is about 15,600, the identified receiving areas have just about enough capacity to accommodate relocation and growth, in most communities(the high estimated growth of 15,090 plus relocated residents).

Housing and Population in Receiving Areas



The Town of Bucoda, City of Oakville, and the Grand Mound UGA seem to have sufficient developable land within their respective receiving areas to accommodate the expected population growth at current zoned densities. But the Cities of Centralia, Chehalis and Napavine might not have sufficient capacity, based on existing land use and zoning densities. So these communities would need to develop policies and regulations (such as zoning) allowing for higher residential building densities and the expanded infrastructure to support them.



Source: Office of Chehalis Basin

Public Sector Actions

Local jurisdictions can undertake a number of actions to reduce the number of structures subject to potential flood damage within the floodplain and to encourage a long-term shift in private market real estate development patterns away from the floodplain. Actions have already been implemented in some, but not all, jurisdictions. The towns, cities and counties, Quinault Nation, and the confederated Tribes of the Chehalis Reservation have the economic and development foundation to create the necessary conditions of market shift through policies and programmatic, regulatory and infrastructure strategies and actions.



POLICY INTERVENTIONS. Cities and counties can revise comprehensive plan policies, including updated land use designations in both sending and receiving areas; revised floodplain development policies in comprehensive plan elements and countywide planning policies; potentially updated Urban Growth Areas; updated comprehensive flood hazard management plans; potential subarea and/or master planning in receiving areas; and revised equity and housing planning policies.



PROGRAMMATIC ACTIONS. Largely centered on the creation and operation of a Safe Structures Program, other programmatic avenues may be considered in parallel by local governments, including updating flood maps; joining the Community Rating System; a possible novel application of the state’s Transfer of Development Rights program; and utilization of the Open Space Taxation (aka the Current Use) program.



REGULATORY ACTIONS. Cities and counties will need to implement regulations for policy actions described above, such as zoning and development code revisions to implement new land use designations and additional flood protection; a model development code; updates to local and county Critical Areas Ordinances; implementing National Flood Insurance Program criteria; and Flood Damage Prevention Ordinance updates.



INFRASTRUCTURE PLANNING AND DEVELOPMENT. Public sector planning will continue to expand infrastructure into areas of each jurisdiction’s designated urban growth area that anticipate relocations under the Safe Structures Program and new development related to natural growth. Infrastructure actions may include capital improvement/facility plan and element updates; funding; and physical development.

New structure development and redevelopment in the receiving areas, including right-of-way and easement dedication and fee payment for infrastructure, will be undertaken predominantly by the private sector. Private sector actors, including individual landowners, developers, and brokers, will need to actively be encouraged to participate in programs and private property transactions for successful implementation.



Source: Office of Chehalis Basin

6 Transportation System and Accessibility Improvements

A major flood can inundate streets and roadways and some, including I-5, have been closed for several days due to flooding. Roadway closures have a dramatic effect on emergency services and transportation—and hinder community recovery efforts after an event.

While there are many potential transportation-related projects that could be implemented, the design and extent of these projects will be dependent on a number of factors, including:



IDENTIFICATION OF THE STORM SEVERITY assumptions and LAND option(s) assumed for construction.



PRIORITIZATION OF PROJECTS based on emergency access needs, protection of essential facilities and equity impacts.



COORDINATION WITH LOCAL JURISDICTIONS to identify any needed changes to address updated flood elevations.



IDENTIFICATION OF ANY AMENDMENTS for projects already in existing plans or if not within existing plans, completing plan amendments to include it in a future capital improvement program.

The following projects would likely be a combination of city, county, and state leadership, depending on who is currently responsible for roads and/or bridges and how construction would be funded. (NOTE: Projects 14-17 shown on the map on page 38 still are still being defined and will be included in future analysis).

COST RANGES				
\$ \$2M	\$ \$2M-\$10M	\$ \$10M-\$24M	\$ \$25M-\$49M	\$ \$50M

1. SOUTH SCHEUBER ROAD BRIDGE (\$\$\$\$\$)

Install a new bridge from Fords Prairie across the Chehalis River to provide an alternative route for I-5 in the event of a closure. Concept layout of the new bridge is from South Scheuber Road to the south and Oakland Avenue to the north. Lewis County has studied this alignment in previous years.

2. SOUTH SCHEUBER ROAD–GRAF ROAD MILITARY ROAD (\$\$)

Raise South Scheuber Road from near the Graf Road/Military Road intersection to approximately 700 feet north of the intersection to maintain access to the hospital.

3. SOUTH SCHEUBER ROAD–WEST CONNECTION (\$\$\$)

Raise sections of South Scheuber Road between State Route 6 and the Graf Road/ Military Road intersection. This project, in combination with projects 1 and 2, will complete an alternative route for I-5.

4. COOKS HILLS ROAD (\$\$\$)

Raise Cooks Hill Road with structural fill to maintain access during an event. This project would also include raising utility castings and surface utilities (fire hydrants, communication and power cabinets and overhead utilities). This section of road does not have curb and gutter or sidewalks. Future improvements could include widening shoulders for a regional bike route and installing a fish-friendly culvert or bridge at Scammon Creek.

5. STATE ROUTE 6 (SOUTH SCHEUBER ROAD TO I-5) (\$\$\$\$\$)

Replace the existing bridge constructed in 1939 and elevate sections of Highway 6 to improve floodplain connections and minimize upstream raised water surface elevation.

6. WEST MAIN STREET (\$\$)

Raise West Main Street or construct a levee system in coordination with BNSF to provide a transportation connection from Chehalis to I-5 during flood events. This would require BNSF to raise its tracks, or construct a levee with a break for the rail and install a pump station on the shoulder. In the event of a flood, floodgates would be installed across the tracks.

7. NATIONAL TO KRESKY AVENUE (COST TBD)

Raise National to NE Kresky Avenue between its intersections with N National Avenue, or provide a series of levees, to maintain the roadway for emergency vehicles during a flood event. While the road is currently one-way northbound, it could also accommodate two-way traffic between Chehalis and Centralia during flood events.

8. SR 507 THROUGH CENTRALIA (\$\$) (ASSUMES LEVEE COSTS ARE IN OTHER PROJECTS)

SR 507 provides a connection from the existing Mellen Street Bridge area to the north of Centralia but is inundated in larger storm events. This project would provide levee protection for the roadway, but would also be coupled with other projects, such as projects 9 and 12.

9. PEARL STREET (SR 507) AND PEARL STREET BRIDGE (\$\$)

This section of roadway is in an area that frequently floods. This project would include replacing the existing 1928 bridge and raising the roadway to allow for vehicle passage. The height of bridge raising would be determined in concert with Skookumchuck Levee configuration and modelling results.

10. REYNOLDS ROAD (\$\$\$)

Reynolds Road provides an important east/west connection across I-5, but regularly floods near the Skookumchuck River. Raising the roadway with structural fill and increasing the width of the road prism would keep the road open and passable. Utility castings would be raised to the new asphalt road surface finish elevation. Surface utilities (fire hydrants, communication and power cabinets and overhead utilities) would also be raised to the new roadway elevation.

This section of road does not have formal curb, gutter , or sidewalk. There is a current project to widen the roadway and add a center turn lane. The Lewis County project team could review the option to raise the roadway as part of their analysis. A levee would be needed near the Reynolds and BNSF undercrossing of I-5. A Skookumchuck levee north of Downing Road would be needed to keep Skookumchuck flows from entering Coffee Creek unless Skookumchuck flows are mitigated upstream. An alternative to raising the roadway would be to install a levee south of the roadway.

11. NEW MELLEN STREET BRIDGE-SOUTH (\$\$\$\$)

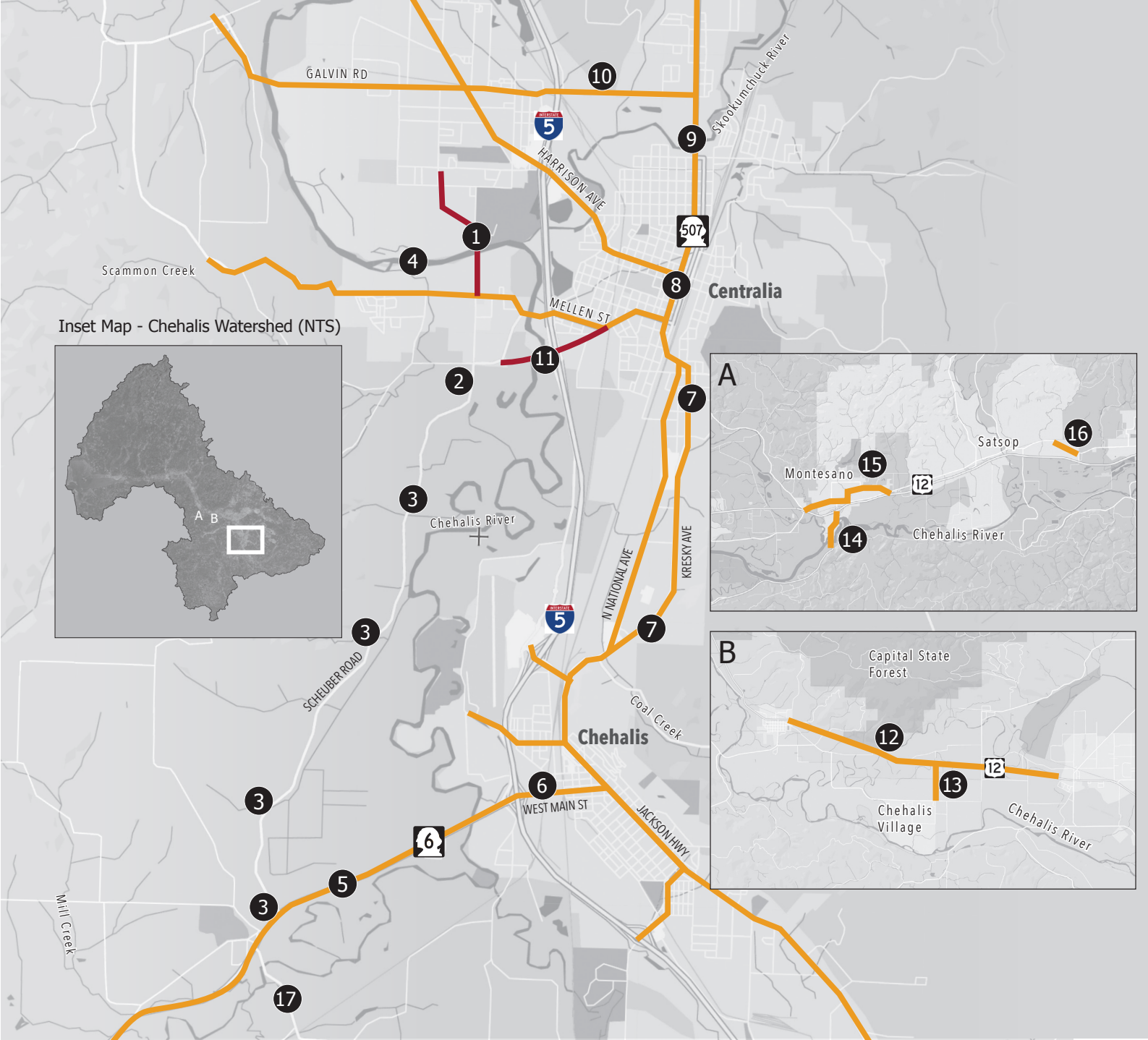
This project would be required if additional conveyance projects are constructed in the general vicinity of the existing Mellen Street Bridge. The project would construct a new bridge across the Chehalis valley from the Ellsbury Overpass to Military/Scheuber Road to provide an operational vehicular connection during the storm events. This project is included in Options 2 and 4 because those options would require removal and relocation of the existing Mellen Street Bridge and approaches.

12. RAISE SR-12, CHEHALIS RESERVATION TO ROCHESTER (COST TBD)

This project would raise or protect SR-12 between the Chehalis Reservation and Rochester to the west to preserve emergency access routes for the area.

13. RAISE ANDERSON ROAD (COST TBD)

Anderson Road is the primary access road to the Chehalis Reservation and is inundated during flood events, limiting access to key facilities off of the Reservation. This project would raise the roadway to maintain access during a flood event.



LEGEND

- Evacuation Routes per 2016 Lewis County Multi-Jurisdictional Hazard Mitigation Plan
- Potential New Bridges
- 1 South Scheuber Road Bridge
- 2 South Scheuber Road —Graf/Military Road
- 3 South Scheuber Road —West Connection
- 4 Cooks Hill Road
- 5 State Route 6 (South Scheuber Road to I-5)
- 6 West Main Street
- 7 National to Kresky
- 8 State Route 507 through Centralia
- 9 Pearl Street and Bridge (SR 507)
- 10 Reynolds Road
- 11 New Mellen Street Bridge
- 12 Raise SR 12
- 13 RaiseAnderson Road
- 14 State Route 107
- 15 Montesano Bypass
- 16 Monte Elma Road
- 17 Old Highway 603

7 Resiliency Programs

As climate change increases the intensity, frequency, and duration of major rain and snow events, the risks of living with a river will also increase. We cannot completely prevent damage caused by outsized weather events. But as we begin to adopt our flood prevention and management plans, we can also build our capacity to recover and thrive after flood events.

Community resilience—the sustained ability of a community to withstand, adapt to and recover from adversity—has both social and material components. A resilient community provides residents and businesses with a sense of safety, connectedness, self-sufficiency, collective efficacy and hope for the future.

Cultivating these qualities in advance of a crisis improves the likelihood that Chehalis Basin communities will successfully remain in the area and rebuild during the months and years it might take to fully recover.

There are also practical skills and plans that can be implemented before a disaster to improve the community's ability to remain self-sustaining. Educating Basin residents about flood risks and projected floodplain boundaries, emergency escape routes, refuge areas, and resources such as resilience hubs is crucial to equipping each family to prepare and execute an emergency plan when disaster strikes.

Ongoing programming that supports resiliency can also become a part of community life. Training programs for trade skills such as carpentry and welding, and survival skills such first aid, strengthen overall community resilience. These programs can be linked to existing school and education programs.

Each Basin community also needs a well-coordinated early warning system (such as an expanded Chehalis Basin Flood Authority early warning system), paired with a way to identify nearby evacuation routes and community resilience hubs. While the region has an existing alert system, expanding broadcast cell phone alerts and networks of communication will continue to be an effective means to distribute early warnings, especially for Basin residents who live in isolated settings.

Resiliency hubs are neighborhood centers—often managed by community members in partnership with local governments—equipped to support residents, coordinate communication, and distribute resources before, during and after a crisis. They're typically located in an existing facility that's on high ground or protected by levees, such as Adna High School, community centers, and places of worship.

Source: Office of Chehalis Basin



Source: Office of Chehalis Basin





Source: Shutterstock

8 Impacts on Agriculture

Overall, the Preliminary LAND Alternative would result in flood inundation extent, depth and duration remaining almost unchanged for agricultural lands in the modeled late-century 2080 major flood event. Median inundation depth decreases for 99.9% of lands, although about one-third of agricultural land would still flood and face potential crop loss.

Land analysis assumes existing programs for livestock refugia and agricultural pads will continue, and there would be funds for flood debris fencing and other non-structural flood damage reduction efforts. Some farm land would be protected behind levees, some farm land would be needed for levee footprints, and other land would not be additionally protected, although farmland and rural structures will be protected through the Safe Structures Program and targeted structural interventions (such as levees in the Adna area).

Croplands in the Basin

There are about 79,000 acres of cropland in the Chehalis Basin—about 40% or 32,461 acres are in the current floodplains of the Chehalis and the Skookumchuck Rivers. (Because extensive flood reduction investments have already been made in livestock refugia, and those investments will continue outside of the LAND Alternative, the analysis here focuses on croplands.)

Over 80% of the croplands in the floodplain are hay/silage; the floodplain contains about half of all the hay/silage grown in the entire Chehalis Basin. The floodplain also includes about 90% of the Basin’s cereal grain acreage and 25% of all the nursery stock.

This will also be true in the late century 2080 100-year floodplain. Other floodplain crops include pastureland, berries, vegetables, orchards and commercial trees.

Crops in the Chehalis Basin have a combined value of more than \$87 million a year. Crops within the floodplain account for about 32% or about \$28 million per year, although they represent about 40% of total acreage. That’s because the floodplain contains more acreage of lower value pasture and hay/silage crops, while the non-floodplain areas contain more acreage of higher value crops like nursery and flower bulbs, blueberries and vegetable seed.



Source: Office of Chehalis Basin

Cropland Inside the Current 100-Year Modeled Floodplain of Chehalis Basin

AGRICULTURAL COMMODITY	GRAYS HARBOR	LEWIS	THURSTON	TOTAL	PERCENT OF TOTAL BASIN CROPS
Nursery & Flower Bulb	132	68	2	202	26.8%
Orchard	4	56	2	62	81.1%
Berry	8	126	67	201	19.7%
Vegetable & Seed	216	148	199	563	68.7%
Cereal Grain & Oilseed	2,292	646	42	2,980	89.3%
Commercial Tree	285	310	159	754	20.1%
Pastureland	3,436	3,543	1,995	8,974	28.6%
Total	13,859	13,588	5,014	32,461	41.2%

Source: Washington State Department of Agriculture
Notes: “Hay/Silage & Other” includes hay/silage, other, turfgrass, and green manure. “Other” is not defined in raw data but independent comparison of satellite imagery indicated lands appeared to be similar to pasture/silage. They represent a small percentage of this category.

Cropland Value Inside the Current 100-Year Floodplain of Chehalis Basin

AGRICULTURAL COMMODITY	GRAYS HARBOR	LEWIS	THURSTON	TOTAL	PERCENT OF TOTAL BASIN CROPS
Nursery & Flower Bulb	\$101,150	\$3,439,114	\$5,006,945	\$8,547,210	22%
Orchard	\$26,448	\$740,544	\$52,896	\$819,888	22%
Berry	\$217,818	\$409,628	\$26,008	\$653,454	20%
Vegetable & Seed	\$563,790	\$419,301	\$606,287	\$1,589,379	70%
Cereal Grain & Oilseed	\$57,538	\$884,992	\$3,139,942	\$4,082,472	89%
Commercial Tree	\$157,520	\$307,114	\$282,347	\$746,981	20%
Pastureland	\$1,635,900	\$2,905,260	\$2,817,520	\$7,358,680	29%
Hay/Silage & Other	\$606,424	\$2,021,096	\$1,761,438	\$4,388,958	50%
Total	\$3,366,589	\$11,127,050	13,696,383	\$28,187,022	32%

Source: ECONorthwest analysis with data from United States Department of Agriculture 2021, Washington State Department of Agriculture 2022
Notes: “Hay/Silage & Other” includes hay/silage, other, turfgrass, and green manure. “Other” is not defined in raw data but independent comparison of satellite imagery indicated lands appeared to be similar to pasture/silage. They represent a small percentage of this category.

Cropland Impacts

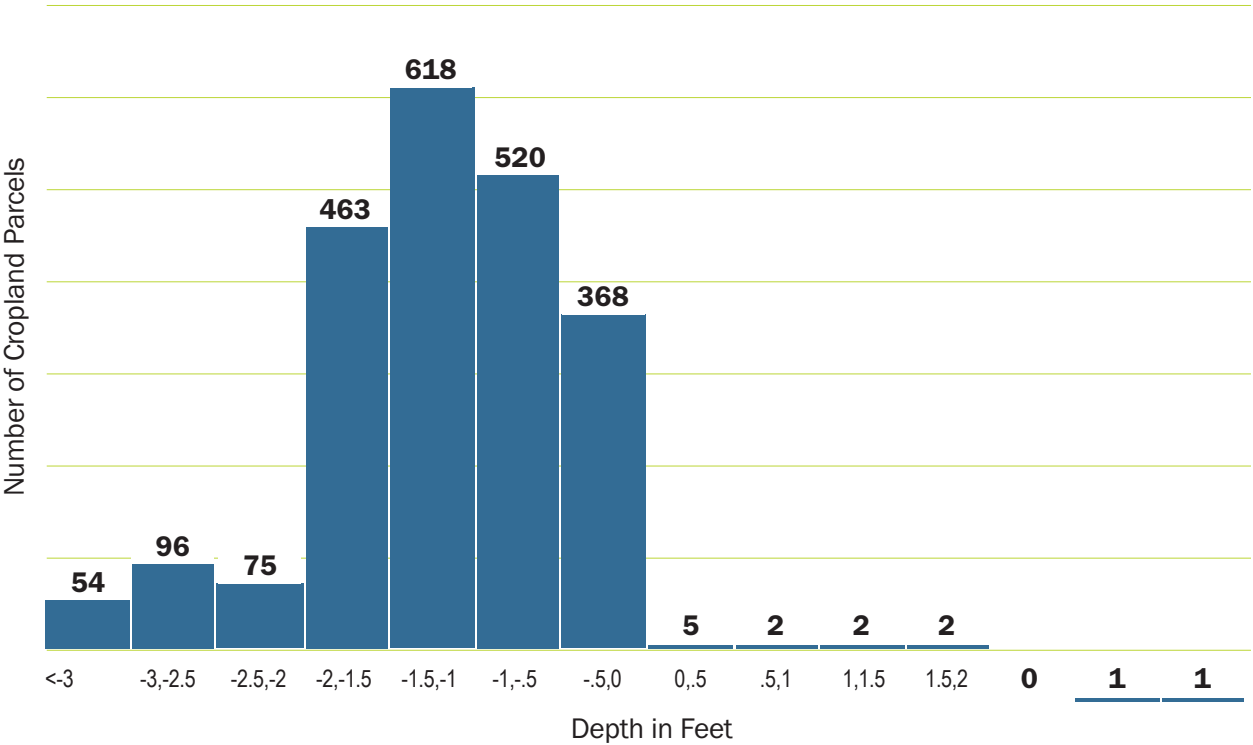
The Preliminary LAND Alternative increases the extent of cropland inundation by about 2%, or 580 acres, in the modeled late-century 2080 major flood event. Inundations depths for about 99.9% of agricultural land decreases—over two-thirds of agricultural parcels will experience reductions of up to 1.5 feet in inundation dept. Almost one-third will experience reductions in inundation depth greater than 1.5 feet, and almost all of these parcels would still flood.

Change in Cropland Floodwater Inundation Extent by Crop Type

CROP TYPE	CURRENT (ACRES)	PRELIMINARY LAND ALTERNATIVE (ACRES)	DIFFERENCE (ACRES)	PERCENT DIFFERENCE ¹
Nursery & Flower Bulb	202	208	6	2%
Orchard	62	62	0	0%
Berry	201	201	0	0%
Vegetable & Seed	563	575	12	2%
Cereal Grain & Oilseed	2,980	2,959	-21	-1%
Commercial Tree	754	773	19	3%
Pastureland	8,974	9,221	247	3%
Hay/Silage & Other ²	18,725	19,043	318	2%
Total	32,461	33,041	580	2%

Source: Washington State Department of Agriculture 2022, MIG
Notes: 1 Positive values represent increases in acreage within the flood inundation area, which means it is potentially at risk during a flood event. Negative values represent crop acreage that is removed from the inundation area and would not be at risk for future flooding.
2 “Hay/Silage & Other” includes hay/silage, other, turfgrass, and green manure. “Other” is not defined in raw data but independent comparison of satellite imagery indicated lands appeared to be similar to pasture/silage. They represent a small percentage of this category.

Distribution of Cropland Parcels by Change in Median Depth of Flood Inundation



Source: ECONorthwest analysis with date from MIG

For most landowners, the changes in inundation extent, depth, and duration are unlikely to make a meaningful difference in realized crop value (or crop loss), especially considering annual fluctuations in cropping patterns, productivity, and market value. Reductions in inundation depth could potentially decrease the risk of crop loss on some parcels, but these changes are impossible to predict with the currently available modeled data.

Because the acres within the floodplain increase slightly over current conditions, the value of crops within the floodplain—and thus the value potentially at risk of flood impact—also increases. Almost 50 percent of the change in value (about \$500,000) is associated with the 6 acres of Nursery and Flower Bulb that shift into the

floodplain, because the per-acre value is so much higher for that crop than other crop types. The value of the almost 250 acres of pastureland shifting into the floodplain accounts for 36 percent of the total value.

The Preliminary LAND Alternative also assumes restoration of the floodplain that is aligned with the Aquatic Species Restoration Plan (ASRP) goals within the Chehalis Basin. In addition to restoration, localized flood and debris management could also include flood fencing and other non-structural flood damage reduction interventions to reduce flooding impacts to farmland during smaller and more frequent events. Existing agricultural practices are assumed to continue on those parcels, to the greatest degree possible.

Estimated Value with Cropland Inundation Under
Current Conditions and Preliminary LAND Alternative

CROP TYPE	CURRENT VALUE (THOUSANDS)	PRELIMINARY LAND ALTERNATIVE VALUE (THOUSANDS)	DIFFERENCE (THOUSANDS)	PERCENT DIFFERENCE¹	PERCENT OF TOTAL
Nursery & Flower Bulb	\$10,216	\$10,489	\$273	3%	48%
Orchard	\$820	\$818	-\$2	~0%	0%
Berry	\$653	\$655	\$2	~0%	0%
Vegetable & Seed	\$1,589	\$1,622	\$33	2%	6%
Cereal Grain & Oilseed	\$4,082	\$4,053	-\$29	<-1%	-5%
Commercial Tree	\$747	\$766	\$19	2.5%	3%
Pastureland	\$7,359	\$7,561	\$202	3%	36%
Hay/Silage & Other²	\$4,389	\$4,455	\$66	1.5%	12%
Total	\$29,855	\$30,418	\$563	2%	100%

Source: ECONorthwest analysis with data from United States Department of Agriculture 2021, Washington State Department of Agriculture 2022.
Notes: 1 Positive values represent increases in acreage within the flood inundation area, which means it is potentially at risk during a flood event. Negative values represent crop acreage that is removed from the inundation area and would not be at risk for future flooding.
2“Hay/Silage & Other” includes hay/silage, other, turfgrass, and green manure. Other” is not defined in raw data but independent comparison of satellite imagery indicated they appeared to be similar to pasture/silage. They represent a small percentage of this category.

Cleanup Costs

Flooding produces other costs for agricultural producers, including costs to remove debris and potential waterborne contamination. The Preliminary LAND Alternative would include funding to continue voluntary installations of debris fencing and non-structural flood management interventions. Expanding fencing is unlikely to make a significant difference in modeled flood inundation because flooding would likely overwhelm any protection fencing provides. Fencing might reduce post-flood cleanup costs in some areas. Reducing inundation risk structures in the floodplain, through the Safe Structures Program and constructed flood control measures, might also reduce the risk of floodwaters becoming contaminated and adversely impacting agricultural land.

Land Values

The Preliminary LAND Alternative will not directly change local zoning or growth management regulations. Currently-designated agricultural land will remain constrained to agricultural uses. Thus, any impacts the Preliminary LAND Alternative may have on other land uses (e.g., for residential housing) are not expected to affect the market (supply, demand, or value) for land that is zoned for agriculture. Other factors that may influence the value of agricultural land, including the current or future market value for crops and livestock, or the availability of water rights, are also not expected to change as a direct result of the Preliminary LAND Alternative.

Source: Shutterstock



Source: Chehalis Basin Partnership





Source: Office of Chehalis Basin

9 Cost Development

The Preliminary LAND Alternative recommendations are all highly conceptual and all will require additional engineering and environmental evaluation to confirm final locations, designs and costs. But overall, estimated costs for the program range from a low estimate of \$1.25 billion to a high estimate of \$1.9 billion.

When finalizing costs, other current and planned land development projects throughout the basin in various stages of development will also need to be taken into consideration. There are also a number of emergency-access projects that would require modifications to existing roadways and bridges in order for them to be accessible during a catastrophic flood event. Improvements to some of these facilities are already included in existing local capital improvement programs, but none account for the level and extent of flooding assumed under the modeled late-century 2080 flood. Those cost estimates have not been included in the total estimated cost because those projects are not required to construct the structural interventions for the Preliminary LAND Alternative.

	Low Estimate (in millions)	High Estimate (in millions)
Corridor Floodplain Management	\$300	\$600
Waterflow Diversion and Improved Conveyance	\$500	\$700
New and Expanded Levees	\$450	\$600
TOTAL	\$1,250	\$1,900

Corridor Floodplain Management

Cost estimates for the Preliminary LAND Alternative assume that work would be completed in alignment with the goals of the Aquatic Species Restoration Plan (ASRP) and be complementary rather than overlapping. The projects would be similar to those used in ASRP, such as surface contouring, removal of human-caused barriers to water flow, reconnecting off-channel flood plain habitats, installing large woody debris, and recreating beaver ponds and side channels.

Other potential projects could include berms and flood fencing, with preference for projects on larger parcels or smaller contiguous parcels where large (50 acres or larger) flood management interventions could be constructed. No specific locations have been identified and implementation would depend on landowner interest. Given the general assumptions for the location and scale for this type of intervention, the Preliminary LAND Alternative assumes a similar cost range as ASRP Scenario 1 (ASRP, Table 8-2, page 225). For comparison, ASRP Scenario 1 includes 222 miles of channel and 9,027 acres of floodplain restoration.

Waterflow Diversion and Improved Conveyance

While a diversion channel and conveyance improvements could be constructed separately, the planning level cost estimate assumes that they would be constructed at the same time, given their proximity to each other.

A west diversion channel would be constructed south of Mellen Street, running west of the Centralia Hospital to reconnect with the Chehalis River downstream of the hospital. This one-mile long, 700-foot wide excavated channel would remain dry during normal weather events but would be inundated during major flood events. The channel would be graded to allow water to drain as flood waters recede to avoid trapping fish. Because untreated waters currently flow from existing roadways to the Chehalis River, the area could also be used for green stormwater treatment, reducing pollution during traditional weather patterns.

About 1.3 million cubic yards of soil would be hauled away, which could potentially be used for other projects (such as levees or berms, if suitable). Three existing arterial streets, and would cross the proposed west diversion channel, and would require new bridges to maintain connectivity. Utilities would also need to be reconfigured.

The current alignment assumes that about 65 properties could be affected, although the final location and scale of the west diversion could change the number of affected properties.

In addition to the conveyance improvements, the area near the existing Mellen Street Bridge is currently used as a public training facility, sewer pump station and WSDOT Park and Ride. The pump station and force mains would be protected or rerouted to another location, the training facility building would be demolished and the existing park and ride area relocated.

New and Expanded Levees

The type, alignment and height of the recommended levees is conceptual at this phase. Planning-level budget estimates used historic bids for similar project types to identify a per-mile cost assumption. Future analysis and refinement will determine specific location considerations, such as urban and rural applications, road/

railroad/driveway crossings, location in public right-of-way vs private property, number of storm drain crossings, and level of mitigation required. This will include additional coordination with WSDOT on levee alignments and flood duration and depths for the levees closest to the highway. Levee location and design should consider WSDOT’s 2014 study of various options to reduce flooding on I-5. Some levee projects could be coordinated with other road and bridge projects.

The two most recent publicly available levee and floodwall costs are for the Hoquiam and Aberdeen North Shore Levee project, estimated at \$8.5M per mile, and the Mount Vernon (WA) Flood Wall, estimated at \$18.2M per mile. Given the uncertainties of levee location and size, we are using a higher \$20M per-mile planning budget.

As projects and dependencies are further refined, a prioritized list of projects with more detailed engineering, design and construction cost estimates can be developed.

Source: Office of Chehalis Basin





Source: Office of Chehalis Basin

10 Economic Benefits

Investments in infrastructure, Safe Structures and other community policies and programs help avoid costs generated by flood damage to both public and private structures, reduce insurance costs, enhance property values and generate direct economic benefits in the Basin.

In 2022, flood damage costs exceeded \$12.4 million, including more than \$6.4 million in damages reported by individuals and businesses. The 2007 flood, the largest on record, resulted in about \$900 million in damages. With climate change, there's every reason to believe flooding—and catastrophic flooding—will continue.


Direct damages from storms—to infrastructure, structures, agriculture and other property damage—are paid by homeowners, businesses and local and state governments. Investment proposed by the Preliminary LAND Alternative will protect valuable structures under the late century 2080 100-year flood event, providing real economic benefits to the Basin.

DIRECT, INDIRECT AND INDUCED BENEFITS


Direct spending on infrastructure generates ripple effects in the local economy, depending on the following key factors:

- Floodplain restoration and levee construction including design, engineering, construction, etc.
- Maintenance and operations of the flood damage reduction system structures
- Safe Structures program including floodproofing and elevating structures
- Economic activity through business-to-business and supply chain transactions (indirect impact) as well as spending of worker wages (induced)

Assuming the total costs of the Preliminary LAND Alternative are \$1.25–\$1.9 billion (see "Cost Development"), the economic benefits to the State of Washington could total:

 **6,000-9,000 jobs**

 **\$740-\$990 million in labor income**

 **\$3.5-\$4.8 billion in total business output**

These assume funds are spent with Washington State firms. The more projects and programs that hire local firms with local workers, the higher the economic benefits within the Basin itself. Note that this includes economic benefits solely from developing the structural interventions, not from other potential opportunities such as new housing, private infrastructure or expanded retail.

SAFE STRUCTURES PROGRAM BENEFITS

The proposed Safe Structures Program will increase the number of structures protected and provide significant benefits over time. For example, a 2013 State of Washington Military Department study determined that raising 35 homes cost \$1 million, but the cost of flood damage to those homes, without elevation, would be \$1.9 million, a net savings of about \$25,000 per home. Depending on the location of structures and the patterns of future flooding, benefits can be realized even before key structural interventions are completed.

FLOOD INSURANCE PREMIUM REDUCTIONS

The structural interventions and the Safe Structures Program would reduce the cost of flood insurance premiums and payouts. Between 1978 and 2015, total flood insurance premiums through the National Flood Insurance Program (NFIP) were \$82 million in Chehalis Basin communities, according to the Floodplain Management Master Report. These payments represent just 10-25% of the total costs of damage during that time. Buildings behind FEMA-certified levees could reduce or eliminate their flood insurance, but buildings in the Safe Structures program would likely pay similar rates to what they pay now.

HIGHER PROPERTY VALUES/MORE HOUSING

While properties values within flood zones are discounted compared to those outside a flood zone, housing markets undervalue the risk of flooding. Depending on the study, housing within a flood zone is now 2-12.2% less compared to housing outside of flood zones. After a major flooding event, that discount percentage rises.

Although until now that's been a temporary discount, it's possible that with continued flooding, the markets might catch up to that realization and discount values even more, thus reducing property values.

The structural interventions in the Preliminary LAND Alternative, however, could equalize prices for properties in areas with enhanced protection. In Missouri, for example, home prices in an area with a levee were equal to those in a non-floodplain area. In Florida, development increased by 57% in areas protected by levees.

Long-term housing prices had been increasing nationwide and in the Basin went up 9% annually between 2012 and 2021. Increased housing supply in non-floodplain areas and in areas newly protected can help decrease the rising cost of housing.

POTENTIAL TRANSPORTATION BENEFITS

The Preliminary LAND Alternative includes transportation investments to support implementation of levees and a diversion channel. The benefits to the Basin of investments in transportation projects will depend on the design and implementation of projects and the magnitude of future flood events. In general, benefits are associated with fewer delays and closures within the local transportation system include:

- Reduced lost wages and business activity due to closures (according to WSDOT, disruptions to US 12 and SR 6 from a 100-year flood could cause more than \$450,000 in additional travel costs per event—\$52/person/hour plus fuel costs)
- Reduced costs due to increased time and mileage associated with detour routes

- Reduced costs to travelers associated with abandoned trips
- Increased safety by reducing travel-related injuries (according to the USDOT, the monetized cost per fatal crash is \$12.8 million, and more than \$300,000 per injury crash)
- New pedestrian, bicycling and transit access amenities
- Reduced emissions caused by idling at closures and longer detour routes
- Improved access for emergency vehicles and faster response times

OTHER POTENTIAL BENEFITS

Investments that contribute to increasing quality of life, such as providing good services, recreational opportunities, and cultural access to lands, are also important to a healthy economy:

- Formerly developed and inundated sites can once again become available to local tribal nations, the community and others who want a deeper connection to natural resources and the Basin's history
- Formerly residential or mixed-use development located within sending areas could also become available (any needed remediation can be subsidized by state and federal grants and non-profits)
- Both active and passive recreation can be available during non-flood times on lands that will be allowed to flood



Source: Office of Chehalis Basin

11 Next Steps

The Chehalis Basin Steering Group developed the Preliminary LAND Alternative during the past year. Decisions about implementing recommended projects, programs, policies will be made collaboratively by the Board and any project sponsors who choose to advance any of the recommendations.

Next Steps for LAND



THE BOARD AGREES ON WHAT ELEMENTS should be included in the Recommended LAND Alternative



REFINE LEVEE LOCATIONS through conceptual engineering



REFINE CHEHALIS RIVER diversion location and design



UPDATE THE CHEHALIS BASIN structures (houses and commercial) database



REVALUATE STRUCTURES with project refinements



COORDINATE WITH LOCAL JURISDICTIONS to provide technical assistance for comprehensive plan and development code updates

LAND Alternative Recommendations

The Steering Group has also developed specific recommendations related to programs and policies that should be pursued in the coming years.

Program Recommendations

CFAR and Safe Structures

- Require local jurisdictions to update flood maps to access Safe Structures funding
- Actively pursue grants and other funding to address the program scale and phasing
- Provide additional project management and technical assistance for landowners, renters and local jurisdictions to implement the program
- Prioritize areas where interventions are not proposed and that flood repeatedly
- Include programs for renters to secure new housing
- Include measures for both commercial and residential structures
- Update emergency access plans, including planning for livestock and machinery in rural areas (e.g. Adna High School accessibility and as a resiliency hub)
- Consider developing resiliency hubs in the region for long-term recovery that reflect urban and rural location needs
- Continue to expand early warning monitoring systems

Resiliency measures should be expanded and coordinated across the Basin, regardless of what future flood intervention measures are implemented.

ASRP/LAND Alignment

- Create an ASRP/LAND Working Group to identify potential synergies between the two programs
- Identify potential permit and regulatory streamlining opportunities to speed ASRP/LAND projects
- Focus LAND-related strategies on projects to reduce damage from smaller floods on agricultural uses

The ASRP does not include flood damage reduction in its goals, but much of what is recommended in the ASRP and LAND could provide economic, environmental and flood damage reduction value.

Expanding CFAR or replacing with a Safe Structures Program is needed regardless of what future flood intervention measures are implemented.

Resiliency

- Organize a working group to develop an Upper Chehalis Basin Resiliency Plan to increase coordination and capacity to manage and maintain preparedness

Policy Recommendations

Policy Recommendations: Growth Management

Update comprehensive plans, as needed, to address land use, housing, infrastructure and critical areas:

- Update future land use maps to restrict development in the floodplain
- Expand Urban Growth Areas to incorporate receiving areas with planned city services
- Refine receiving area locations through subarea planning, including infrastructure requirements to support future development in receiving areas
- Assume Flood of Record boundary and expanded critical areas for land capacity analysis
- Assume voluntary relocation of identified structures to receiving areas
- Incorporate comprehensive flood hazard management planning to ensure consistency with all other management policies, such as the Safe Structures Program and receiving areas
- Address equity and affordable housing to include projections of the impact of updated plans and policies on housing needs and future land use designations

Local comprehensive plan updates are required in the next 3-5 years. They can establish the foundation for more resilient communities and less development in flood-prone areas.

Development Code

First, update flood maps within the Upper Basin to reduce development in flood prone-areas (if not already completed). Also review/update Development Codes:

- Complete audits of all development codes in the Basin related to floodplain development
- Create a model code and provide technical assistance to local jurisdictions to implement flood-related development and building code changes
- Update Critical Areas Ordinances for consistency between local and county ordinances and with other policy elements previously described
- Update Flood Damage Prevention Ordinances related to developer and shoreline permits, construction, flood protection and subdivision proposals

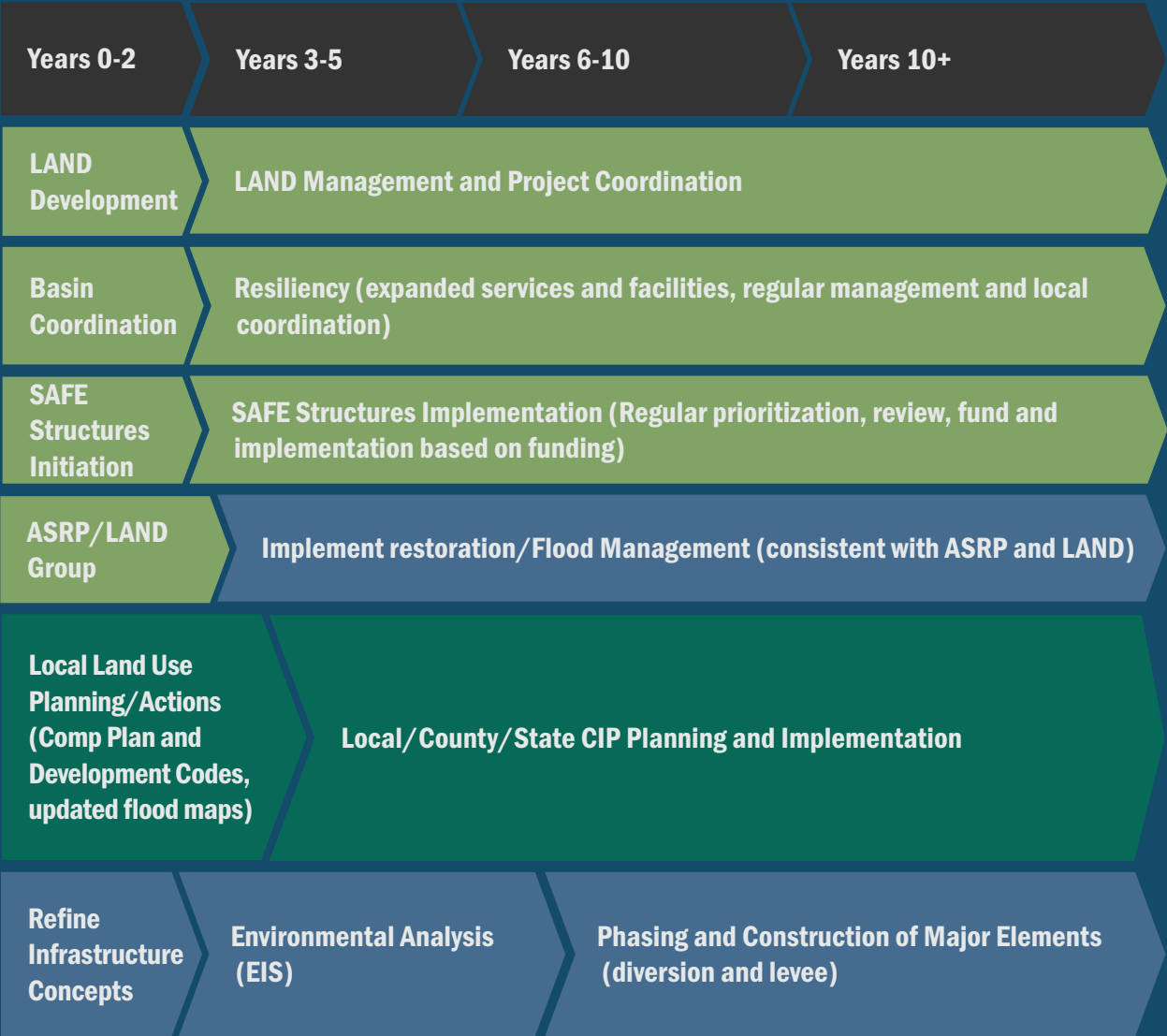
Some flood maps have not been updated in over 20 years.

Recommendations: Other Plan Updates

- Update Capital Facilities Plans in concert with Comprehensive Plan updates and other land use planning activities, including a short-term financing plan
- Prioritize required facilities and continue to update plans regularly to ensure facilities are in place to serve development in the receiving area
- Identify existing or new funding sources for capital projects—options include:
 - Real estate excise taxes
 - General obligation bonds
 - Impact fees
 - Local improvement districts
 - Connection fees and Latecomer charges
 - State and federal grants

LAND Initiation, Planning, DESIGN, and Implementation

The team has developed a 10+ year timeline for LAND initiation, planning, design and implementation, subject to local and state planning, community participation and funding. The goal is that by 2033, flood damage will be significantly reduced for people, structures and agricultural lands, as well as roads and highways—and our Chehalis Basin community will be stronger and more resilient.



Chehalis Basin
LAND
*LOCAL ACTIONS NON-DAM ALTERNATIVE





ChehalisBasinLand.com