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Implementation

The LAND Alternative proposes short, medium, and long-term strategies to reduce flood damage within the Chehalis Basin. Some actions can occur today, building upon existing projects and programs, while others will require additional studies and design refinement on floodplain boundaries. The implementation matrix beginning on page 93.



THE LAND ALTERNATIVE INCLUDES THREE MAJOR ELEMENTS:



PROJECTS:

- PJ1: Critical Roads and Bridges
- PJ2: Levees and Floodwalls
- PJ3: Improved Channel Conveyance
- PJ4: Channel Diversion
- PJ5: China Creek Daylighting



PROGRAMS

- PG1: Safe Structures
- PG2: Community Resiliency
- PG3: ASRP/LAND Alignment
- PG4: Equity Set Aside
- PG5: Floodplain Restoration



POLICIES

- PL1: Economic Development, Land Use, and Growth Management
- PL2: Building and Development Codes
- PL3: Capital Facilities
- PL4: Funding

The elements include recommendations for infrastructure projects, programs, and policy changes to reduce damage from flooding within the Chehalis Basin. Implementation of LAND requires action from all local jurisdictions, many of which can be undertaken separately and under local control. These include decisions about future growth and where capital facilities, such as sewer and water, are planned. Broader coordination is also required to address the need to align Basin-wide efforts, including:

- Expanding CFAR or creating a new Safe Structures program to address the scale of need within the Chehalis Basin.
- Evaluating, coordinating, and expanding resiliency programs.
- Aligning non-structural interventions, such as floodplain restoration, to reduce flood damage from smaller flood events that meet the goals of the Aquatic Species Restoration Plan (ASRP)
- Evaluating and implementing a phased package of levees, diversion, and conveyance, to reduce flood damage to areas where there are high concentrations of structures.

Preliminary Infrastructure and Safe Structures Costs

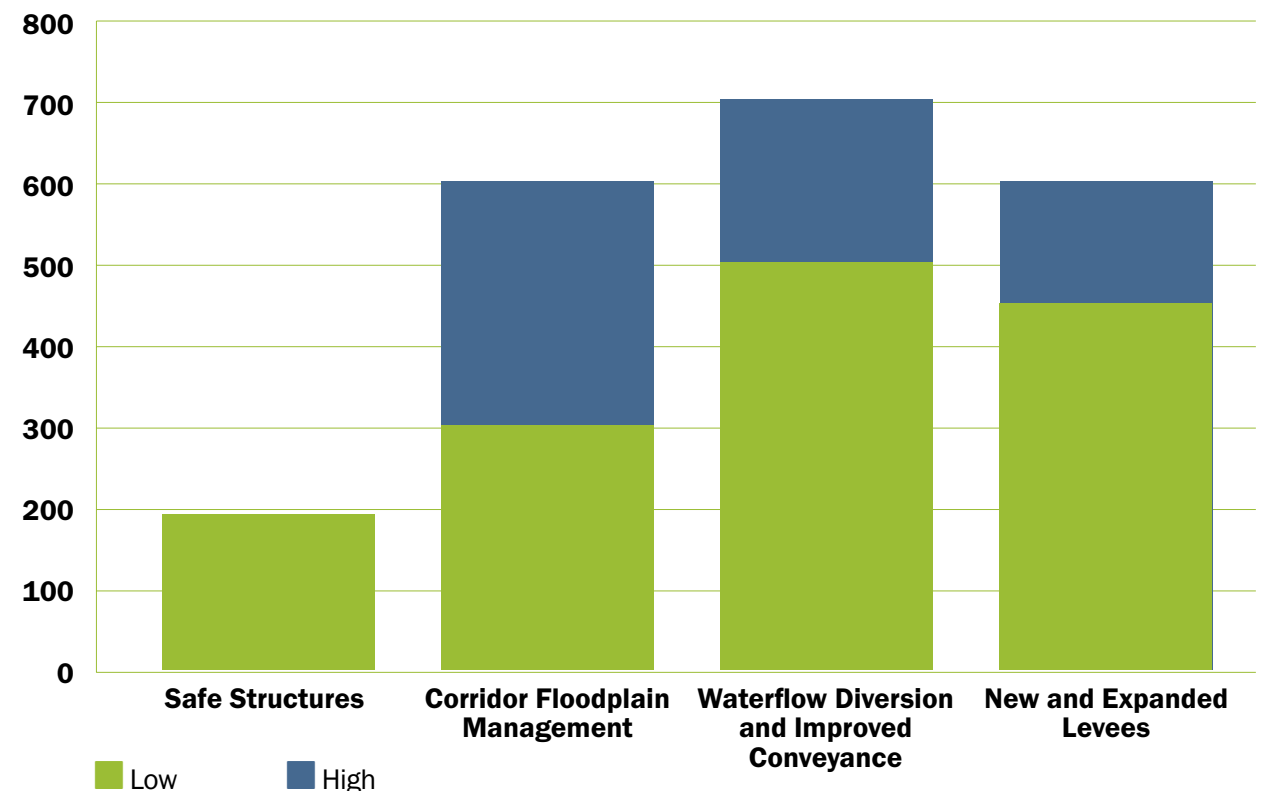
The LAND Alternative infrastructure interventions are all highly conceptual and all will require additional engineering and environmental evaluation to confirm final location and design. There are also current and planned land development projects throughout the Basin in various stages of development that could affect future development of the interventions. Estimated costs for infrastructure interventions range from a low estimate of \$1.25 billion to a high estimate of \$1.9 billion. Cost estimates are for construction only and do not include funding for operations, maintenance, or long-term management.

Costs assumed for the LAND Alternative could be funded through a number of funding mechanisms, including local, state, and federal options.

The LAND Alternative also identifies known current and planned roadway and bridge projects that could provide emergency-access if modified 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. Cost estimates for local projects are not included in the total estimated cost. Those projects are not required to complete the structural interventions proposed specifically under the LAND Alternative, even though they could improve emergency access as part of a more resilient transportation network. Additional coordination should occur to maximize the potential for current projects to improve emergency access during a catastrophic flood.

Cost Estimates by LAND Component

in millions



CORRIDOR FLOODPLAIN MANAGEMENT: (\$300M TO \$600M)

Corridor floodplain management includes flood management through nonstructural interventions that reduces flooding from smaller storm events, while also continuing to implement the goals of the ASRP. Costs for these types of projects are independent of structural interventions and could be funded separately. These projects are not focused on addressing the catastrophic flood, rather, they are designed to reduce more frequent flooding provided they are also supported by local landowner(s). Also, any mitigation work conducted to support the LAND would be separate from the restoration work being undertaken by the ASRP.

The LAND Alternative program includes a recommendation to develop an ASRP/Land Working Group to align the flood management and flood damage reduction goals of the LAND Alternative. The ASRP does not include specific flood damage reduction goals but could be coordinated with the LAND Alternative to provide multiple watershed benefits and identify permit streamlining opportunities where the flood damage goals of the LAND Alternative.

Cost estimates for the LAND Alternative assume that work is aligned with the goals of the Aquatic Species Restoration Plan and is complimentary rather than overlapping. These types of projects are assumed to include those similar to ASRP projects, such as surface contouring, removal of human caused barriers, reconnecting off channel flood plain habitats, large woody debris installation, recreating beaver ponds and side channels (see page 42 of the Aquatic Species Restoration Plan). Other potential projects related to flood damage reduction 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. Specific locations have not been identified and would depend on landowner interest. Given the general assumptions for the location and scale for this type of intervention, the LAND Alternative assumes a cost range of \$300M to \$600M, the same assumption 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. If aligned, these costs for corridor floodplain management could be reduced if they also meet ASRP goals.

WATERFLOW DIVERSION AND IMPROVED CONVEYANCE: (\$500M - 700M)

The LAND Alternative includes a diversion channel and conveyance improvements. While these projects could be constructed separately, the planning level-level cost estimate assumes that they would be constructed at the same time given each project's proximity to one another.

West Diversion

The west diversion would be constructed south of Mellen Street, running west of the Centralia Hospital to reconnect with the Chehalis River downstream of the hospital. The west diversion is an approximately one mile long, 700-foot-wide excavated channel that would remain dry during normal weather events but would be inundated during major flood events. The diversion channel would be graded to allow water to drain as flood water recedes to avoid trapping fish. The diversion channel and immediate vicinity would include floodable features that when dry, would provide recreation, habitat, and trails that would connect to a larger trail system. The area could also be used for green stormwater treatment for surrounding roadways and other impervious surfaces (pollution generating impervious surfaces) during traditional weather patterns. Existing roadways currently discharge untreated stormwater runoff to the Chehalis River.

Constructing the west diversion would require excavation of approximately 1.3 million cubic yards of soil, which could potentially be used for other projects (such as levees or berms, if suitable) or hauled off by truck or rail. There are three existing arterial streets that would cross the proposed west diversion channel that would require new bridges to maintain connectivity. Utilities would also be reconfigured. The current alignment assumes that approximately 65 properties could be affected,

although refinement of the location and scale of the west diversion, if pursued, would likely change the number of affected properties.

Improved Conveyance:

The LAND Alternative would improve water conveyance on the Chehalis River at approximately the same location as the existing Mellen Street Bridge, which was constructed in 1911. This section of the Chehalis River is narrow and restricts river flow. Improving conveyance would include the following structural interventions:

- Remove the aging Mellen Street Bridge and relocate it approximately 2,000 feet to the south of its current location. The eastern approach would connect to the existing Ellsbury Road/Airport Road overpass which is above the elevation of major flood events. The western approach would connect to Military or Scheuber Roads.
- Widen the Chehalis River channel near the existing Mellen Street Bridge by removing approximately 1.3 million cubic yards of soil immediately upstream and approximately 3,000 feet downstream of the existing Mellen Street Bridge location.

In addition to the conveyance improvements, the area adjacent to the Chehalis River near the existing Mellen Street Bridge is currently used as a public training facility, sewer pump station and WSDOT Park and Ride. There are two sanitary sewer force mains running north from the pump station. The pump station and force mains would be protected or rerouted to another location. Previous studies have also indicated the need to protect or reroute these facilities away from Chehalis River. Other changes to the area would include relocating the existing park and ride and demolishing the training facility buildings.

NEW AND EXPANDED LEVEES (\$450-600M)

The LAND Alternative includes constructing new or expanding existing levees, totaling approximately 22.1 miles of potential levee projects. The type, alignment and height of the levees are conceptual at this phase. There are some existing levees in the Basin that would be modified to address water surface elevation assumptions for the late century 2080 flood. 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, pump station requirements, road/railroad/driveway crossings, location in public rights-of-way vs private property, number of storm drain crossings, and level of mitigation required. This will also include additional coordination with WSDOT on levee alignments and flood

duration and depths for the levees closest to the highway. Levee location and design would also be considered WSDOT's 2014 study of various options to reduce flooding on I-5. Some levee projects could also 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 and the Mount Vernon (WA) Flood Wall. The Mount Vernon floodwall is reported to be a \$31 Million project and listed as 1.7 miles (\$18.2M per mile). This project also included riverfront park improvements. The North Shore Levee West Segment is listed as \$40M for 4.7 miles (\$8.5M per mile). The HDR project website lists \$182.6M for 9.6 miles and includes the Fry Creek Pump Station. Based on these referenced costs, the LAND Alternative assumes a \$20M per mile planning budget, given the uncertainties of levee location and size.

Source: Office of Chehalis Basin



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#	Action	Description (as needed)	Related Projects/ Programs/ Policies	Timeframe			Champion		Primary Funding Source(s)			Comments
				Short 1-5 yrs	Mid 6-10 yrs	Long 11+ yrs	Lead	Support	Federal	State	Local	
PJ 1 CRITICAL ROADS AND BRIDGES												
PJ 1.1	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 closure.	PJ 1.2, PJ 1.3	■	■	■	Lewis County	Cities of Centralia, Chehalis, WSDOT	■	■	■	Listed in the current Lewis County Transportation Improvement Plan Lewis County has studied this alignment in previous years. The new bridge would be located between South Scheuber Road and Oakland Avenue.
PJ 1.2	South Scheuber Road (Graf to 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.	PJ 1.1, PJ 1.3		■	■	Lewis County	Cities of Centralia, Chehalis, WSDOT	■	■	■	Listed in the current Lewis County Transportation Improvement Plan This project, in combination with PJ 1.1, PJ 1.3, will complete an alternative route for I-5.
PJ 1.3	South Scheuber Road (West Connection)	Raise sections of South Scheuber Road between State Route 6 and the Graf Road/Military Road intersection.	PJ 1.1, PJ 1.2		■	■	Lewis County	Cities of Centralia, Chehalis, WSDOT	■	■	■	Listed in the current Lewis County Transportation Improvement Plan This project, in combination with PJ 1.1, PJ 1.2, will complete an alternative route for I-5.
PJ 1.4	Cooks Hill Road	Raise Cooks Hill Road with structural fill to maintain access during a flood event. This project would also include raising utility castings and surface utilities.				■	City of Centralia	Lewis County	■	■	■	Future improvements could include widening shoulders for a regional bike route and installing a fish-friendly culvert or bridge at Scammon Creek.
PJ 1.5	State Route 6	Replace the existing bridge constructed in 1939 and elevating sections of SR 6 to improve floodplain connections and minimize upstream raised water surface elevation.			■	■	WSDOT	Lewis County	■	■	■	
PJ 1.6	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.				■	City of Chehalis	BNSF	■	■	■	This could require BNSF to raise its tracks or construct a levee with a pump station and flood, floodgates across the tracks.
PJ 1.7	National to Kresky	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.				■	Cities of Chehalis and Centralia	City of Centralia	■	■	■	While the road is currently one-way northbound, it could also accommodate two-way traffic between Chehalis and Centralia during flood events.
PJ 1.8	State Route 507 Through Centralia	Provide levee protection or raise the roadway to provide emergency access.	PJ 1.9 and PJ 1.12	■	■		WSDOT	City of Centralia	■		■	Could be coupled with other projects that are already scheduled for big (PJ 1.9)

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				Short 1-5 yrs	Mid 6-10 yrs	Long 11+ yrs	Lead	Support	Federal	State	Local		
PJ 1.9	Pearl Street and Bridge	Replace the existing 1928 bridge and raise the roadway to allow for vehicle passage.	PJ 2.3	■	■		City of Centralia	WSDOT			■	■	Scheduled for bid prior to 2027 Bridge height would be determined in concert with Skookumchuck Levee configuration
PJ 1.10	Reynolds Road	Raise the roadway with structural fill. 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.		■	■		Lewis County	City of Centralia				■	Reynolds Road provides an important east/west connection across I-5, but regularly floods near the Skookumchuck River There is a current project to widen the roadway and add a center turn lane. 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 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.
PJ 1.11	New Mellen Street Bridge	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.	PJ 3, PJ 4		■	■	WSDOT/ Lewis County	City of Centralia			■	■	This project would be required if additional conveyance projects are constructed in the general vicinity of the existing Mellen Street Bridge.
PJ 1.12	Raise SR-12	Raise or protect SR-12 between the Chehalis Reservation and Rochester to the west to preserve emergency access routes for the area.				■	WSDOT	Lewis County			■	■	
PJ 1.13	Raise Anderson Road	Raise the roadway to maintain access during a flood event.				■	Grays Harbor County				■	■	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.
PJ 1.14	State Route 107	Evaluate SR 107 between Montesano to the north side of the Chehalis River to address flooding potential and potentially raising this section of the highway while maintaining access to the boat ramp and nearby lumber mill.				■	WSDOT	Grays Harbor County				■	
PJ 1.15	Montesano Bypass	Analyze bypass to existing ramps or reconfigure ramps to allow access to SR 12 for emergency vehicles.	PJ 1.14			■	Grays Harbor County				■	■	SR 12 appears to be dry and raised above flood, although on ramps and off ramps are flooded. Could be completed in concert with project 1.14.

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PJ 1.16	Monte/Elma Road	Evaluate potential for bypass route and associated improvements to Monte/Elma Road to allow freight and emergency vehicles access through that area during flood events.				■	Grays Harbor County					
PJ 1.17	Old Highway 603	Raise road between SR 6 and to the east of Twin Oaks Road to provide an additional connection across the Chehalis River Valley.				■	Grays Harbor County					
PJ 2 LEVEES AND FLOODWALLS												
PJ 2.1	Adna	Construct new ring levee in Adna around the new high school and commercial area (1.7 miles)	PG 2 (Resiliency Hub)		■		Lewis County, USACE	School District	■	■	■	This project should coincide with the development of a resiliency hub for the upper Basin
PJ 2.2	East bank of the Newaukum and Chehalis Rivers	Construct new levee on the east bank of the Newaukum and Chehalis Rivers east of I-5 near (1.2 miles)			■	■	Lewis County, USACE	City of Chehalis	■	■	■	
PJ 2.3	Skookumchuck River	Construct new and expand levees on the north and south sides of the Skookumchuck River (6.6 miles)	PJ 1.8, PJ 1.9		■	■	City of Centralia, USACE	Lewis County	■	■	■	The height of these levees will be determined by the height of the Pearl Street Bridge replacement. Control of the Skookumchuck Dam for flood management could affect the size and location of levees along the river.
PJ 2.4	Fort Borst Park	Construct new levee on the north bank of the Chehalis River from north of Fort Borst Park downstream to Galvin Road (2.7 miles)	PJ 1.1, PJ 1.2		■	■	City of Centralia, USACE	Lewis County	■	■	■	The height of this levee will inform the height of the future Scheuber Road Bridge and approach ramps. Both the levee and the bridge should be considered concurrently.
PJ 2.5	China Creek	Construct new levees on the north and south sides of China Creek from I-5 to the railroad tracks (2.3 miles)	PJ 5			■	City of Centralia, USACE	Lewis County, WSDOT	■	■	■	The City of Centralia should complete an alternatives analysis to determine the location, extent, and size of project, including impacts to stormwater collection in the area This project is an opportunity to consider future economic development and water-oriented development in the vicinity of China Creek.
PJ 2.6	I-5 from China Creek to Salzer Creek	Construct new levee on the east side of I-5 from China Creek to Salzer Creek (3.3 miles)	PJ 2.5, PJ 5		■	■	City of Centralia, USACE	Lewis County, WSDOT	■	■	■	
PJ 2.7	Chehalis-Centralia Airport	Expand levee around the Chehalis-Centralia Airport (4.3 miles)	PJ 3, PJ 4			■	City of Chehalis, Chehalis-Centralia Airport, USACE	Lewis County, WSDOT	■	■	■	This project is also assumed in the DEIS for the proposed flood retention facility

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PJ 3 IMPROVED CONVEYANCE														
PJ 3.1	Remove Pinch points along the Chehalis River in the Chehalis/Centralia area	Increase conveyance near the existing Mellen Street Bridge by removing approximately 1.3 million cubic yards of soil immediately upstream and for approximately 3,000 feet downstream of the existing Mellen Street Bridge.	PJ 1.11, PJ 2, PJ 4, PJ 5		■	■	City of Chehalis/Centralia, USACE	Lewis County		■	■	■	PJ 2, PJ 3, and PJ 4 are related projects that should be considered comprehensively, even if construction is phased. At the request of the Chehalis Basin Board, OCB will further evaluate PJ 2, PJ 3, and PJ 4 to determine the feasibility of these projects.	
PJ 4 CHANNEL DIVERSION														
PJ 4.1	Construct a new diversion to increase water flow	Construct a new 700-foot-wide, one mile long waterflow diversion by excavating approximately 1.3 million cubic yards of soil west of the existing Mellen Street.	PJ 1.11, PJ 2, PJ 3, PJ 5		■	■	City of Chehalis/Centralia, USACE	Lewis County		■	■	■		
PJ 5 CHINA CREEK DAYLIGHTING														
PJ 5.1	Day light China Creek	Day light China Creek to create additional conveyance and amenity to encourage redevelopment of adjacent parcels for higher density, mixed uses.	PJ2.5, PL 1, PL 2, PL 3			■	City of Centralia					■	■	This project provides localized flood protection in areas where the City of Centralia has purchased repetitive loss structures. The City of Centralia should complete an alternatives analysis to determine the location, extent, and size of project, including impacts to stormwater collection in the area This project is an opportunity to consider future economic development and water-oriented development in the vicinity of China Creek.
PG 1 SAFE STRUCTURES														
PG 1.1	Assist local jurisdictions to update flood maps to access Safe Structures funding within their jurisdictions.				■		City/County	OCB		■	■	■	OCB has selected a consultant to assist with CFAR-related projects and land use assistance for local jurisdictions	
PG 1.2	Pursue funding opportunities to address program scale and phasing.				■	■	OCB	City/County		■	■			
PG 1.3	Provide additional project management and technical assistance for landowners, renters, and local jurisdictions to implement the program.				■	■	OCB	City/County			■			
PG 1.4	Prioritize flood prone areas where interventions are not proposed.				■		OCB	City/County		■	■	■		
PG 1.5	Include programs for renters to secure new housing.		PG 4		■	■	OCB	City/County			■	■		

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				Short 1-5 yrs	Mid 6-10 yrs	Long 11+ yrs	Lead	Support	Federal	State	Local	
PG 2 COMMUNITY RESILIENCY												
PG 2.1	Organize a working group to develop an Upper Chehalis Basin Community Resiliency Plan to increase capacity and coordination among public agencies.			■			City/ County	OCB				■
PG 2.2	Update emergency access plans, including planning for livestock and machinery in rural areas (e.g., Adna High School accessibility and as a resiliency hub).			■			City/ County	OCB				■
PG 2.3	Identify potential sites for establishing resiliency hubs in both urban and rural locations			■			City/ County	OCB				■
PG 3 ASRP/LAND ALIGNMENT												
PG 3.1	Create an ASRP/LAND Working Group to identify potential synergies between the two programs			■			OCB			■	■	
PG 3.2	Identify potential permit and regulatory streamlining opportunities to speed ASRP/ LAND projects			■			OCB			■	■	
PG 3.3	Focus LAND-related strategies on projects to reduce damage from smaller floods on agricultural uses			■	■	■	City/ County	OCB		■	■	
PG 4 EQUITY SET ASIDE												
PG 4.1	Establish a program to provide resources to assist low-income households that are impacted by flooding.	Resources could take the form of funding assistance, low interest loans, and technical assistance to assist households to better understand their options for coping with flood risk.	PG 1	■			OCB	City/County				■
PG 5 FLOODPLAIN RESTORATION												
PG 5.1	Identify potential floodplain restoration projects through more detailed investigations of parcel size, ownership, and connectivity to the river. Analysis should consider the following: <ul style="list-style-type: none"> Lands that are currently in public ownership should be first priority candidate sites. Where private land is involved, floodplain restoration efforts should only be undertaken with willing cooperation of the private landowners 			■			OCB	City/County				The LAND process has developed an initial methodology and has identified potential locations where floodplain restoration and management could occur. Consistency with the ASRP and further analysis is needed.

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PL 1 ECONOMIC DEVELOPMENT, LAND USE AND GROWTH MANAGEMENT													
PL 1.1	Through the Comprehensive Plan update process, consider the following: <ul style="list-style-type: none"> Update future land use maps to limit development in the floodplain. Evaluate Urban Growth Areas to incorporate receiving areas with planned city services. Refine receiving area locations through subarea planning that also incorporates infrastructure requirements. Incorporate comprehensive flood hazard management planning into comprehensive plans Update equity and affordable housing needs/policies, assuming updated floodplain maps and future land use designations are included in comprehensive plans. 			■			City/ County	OCB				City and county jurisdictions within the Basin will be required to update their comprehensive plans and development code to address state requirements, providing an opportunity to reduce development in the floodplain and direct development to more suitable locations. OCB has hired a consultant to provide technical assistance to local jurisdictions to assess their flood related development codes.	
PL 2 BUILDING AND DEVELOPMENT CODES													
PL 2.1	Revise building and development codes to address the following: <ul style="list-style-type: none"> Update flood maps within the Upper Basin to reduce development in flood prone areas (if not already completed). Complete audits of all development codes in the Basin related to floodplain development. Update Critical Areas Ordinances for consistency between local and county ordinances. Update Flood Damage Prevention Ordinances related to developer and shoreline permits, construction, flood protection and subdivision proposals. 			■			City/ County	OCB				OCB has hired a consultant to provide technical assistance to local jurisdictions to assess their flood related development codes.	
PL 2.2	Create a model code and provide technical assistance to local jurisdictions to implement flood related development and building code changes			■			OCB					■	
PL 3 CAPITAL FACILITIES													
PL 3.1	Update Capital Facilities Plans in concert with Comprehensive Plan updates and other land use planning activities		PL 4.1	■	■	■	City/ County					■	Capital facilities plans are typically updated as part of the comprehensive planning process every 10 years, but project priorities are often revisited every 5 years, as funding changes.
PL 4 FUNDING													
PL 4.1	Identify and prioritize appropriate funding sources for capital infrastructure and floodplain management projects.		PL 3.1				City/ County	OCB				■	

Chehalis Basin LAND*

*LOCAL ACTIONS NON-DAM ALTERNATIVE



ChehalisBasinLand.com