Appendix G:
General adaptation approaches for Grays Bay

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1. Local resilience principles

During Workshop 1, participants placed sticky notes on maps to locate memories, concerns (non-hazards), and important assets. These were summarized along with the information gleaned from the Message Box Worksheets (Figure B.6) to create an overview of themes related to values and priorities, referred to as “Local Resilience Principles”.

These Local Resilience Principles were presented to Workshop 2 participants and participants were given the opportunity to add any values or priorities that might have been missed in Workshop 1. Results from this activity are listed below in Figure G.1 and Table G.1.

Participants also identified which principles were most applicable to each focus area of Baker Bay, and the resulting resilience projects. These are described further in Appendix H. These principles guided the project team as they scoped resilience project concepts shared during Workshop 3, and also assisted the project team to support specific projects. The project team believes that Grays Bay projects will be most successful and beneficial to the local community if they incorporate these principles, and in turn will support local social and ecological resilience.

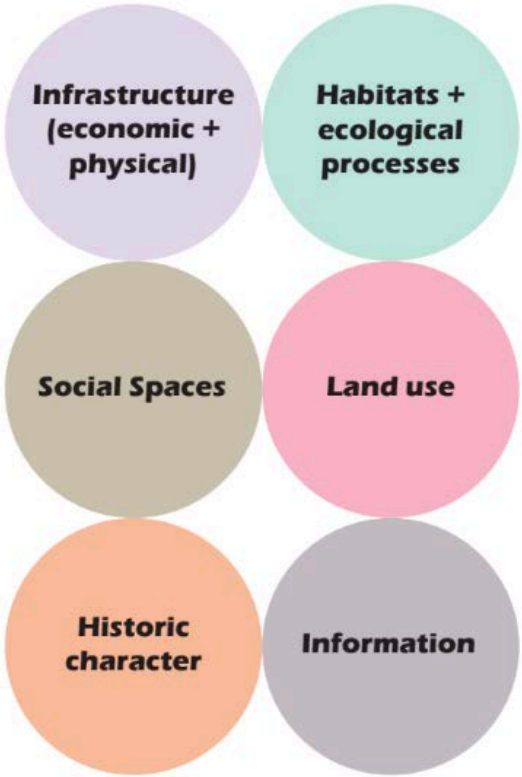

Figure G.1. Local resilience principles identified in workshops 1 and 2 for Grays Bay.

Table G.1. Local resilience principles related to coastal flooding identified by participants in workshops 1 and 2 (see Appendix B for methods).

Category	Asset	
Infrastructure	-State Route 4 -local roads -emergency access -Grays River covered bridge -logging roads (adjacent to creeks) -undersized culverts	-aging tide gates -damaged dikes/levees -septics -boat launches -WDFW fish trap
Land Use	-change from agriculture -logging practices -new residences in floodplain -existing residences in floodplain	-new landowners -habitat restoration -economic development
Historic Character	-agriculture heritage -logging heritage -gravel removal -fishing and boating	-downtown Deep/Grays River -Grays River covered bridge
Social Spaces	-Grays River Grange -Grays River covered bridge -riverside parks -water access	-swimming -barbeques along river -Community Supported Agriculture (CSAs)
Habitat & Ecological Processes	-salmon habitat quality -salmon predators -sea lions -large old trees -Sitka spruce swamps -large wood in streams -riparian vegetation -wetland water storage	-river migration -floodplain health -rich floodplain soils (agriculture) -sediment deposition -gravel transport -seasonality -king tides
Information	-hydrologic studies -Grays River stream gauge	-Riverine processes -Hydrology of logging roads

2.“And-But-So” activity results

During Workshop 2, participants filled out “And-But-So” worksheets for each focus area. The And-But-So worksheet is a facilitation tool that allows complex topics to be tied together with both larger issues and suggested next steps. An example of the And-But-So worksheet is provided in Fig. B.12. Groups were encouraged to write 2-3 And-But-So worksheets for their subregion.

Following this activity, workshop participants were brought back together for a full-group discussion to share their And-But-So worksheets. Each participant was then given three stickers. All And-But-So worksheets were displayed on tables around the edge of the room and participants were encouraged to walk around, read each worksheet and use the stickers to vote on the top three worksheets they felt represented the most relevant and sustainable topics for the project. The goal of this activity was to gain insights of the workshop participant priorities regarding flood-related concerns and potential community-supported actions. These results are described in Table G.2 and informed the resilience projects described in Appendix E.

Table G.2. Top 9 adaptation priorities identified by Workshop 2 participants using the And-But-So worksheets for Grays Bay.

Region	Statement	And	But	So	Votes
Middle Deep River	Landowners property is flooding	Entities are buying land & breaking dykes	The community doesn't have a voice	how do we give the community an influence in decision making.	11
Seal Creek at SR 4	People want fish	Protective features are blocking fish.	We need protection for landowners	Compromises are needed. Allow flooding in some areas or at different times. Increasing buffers, planting trees, no building in the floodplain	7
Grays River at Altoona-Pillar Rock Rd.	Altoona Rd. is flooding and cuts off emergency services	Dredging the river and deepens the river will increase velocity of river to reduce flooding "clear out water." USACE is authorized to dredged river ~up to 5 miles	USACE no longer dredges because of lack of commerce-no longer authority to dredge; no commerce b/c boats can't get through. ** Used to be dredged, boat traffic also kept river bottom deeper ; Logging no longer use river as in past	Need congress to authorize USACE to dredge the river	11
Grays River at Loop Rd. and Hull Creek	Logging practices impact sediment levels in the river	causes flooding downstream (and water quality issues)	Stopping logging is not possible	Need to improve stream function other ways (+ habitat) in tributaries farther upstream	4
Grays River Covered Bride to Fossil Creek	Some funding available for improvements, restoration,		need a more watershed scale or broader study to prioritize	a more unified approach to help landowners receive & prioritize	2

	salmon		and then fund projects	fish funding	
Grays River Covered Bride to Fossil Creek	There is some stream gauge info at covered bridge. (new in 2020s). (topic: problem issue.)	it provides height info (desire need issue)	It doesn't provide flow rate or velocity	a new flow gauge + warning/info system would help downstream residents with flood warning info.	1
Grays River Covered Bride to Fossil Creek	Some culvert replacements + creek restoration.	some road decommissioning	current work hasn't helped enough	Need to communicate/ organize with the forest practice board about watershed effects that are causing problems. Have bigger voice, more monitoring activities [more]	14
Watershed	We can pair green + traditional infrastructure solutions to develop new solutions	Solutions must be thoughtful of historic character + include farming, forestry, hunting, fishing.	How do you decide what to keep/what area to sacrifice to develop the solution	Need a community conversation to determine where to do off river storage. Need basin-wide evaluation + analysis to develop a better understanding of existing solutions among all parties.	10
Watershed	SR 4 is flooding more regularly than usual	It affects day to day life, emergency services, daily economy	Raising the road is expensive	Look for strategic infrastructure solutions to move water through more effectively--> undersized culverts; creative green/soft infrastructure.	3
Watershed	Western Wahkiakum County is economically challenged + suffers from chronic underemployment	Pressure is on local government agencies (Port/County) to create economic opportunity.	Climate change, more rain events, sea level rise do and will impact what lands can be developed + improved, and what is set aside.	We need planning & climate mitigation solutions that create economics opportunities & economic diversification to build a more resilient community	3

3. Flood reduction approaches: poll results

During Workshop 3 for Grays Bay, participants reviewed flooding impacts reduction approaches for each region. The project team tried to identify as many potential flood impacts reduction approaches as possible, based on a harden-soften-move approach (see Figure B.15) and employing ideas from previous workshops and conversations. Participants were then polled regarding their preferred flood impacts reduction approaches.

Poll results are described below by region (Tables G.3, G.4, and G.5). Poll results are described as follows:

- Abbreviated flood mitigation approaches are described and numbered according to their general approach. H = Hardening, S = softening, and M = Move/Relocation.
- The poll asked participants whether they liked, disliked, or needed more info about each approach. Highest-ranking results for each category are highlighted in green, red, and yellow, respectively.
- Poll respondents were asked whether they were a resident of each region. On the right half of each table, poll results are described based on resident and non-resident responses for each approach. These are coded with the same color scheme as the left half of the tables.

a. Deep River poll results

At Deep River, as shown in Table G.3, participants had high preference (15 votes total, 94% of the vote for that category) for the repair and upgrade of existing tide gates, improvement of drainage behind dikes, and dredging as part of the hardening design. For hardening approaches, a significant number of participants would like more information regarding raising Deep River Road to perform as a dike (53%), flood-proofing buildings (43%), and building new dikes along the East Fork Deep River (50%). For softening approaches, participants favored the concept of enhancing riparian area upland (64%) and preserving larger forest (53% vote). On the other hand, participants were split about upland management, upland and lowland storage of sediment and water, and adding woody debris for sediment retention and flood reduction (38 - 42% vote). The group had a strong objection toward the removal of East or West Deep River Road and opening dikes to store water and/or sediment (75%).

Table G.3. Deep River poll results.

Poll results: Total					Poll results: Residents and Non-Residents					
Approaches		Like	Dislike	Need more info	Like		Dislike		Need More Info	
#	Description				Residents	Non-Res.	Residents	Non-Res.	Residents	Non-Res.
H1	Raise E + W Deep River road, improve performance as dike	6	1	8	4	2	0	1	3	5
H2	Repair/upgrade existing tide gates	15	0	1	8	7	0	0	0	1
H3	Improve drainage behind dikes	15	1	0	8	7	0	1	0	0
H4	Floodproof buildings	3	5	6	1	2	1	4	5	1

H5	Build new dikes along East Fork Deep River (with tidegates, ditches, and improved drainage behind dikes)	4	4	8	3	1	1	3	4	4
H6	Dredge river	15	1	2	8	7	0	1	0	2
S1	Address (upland) land management to store sediment and water	8	6	2	3	5	3	3	1	1
S2	Identify (upland) drainage patterns, decommission/modify roads or other features to slow and store runoff	5	6	3	3	2	3	3	1	2
S3	Enhance (upland) riparian areas and channel complexity	9	2	3	4	5	1	1	1	2
S4	Add large woody debris	4	9	1	1	3	5	4	0	1
S5	Grow larger/older forests	9	2	6	3	6	2	0	2	4
S6	Muted Tidal Regulators to replace tide gates where East Fork Deep River joins mainstem	7	1	6	3	4	0	1	4	2
S7	Look for opportunities throughout floodplain to store water and sediment: widen channel and add riparian buffers	4	5	5	0	4	4	1	3	2
S8	Add flow/storage over bends downstream	3	3	5	0	3	2	1	2	3
M1	Remove East OR West Deep River Road, open dikes to store water and sediment	1	12	3	0	1	6	6	1	2
M2	Create alternative upland access for remaining structures	3	5	6	1	2	2	3	3	3
	Harden (total)	58	12	25	32	26	2	10	12	13
	Soften (total)	49	34	31	17	32	20	14	14	17
	Move (total)	4	17	9	1	3	8	9	4	5
	All (total)	113	63	65	50	61	30	68	68	68

b. Grays River poll results

Participants (Table G.4) showed a strong preference for hardening approaches such as repair and upgrade of existing tide gates, improving drainage behind tide gates, reinforcing the base of SR-4 bridge to mitigate erosion, dredging, and removal of gravel bars (87%, 82%, 82%, 80%, and 70% votes respectively.) In contrast, about 50% of the participants disliked the construction of dams in the upper watershed and new dike construction along the river and tributaries. Among the softening components, the participants favor upland enhancement (69%) and riparian zone planting (79%). About forty percent of the participants did not like the idea of shoreline layback and high flow bypass.

Table G.4. Grays River poll results.

Poll results: Total					Poll results: Residents and Non-Residents					
Approaches		Like	Dislike	Need more info	Like		Dislike		Need More Info	
#	Description				Residents	Non-Res.	Residents	Non-Res.	Residents	Non-Res.
H1	Dam or other control structure in upper watershed	3	13	5	3	0	6	7	3	2
H2	Raise/build dikes along the river	8	10	3	7	1	5	5	0	3
H3	Repair/upgrade existing tide gates	21	0	3	14	7	0	0	0	3
H4	Improve drainage behind tide gates	18	0	4	13	5	0	0	0	4
H5	Floodproof buildings	9	6	5	7	2	2	4	2	3
H6	Reinforce base of SR4 bridge to mitigate scour/erosion	18	1	3	10	8	1	0	2	1
H7	Raise low-lying roads	15	6	2	10	5	2	4	1	1
H8	Dikes to contain Grays River backwaters up creek	4	11	6	3	1	6	5	3	3
H9	Public ownership or management of dikes/tidegates affecting public infrastructure or multiple landowners	10	2	7	7	3	1	1	2	5
H10	Remove gravel bars from channel	16	5	2	9	7	3	2	0	2
H11	Dredge lower Grays River and Grays Bay	21	3	2	12	9	2	1	0	2
S1	Address (upland) land management to store sediment and water	11	3	5	6	5	0	3	3	2
S2	Identify (upland) drainage patterns and decomission/modify roads or	13	3	3	7	6	1	2	1	2

	other features to slow and store runoff									
S3	Enhance (upland) riparian areas and channel complexity	16	4	3	10	6	1	3	2	1
S4	Add large woody debris	14	7	1	10	4	1	6	1	0
S5	Grow larger/older forests	15	5	2	9	6	1	4	2	0
S6	Plant riparian trees and shrubs along river banks, remove invasive species	19	3	2	12	7	0	3	2	0
S7	Widen channel or lay back banks, add setback dikes as needed	8	9	4	5	3	4	5	2	2
S8	Allow river to flow over bends	11	4	4	7	4	1	3	2	2
S9	Large wood anchored throughout	13	6	1	10	3	1	5	0	1
S10	Look for opportunities to connect river with floodplain to store water and sediment	10	6	4	5	5	3	3	3	1
S11	High-flow bypass to direct water into TBD strategice areas, maintaining regular use	8	8	4	4	4	5	3	2	2
S12	Raise low-lying roads on pilings (bridge) with box culverts	9	2	3	6	3	0	2	1	2
S13	Store water along tributaries and where they meet Grays Ricer	5	5	2	2	3	3	2	0	2
S14	Enhance existing restored areas to store more water and sediment	10	1	2	3	7	1	0	2	0
M	NA	0	3	0						
	Harden (total)	143	57	42	95	48	28	29	13	29
	Soften (total)	162	66	40	96	66	22	44	23	17
	Move (total)	0	3	0						
	All (total)	308	126	82	191	114	50	73	36	46

c. Seal Slough poll results

In Table G.5, participants showed a strong preference toward hardening at Seal Slough. The hardening components with the highest votes include dredging the lower Grays River and Grays Bay, the repair and upgrade of existing dikes and tide gates, and drainage improvement behind dikes (87%, 85%, 85% of votes, respectively.) Softening components with favorable votes include raising SR 4 with improved flow/box culverts/bridge, raising of driveways as needed, and enhancement of restored area to store more water and sediment (62%, 67%, and 58%, respectively). Votes for other softening components are mixed, with most participants disliking the possibility of connecting the river with its floodplain or removing additional dikes to reduce flood impacts on developed land.

Table G.5. Seal Slough poll results.

Poll results: Total					Poll results: Residents and Non-Residents					
Approaches		Like	Dislike	Need more info	Like		Dislike		Need More Info	
#	Description				Residents	Non-Res.	Residents	Non-Res.	Residents	Non-Res.
H1	Raise road	6	3	2	2	4	0	3	0	2
H2	Raise driveways	4	3	2	2	2	0	3	0	2
H3	Repair/upgrade existing dikes and tide gates	11	0	2	2	9	0	0	0	2
H4	Improve drainage behind dikes	11	0	2	1	10	0	0	1	1
H5	Floodproof buildings	3	3	4	0	3	0	3	2	2
H6	Dredge lower Grays River and Grays Bay for faster drainage	13	0	2	2	11	0	0	0	2
S1	Raise road on pilings (bridge) or with box culverts	7	2	2	0	7	1	1	0	2
S2	Raise driveways as needed	8	2	2	1	7	0	2	0	2
S3	Look for opportunities to connect river with floodplain to store water and sediment: widen channel, add riparian buffers, and/or remove dikes	4	4	4	0	4	1	3	1	3
S4	Enhance existing restored areas to store more water/sediment	7	3	2	1	6	1	2	0	2

S5	Remove remaining dikes along restored land to allow more direct flow of water across site (storage) and less flooding next door	6	6	3	0	6	1	5	1	2
M	NA	0	1	0						
	Harden (total)	48	9	14	9	39	0	9	3	11
	Soften (total)	32	17	13	2	30	4	13	2	11
	Move (total)	0	1	0						
	All (total)	81	27	27						