Appendix A. - Bonneville Tributaries Sub-Basin Stock Summary And Habitat Priorities

Stocks and Priorities

SASSI and LCSCI Stocks	Priority	Other Anadromous Salmonids Present in the Sub-basin (LFA)
Hardy Creek Chum Salmon (SASSI)	Tier 1	Fall Chinook
Hamilton Creek Chum Salmon (SASSI)	Tier 1	Coastal Cutthroat Trout
Hamilton Creek Steelhead (LCSCI)	Tier 1	
Bonneville Tributaries Coho Salmon (SASSI)	Tier 3	

Not all stocks are present in all parts of the subbasin. Use LFA maps or contact Gary Wade at the LCFRB for specific site information.

Prioritization of Limiting Factors and Identification of Potential Restoration and Preservation Needs*

Limiting Factor	Priority Rating	Priority Restoration Actions	Preservation Actions
Fish Passage	**Medium/High:** 13.7% of the historic habitat is blocked. High priority in Gibbons Creek; medium priority in other streams.	Two culverts on Gibbons Creek (Hans Nagel Rd. and upstream a private culvert block 1.4 miles for steelhead, coho, cutthroat). Hardy Creek railroad culvert (0.9 miles blocked for steelhead, coho, cutthroat) A series of culverts on Campen Creek block 1.0 mile for steelhead, coho, and cutthroat. Assess the potential impacts to Western Pond Turtles if Greenia Creek pond is opened to fish passage (potentially high quality rearing habitat opened).	None
Floodplain Conditions	**High:** Very limited floodplain habitat available with numerous modifications.	Reconnect floodplain habitat in the lower end of Gibbons Creek and on the Columbia River floodplain at Steigerwald Refuge. Reconnect floodplain habitat in the lower mile of Hardy Creek, and open Greenia Creek and associated wetlands to fish. Reconnect lower Woodward Creek to its floodplain. Reconnect lower Hamilton Creek to its floodplain.	Reconnect and preserve off-channel and side channel habitat and associated wetlands wherever they occur. Lower Gibbons Creek, Steigerwald Refuge, Frans Lake, and Greenia Creek wetlands are priorities.

Prioritization of Limiting Factors and Identification of Potential Restoration and Preservation Needs*

Limiting Factor	Priority Rating	Priority Restoration Actions	Preservation Actions
Sediment	**High:** Sediment fines and/or excessive bedload deposition are significant problems in a number of streams	***Reduce fine sediment inputs from roads, riparian loss, and stormwater in Gibbons, Campen, Hardy, Woodward, and Duncan Creeks (affects steelhead, coho, chum, and cutthroat).*** ***Reduce excessive bedload deposition in Hamilton, Good Bear, Lawton, and Indian Mary Creeks by improving sediment transport through railroad and SR 14 culverts and by reducing land use activities that affect stream bank and channel stability (affects steelhead, coho, chum)***	Protect and enhance riparian corridors, especially in the upper watersheds of the Bonneville Tributaries Sub-basin
Channel/LWD Conditions	**Medium:** LWD levels and pool habitat are "poor" throughout the sub-basin	Increase functioning LWD structures, or similar natural structures, in appropriate stream reaches through LWD placement projects and/or through recruitment (though recruitment potential is low for most streams). Many of the gorge tributaries are extremely high-energy systems where LWD placement may fail if improperly place and/or designed. Placement of LWD structures in the new Hardy Creek spawning channel could provide multiple benefits without the problems found in other high-energy stream systems.	Protect existing mature riparian vegetation for LWD recruitment. Maintain current appropriate pieces of LWD, and other natural structures, through increased education and enforcement.
Riparian	**High:** Riparian conditions are "poor" almost throughout the sub-basin	Target riparian restoration efforts along the most productive and/or degraded streams including the lower reaches of Hardy, Hamilton, Lawton, and Woodward Creeks and Gibbons above SR 14.	Preserve healthy riparian corridors in the headwaters of all the sub-basins tributaries, especially in Hardy, Hamilton, and Greenleaf Creeks.
Water Quality	**Medium/High:** High Priority to address significant water quality problems that occur in Gibbons and Campen Creeks. Data is generally lacking for other streams (Medium	Restore riparian cover for all streams within the sub-basin, especially along Campen and Gibbons Creeks. Reduce livestock access to streams and riparian corridors. Restore and enhance wetlands. Reduce stormwater impacts on water quality, especially in Gibbons, Campen, and Hamilton Creeks	Protect riparian corridors in all headwaters areas to maintain the supply of cool, clean water to critical downstream spawning and rearing areas.

Prioritization of Limiting Factors and Identification of Potential Restoration and Preservation Needs*

Limiting Factor	Priority Rating	Priority Restoration Actions	Preservation Actions
	Priority).		
Water Quantity	**Medium:** Both elevated peak and low flows present problems in the sub-basin.	Reduce stormwater impacts in the Gibbons Creek watershed and downstream of North Bonneville. Restore unimpeded sediment transport through railroad and SR 14 culverts to reduce bedload deposition that often leads to subsurface flows during dry months. Monitor the operation of Duncan Creek Dam and its effects on aquatic and fish assemblages.	Protect the supply of water to springs that provide critical chum spawning sites in Duncan, Hardy, and Hamilton Creeks.
Biological Processes	**Medium:** Escapement is well below historic levels and the lack of nutrients may be limiting. Invasive species reduce riparian function.	Increase contribution of marine–derived nutrients through increased use of carcasses. Remove invasive, non-native vegetation and replace it with native species, especially along lower Hardy, Lawton, Gibbons, Campen, Duncan, and Hamilton Creeks. Monitor the operation of Duncan Creek Dam and its effects on the aquatic community.	Preserve riparian corridors and wetlands with native vegetation

* Restoration and preservation actions by limiting factor were identified based upon the Limiting Factors Report and will be circulated to TAG members for their review.

Appendix B. - Elochoman/Skamokawa Sub-Basin Stock Summary And Habitat Priorities

Stocks and Priorities

SASSI and LCSCI Stocks	Priority	Other Anadromous Salmonids Present in the Sub-basin (LFA)
Skamokawa Fall Chinook (SASSI)	Tier 2	Chum Salmon
Skamokawa Coastal Cutthroat (SaSI)	Tier 3	
Skamokawa Coho (SASSI)	Tier 3	
Skamokawa Winter Steelhead (LCSCI)	Tier 4	
Elochoman Fall Chinook (SASSI)	Tier 2	
Elochoman Coastal Cutthroat (SaSI)	Tier 3	
Elochoman Coho (SASSI)	Tier 3	
Elochoman Winter Steelhead (LCSCI)	Tier 4	

Not all stocks are present in all parts of the subbasin. Use LFA maps or contact Gary Wade at the LCFRB for specific site information.

Prioritization of Limiting Factors and Identification of Potential Restoration and Preservation Needs*

Limiting Factor	Priority Rating	Potential Restoration Actions	Preservation Actions
Fish Passage	**High:** There were a number of passage barriers identified in the subbasin	Cowlitz/Wahkiakum Conservation District is currently conducting a culvert inventory for these watersheds that should provide more accurate data in the near future on passage problems. Dead Slough has a tide gate at the lower end (RM .2) and a gate valve on the upper end (RM 1.7) that blocks 2.3 miles of low gradient habitat. Any alterations to the existing tidegates could potentially impact water quality in Skamokawa Creek and will require careful consideration before any modifications are proposed (TAG). The pump station at the wildlife refuge blocks access to approximately 1.44 miles of habitat in Risk Creek. The tide gate on Alger Creek needs to be assessed along with two culverts near State Highway #4. Eggman Creek culvert, RM 2.1, has an outfall drop of three feet	None

Prioritization of Limiting Factors and Identification of Potential Restoration and Preservation Needs*

Limiting Factor	Priority Rating	Potential Restoration Actions	Preservation Actions
		that blocks .4 miles of habitat. Kelly Creek, RM 0.1, and its Unnamed Creek have culverts that are barriers. TAG indicated that the upper watershed is in good timbered condition and supports natural wetlands that may be important habitat. Several unnamed tributaries to Standard Creek have passage culvert problems that need repair. Beaver Dam Creek (Kelly Creek on USGS 7.5-minute maps) culvert located under State Route 4 in West Valley may impair passage to 1-2 miles of habitat. Several passage barriers have been repaired on Birnie Creek; however, the fish screens near the mouth may block passage and need assessment and repair. A culvert on Nelson Creek, RM 2.0, blocks access to approximately 1.6 miles of habitat. Although the Beaver Creek Hatchery, RM 5, is no longer in operation, the intake dam may be a barrier, blocking 2.6 miles of habitat, and it needs assessment and repair. Four culverts on Duck Creek, RM 0.1 to 1.7, have outfall and gradient problems. Clear Creek, RM 9, culvert and the hatchery's water intake are concerns that need assessment. A culvert under old railroad grade and county road on Rock Creek at RM 11 blocks almost .8 miles of habitat.	

Prioritization of Limiting Factors and Identification of Potential Restoration and Preservation Needs*

Limiting Factor	Priority Rating	Potential Restoration Actions	Preservation Actions
Floodplain Conditions	**High:** Data is generally lacking on the condition of floodplain habitat in the subbasin	Dikes, numerous stream adjacent roads, and a railroad grade reduce floodplain connectivity along the Elochoman River and its tributaries. These floodplain constrictions should be assessed and improved to provide additional floodplain and off-channel habitat. Dikes and entrenchment also limit floodplain connections to most of the low gradient habitat in the Skamokawa Creek watershed including the mainstem Skamokawa, the West Fork Skamokawa, and Wilson, Falk, Pollard, and Bell Canyon Creeks. Where possible, restore floodplain access and connectivity. The Columbia Land Trust was recently awarded a grant to open up floodplain habitat adjacent to Alger Creek. Where possible, build on these restoration efforts.	Preserve and enhance off-channel and side channel habitat and associated wetlands wherever they occur. Side channels that exist in the upper segments of Wilson, Falk, and Left Fork Skamokawa Creeks need protection and enhancement.
Sediment	**High:** Sediment fines are a significant problem in the subbasin. Numerous mass-wasting events occur in both the Elochoman and Skamokawa watersheds.	***Forest practices and roads have contributed substantially to mass-wasting events in the Elochoman watershed. Prioritize identification of and avoidance of unstable slopes, and decommission or repair roads that are contributing excessive sediments to streambeds. TAG members noted that the West Fork Elochoman had some of the worst mass wasting, bank instability, and fine sediment problems. Avoid development on unstable slopes, repair or decommission roads and road crossings, and restore riparian vegetation, starting in areas where slope stability is a problem.*** ***The Wilson Creek sub-watershed had by far the highest number of mass failures/square mile of the 13 watersheds assessed by Waterstrat (1994) in Wahkiakum County.*** ***Jim Crow Creek watershed has very high road densities and a high rate of mass wasting that needs attention.*** Bank stability problems were noted along Skamokawa and Wilson Creeks, especially along the agricultural reaches. Eliminate livestock access and restore riparian vegetation along streams in the subbasin.	Protect and enhance functional riparian corridors to reduce sediment delivery to streams. Identify and protect limited chum spawning sites in the subbasin. Crippen and Standard Creeks are productive habitats for steelhead.

Prioritization of Limiting Factors and Identification of Potential Restoration and Preservation Needs*

Limiting Factor	Priority Rating	Potential Restoration Actions	Preservation Actions
Channel/LWD Conditions	**Medium:** LWD levels and pool habitat are generally "poor" throughout the sub-basin	LWD is the principle pool-forming agent in many of the stream systems within this subbasin. Increase functioning LWD structures, or similar natural structures, in appropriate stream reaches through LWD placement projects and/or through recruitment (although recruitment potential is low for most streams). Wilson Creek, the mainstem Skamokawa above tidewater, and Left Fork Skamokawa would respond well to LWD placement. Riparian vegetation in these areas will likely not be able to provide for long term LWD recruitment. LWD is almost non-existent in the lower reaches of the Elochoman River. Most LWD is quickly washed out of the system during high flows. In the mainstem Elochoman, pool habitats are now formed mainly by channel processes. The lack of quality pool habitat combined with low summer flows and high water temperatures limits rearing habitat in the subbasin. Develop and enhance pool habitat in the subbasin focusing on Bell Canyon, Pollard, and Crippen Creeks.	Protect existing mature riparian vegetation for LWD recruitment. Standard and McDonald Creeks were in the best condition for existing LWD in the Skamokawa Creek watershed. Riparian vegetation along these creeks should provide both near and long-term LWD recruitment. In the West Fork Elochoman there were some large pools with extensive cove habitat associated with logjams in the main channel. These logjams were anchored by old growth LWD with recently recruited alder LWD contributing to these formations. Maintain current appropriate pieces of LWD, and other natural structures, through increased education and enforcement.
Riparian	**High:** Riparian conditions are generally "poor" throughout the sub-basin. Deciduous species dominate many of the riparian corridors.	Agricultural activities have reduced or eliminated riparian cover along the lower reaches of many streams within the subbasin. Eliminate livestock access and restore riparian vegetation wherever possible. Target riparian restoration efforts along the most productive and/or degraded streams including the Middle Valley Skamokawa from RM 2.2-6.6, lower Wilson Creek, the lower 3 miles of Wilson Creek, all of Bell Canyon, Quarry, and Skamokawa Creeks, the lower reaches of Nelson Creek, the lower 3 miles of the West Fork Elochoman, and the mainstem Elochoman above the West Fork confluence. Deciduous species dominate riparian corridors along a number of streams in the sub-basin. Manage riparian corridors to increase the percentage of conifers in riparian corridors.	Preserve healthy riparian corridors in the headwaters of all the sub-basins tributaries. Protect and enhance functional riparian corridors along Standard Creek (some of the best riparian habitat in the sub-basin).

Prioritization of Limiting Factors and Identification of Potential Restoration and Preservation Needs*

Limiting Factor	Priority Rating	Potential Restoration Actions	Preservation Actions
Water Quality	**High:** Significant water quality problems occur in the Elochoman River and Skamokawa Creek and their tributaries	Maintain and restore riparian cover for all streams within the sub-basin, especially along lower Wilson Creek where temperatures are considerably higher than found in the upper reaches. Reduce livestock access to streams and riparian corridors. Water quality monitoring found elevated fecal coliform and nitrate levels, thought to originate from septic systems and agricultural activities, in surface and shallow groundwater in Skamokawa watershed. Identify sources of these water pollutants and reduce inputs to stream systems. Improve water quality and rearing conditions in Bell Canyon, Pollard, and Crippen Creeks.	Protect riparian corridors in all headwaters areas to maintain the supply of cool, clean water to critical downstream spawning and rearing areas. Protect and restore wetlands. Identify and protect cooler water refuges such as Falk Creek.
Water Quantity	**Medium:** Both elevated peak and low flows present problems in the sub-basin.	By July median flows in the Elochoman dip below 40 c.f.s., which is less than 50% of optimal flows for steelhead and salmon spawning and rearing. Identify ways to augment low summer flows and enhance rearing habitat in the Elochoman River and other low flow limited habitats. Assess potential impacts on low flows in the Elochoman River from the City of Cathlamet's water withdrawals. Reduce road densities, and the direct connections between road drainage ditches and streams to reduce peak flows, promote groundwater recharge, and potentially enhance low summer flows. Restore and enhance off-channel rearing habitats that can provide refuge for juveniles during peak flows.	Protect fully forested and unroaded areas in the upper watershed from further development to reduce peak flows to downstream habitats and provide refuges for salmonids from elevated stream temperatures. Preserve floodplain connections and associated wetlands to provide off-channel refuge from high flows and additional flood capacity.

Prioritization of Limiting Factors and Identification of Potential Restoration and Preservation Needs*

Limiting Factor	Priority Rating	Potential Restoration Actions	Preservation Actions
Biological Processes	**Medium:** Escapement is well below historic levels and the lack of nutrients may be limiting.	Increase contribution of marine–derived nutrients through increased use of carcasses. There have been reports of invasive aquatic plants in the lower reaches of streams in the sub-basin. Expand monitoring for invasive aquatic plants into the Elochoman River, Skamokawa Creek, Grays River and slough on Puget Island.	Preserve riparian corridors and wetlands with native vegetation.

* Restoration and Preservation Actions by Limiting Factor were prioritized based upon the Limiting Factors Report and will be circulated to TAG members for their approval.

Appendix C. - Lake River Sub-Basin Stock Summary And Habitat Priorities

Stocks and Priorities

SASSI and LCSCI Stocks	Priority	Other Anadromous Salmonids Present in the Sub-basin (LFA)
Salmon Creek Winter Steelhead (LCSCI)	Tier 1	
Salmon Creek Coastal Cutthroat (SaSI)	Tier 3	
Washougal Coho Salmon (SASSI)	Tier 3	

Not all stocks are present in all parts of the subbasin. Use LFA maps or contact Gary Wade at the LCFRB for specific site information.

Prioritization of Limiting Factors and Identification of Potential Restoration and Preservation Needs*

Limiting Factor	Priority Rating	Potential Restoration Actions	Preservation Actions
Fish Passage	**Medium/High:** Medium priority to address the 4.7% of the historic habitat in the subbasin that is blocked. A dam on Baker Creek is a high priority.	Baker Creek dam blocks approximately 1 mile of coho and steelhead habitat. Private culverts on upper Rock Creek may block passage and need assessment. Possible culvert barriers on Morgan Creek above 179th St. need assessment and repair. Culverts on Burnt Bridge Creek at Royal Oaks golf course block passage for cutthroat and coho. Passage conditions in the flushing channel into Vancouver Lake may inhibit juvenile fish use and may even trap juveniles. The flushing channel needs assessment and potentially repairs. Passage is limited to many small Columbia Slope tributaries by culverts under the railroad and roads. Passage barriers need assessment in this area.	None
Floodplain Conditions	**High:** Very limited floodplain habitat available with numerous modifications.	Restore floodplain connectivity wherever possible in the Columbia River lowlands around Vancouver Lake and Lake River. This area provides rearing habitat for mainstem Columbia River migrants, as well as local stocks. Studies have determined that lack of suitable rearing habitat likely limits productivity in the Salmon Creek watershed. Increase floodplain and off-channel rearing habitat in lower Salmon Creek below I-5, between 72nd and 182nd Avenues, and in Mill, and Curtin Creeks. Restore floodplain and wetland connections in Whipple, and Burnt Bridge Creeks.	Preserve off-channel and side channel habitat and associated wetlands wherever they occur. The lower reaches of Salmon, Whipple, and Burnt Bridge Creeks are priorities.

Prioritization of Limiting Factors and Identification of Potential Restoration and Preservation Needs*

Limiting Factor	Priority Rating	Potential Restoration Actions	Preservation Actions
Sediment	**High:** Sediment fines are significant problems in almost all streams in the subbasin.	***Reduce impacts from stormwater and erosion that occurs in rapidly developing basins like Salmon, Whipple, and Burnt Bridge Creeks.*** ***Fence livestock from streams and restore riparian corridors along Mill, Woodin, Morgan, Baker, Rock, Whipple, and upper Salmon Creeks.*** ***Address bank erosion problems on Salmon Creek between I-5 and 182nd, by Pleasant Valley School, and in areas of Mill, Rock, Morgan and Whipple Creeks.*** ***Identify and repair roads that are contributing excessive fine sediments to streams in the sub-basin.***	Protect existing quality riparian corridors from additional development along all anadromous streams within the subbasin. Preserve vegetation and limit development in areas with steep, unstable slopes.
Channel/LWD Conditions	**Medium:** LWD levels and pool habitats are very limited throughout the subbasin.	Increase functional LWD structures, or similar natural structures, in appropriate stream reaches through LWD placement projects and/or through recruitment (though recruitment potential is low for most streams). Areas to focus include upper Salmon and Rock Creeks where a majority of the steelhead and coho spawning occurs. Encourage beaver activity wherever possible.	Protect existing mature riparian vegetation for LWD recruitment, especially along the upper reaches of Salmon, Morgan, and Rock Creeks. Maintain current appropriate pieces of LWD, and other natural structures, through increased education and enforcement.
Riparian	**High:** Riparian conditions are "poor" almost throughout the sub-basin.	Target riparian restoration efforts along the most productive and/or degraded streams including upper Salmon and Rock Creeks. Support ongoing efforts by CPU to identify priority riparian projects, educate property owners, and provide support for riparian restoration. Restore riparian corridors along the County's Park properties in lower Salmon and Whipple Creeks.	Preserve healthy riparian corridors in the headwaters of all the subbasins tributaries, focusing first on upper Salmon, Morgan and Rock Creeks.

Prioritization of Limiting Factors and Identification of Potential Restoration and Preservation Needs*

Limiting Factor	Priority Rating	Potential Restoration Actions	Preservation Actions
Water Quality	**High:** Water quality is a significant problem in almost all watersheds of the subbasin.	Restore degraded riparian cover for all streams within the subbasin, especially along Salmon, Whipple and Burnt Bridge Creeks. Reduce livestock access to streams, notably in Salmon, Mill, Morgan, and Mud Creeks. Protect and restore wetlands, springs, and seeps in the subbasin. Reduce stormwater impacts on water quality in all urbanized portions of the subbasin. Identify and eliminate failing septic tanks and drain fields in the subbasin. Reduce direct runoff from roads to streams. Enhance pool habitat to provide thermal refuge for salmonids rearing in the watersheds.	Protect riparian corridors in all headwaters areas to maintain the supply of cool, clean water to critical downstream spawning and rearing areas. Protect and enhance wetlands and spring fed sources of cool water wherever encountered in the subbasin.
Water Quantity	**High:** Both elevated peak and low flows present problems in the sub-basin.	Reduce impervious surfaces and develop stormwater facilities that will promote groundwater recharge, reduce peak flows, and potentially enhance low summer flows. Reduce water withdrawals from areas that might reduce summer flows. Identify unauthorized private diversions within the subbasin and work with landowners on alternative sources of water. Explore opportunities for water reuse where it could supplement instream flows (one source could be treated wastewater from the City of Battle Ground).	Protect fully forested and unroaded areas in the upper watershed from further development to reduce peak flows to downstream habitats and provide refuge for salmonids from elevated stream temperatures. Preserve floodplain connections and associated wetlands to provide off-channel refuge from high flows and additional flood capacity.

Prioritization of Limiting Factors and Identification of Potential Restoration and Preservation Needs*

Limiting Factor	Priority Rating	Potential Restoration Actions	Preservation Actions
Biological Processes	**Low/Medium:** Escapement is well below historic levels and a lack of nutrients may be limiting (Medium Priority). Invasive species reduce riparian function (Low Priority)	Increase contribution of marine–derived nutrients through increased use of carcasses. Along riparian corridors and wetlands, remove invasive, non-native vegetation and replace it with native species. Assess and identify possible remedies to predation in Lake River and lower Salmon Creek.	Preserve natural vegetation along riparian corridors and within wetlands.

* Restoration and Preservation Actions by Limiting Factor were prioritized based upon the Limiting Factors Report and will be circulated to TAG members for their approval.

Appendix D - Mill/Abernathy/Germany Sub-Basin Stock Summary And Habitat Priorities

Stocks and Priorities

SASSI and LCSCI Stocks	Priority	Other Anadromous Salmonids Present in the Sub-basin (LFA)
Mill Fall Chinook (SASSI)	Tier 2	Chum Salmon
Mill Coastal Cutthroat (SaSI)	Tier 3	
Mill Coho (SASSI)	Tier 3	
Mill Winter Steelhead (LCSCI)	Tier 4	
Abernathy Fall Chinook (SASSI)	Tier 2	
Abernathy Coastal Cutthroat (SaSI)	Tier 3	
Abernathy Coho (SASSI)	Tier 3	
Abernathy Winter Steelhead (LCSCI)	Tier 4	
Germany Fall Chinook (SASSI)	Tier 2	
Germany Coastal Cutthroat (SaSI)	Tier 3	
Germany Coho (SASSI)	Tier 3	
Germany Winter Steelhead (LCSCI)	Tier 4	

Not all stocks are present in all parts of the subbasin. Use LFA maps or contact Gary Wade at the LCFRB for specific site information.

Prioritization of Limiting Factors and Identification of Potential Restoration and Preservation Needs*

Limiting Factor	Priority Rating	Potential Restoration Actions	Preservation Actions
Fish Passage	**Medium/High:** High Priority to address passage problems in Germany and Coal Creeks where 30% and 34% of the habitat is blocked. Medium priority to	A culvert on an unnamed tributary to Mill Creek blocks access to approximately 1.7 miles of habitat. Low flow passage problems on the mainstem of Mill Creek need assessment. TAG members identified culverts on Wiest Creek, Midway Creek, and an unnamed tributary to Abernathy Creek that need assessment and potentially repair. A culvert near the upper end of anadromous distribution may block access to almost a mile of habitat on Erick Creek and it needs assessment.	None

Prioritization of Limiting Factors and Identification of Potential Restoration and Preservation Needs*

Limiting Factor	Priority Rating	Potential Restoration Actions	Preservation Actions
	assess and repair passage problems in Mill and Abernathy Creeks.	Seven unnamed tributaries in the upper reaches of Germany Creek have culverts near their mouths that block between 0.2 and 1.7 miles of habitat. Over 4 miles of potential habitat is blocked by a culvert on Clark Creek. A culvert on Coal Creek blocks access to approximately 0.6 miles of habitat. A mile of habitat is blocked by a culvert on Stewart Creek.	
Floodplain Conditions	**High:** Where surveys have been completed streams are often entrenched and floodplain connectivity is generally "poor" in the subbasin.	Floodplain connectivity throughout lower Mill Creek has been impaired by past practices. Splash damming has resulted in an incised channel throughout the lower 1.5 miles. Extreme flood events are contained with the channel. Look for opportunities to reconnect off-channel and side channel habitat in Mill Creek. Between the mouth and RM 5.5 Abernathy Creek is confined by stream adjacent roads and/or entrenched in many areas. Identify opportunities to reconnect floodplain, off-channel, and side channel habitat in this reach. From RM 1.9 to 5.7 Germany Creek flows through agricultural land where the stream is slightly entrenched. Work with landowners to identify and reconnect productive floodplain and off channel habitat. Debris jams were forcing the return to a multi-thread channel in the lower 3000 feet of Germany Creek. However, removal of debris jams by local residents is serving to return Germany Creek to a single thread. Work with landowners to identify and maintain key log jams in the lower creek. Look for opportunities to reconnect floodplain habitat in the Coal and Clark Creek watersheds.	Preserve and enhance off-channel and side channel habitat and associated wetlands wherever they occur. From RM 10 to RM 12 Mill Creek flows through a series of wetlands where side channel availability and floodplain connectivity improves. This area could provide excellent habitat for a number of anadromous species. The upper reaches of Abernathy Creek are also largely unconfined with good floodplain connectivity and need protection and enhancement. Preserve and enhance floodplain connectivity in lower Germany Creek.

Prioritization of Limiting Factors and Identification of Potential Restoration and Preservation Needs*

Limiting Factor	Priority Rating	Potential Restoration Actions	Preservation Actions
Sediment	**High:** Sediment fines are a significant problem in the subbasin. Numerous mass-wasting events occur in both the Elochoman and Skamokawa watersheds.	Past splash damming has scoured many of the streams in this subbasin to bedrock, leaving incised channels with limited spawning gravels. Identify areas where channel modifications (LWD or large rocks) could help slow flows and capture scarce spawning gravels.	Protect and enhance functional riparian corridors to reduce sediment delivery to streams. Identify and protect limited chum spawning sites in the subbasin. Crippen and Standard Creeks are productive habitats for steelhead.
Channel/LWD Conditions	**Medium:** LWD levels and pool habitat are generally "poor" throughout the sub-basin	LWD is the principle pool-forming agent in many of the stream systems within this subbasin. Increase functioning LWD structures, or similar natural structures, in appropriate stream reaches through LWD placement projects and/or through recruitment (although recruitment potential is low for most streams). Wilson Creek, the mainstem Skamokawa above tidewater, and Left Fork Skamokawa would respond well to LWD placement. Riparian vegetation in these areas will likely not be able to provide for long term LWD recruitment. LWD is almost non-existent in the lower reaches of the Elochoman River. Most LWD is quickly washed out of the system during high flows. In the mainstem Elochoman, pool habitats are now formed mainly by channel processes. The lack of quality pool habitat combined with low summer flows and high water temperatures limits rearing habitat in the subbasin. Develop and enhance pool habitat in the subbasin focusing on Bell Canyon, Pollard, and Crippen Creeks.	Protect existing mature riparian vegetation for LWD recruitment. Standard and McDonald Creeks were in the best condition for existing LWD in the Skamokawa Creek watershed. Riparian vegetation along these creeks should provide both near and long-term LWD recruitment. In the West Fork Elochoman there were some large pools with extensive cove habitat associated with logjams in the main channel. These logjams were anchored by old growth LWD with recently recruited alder LWD contributing to these formations. Maintain current appropriate pieces of LWD, and other natural structures, through increased education and enforcement.

Prioritization of Limiting Factors and Identification of Potential Restoration and Preservation Needs*

Limiting Factor	Priority Rating	Potential Restoration Actions	Preservation Actions
Riparian	**High:** Riparian conditions are generally "poor" throughout the sub-basin. Deciduous species dominate many of the riparian corridors.	Agricultural activities have reduced or eliminated riparian cover along the lower reaches of many streams within the subbasin. Eliminate livestock access and restore riparian vegetation wherever possible. Target riparian restoration efforts along the most productive and/or degraded streams including the Middle Valley Skamokawa from RM 2.2-6.6, lower Wilson Creek, the lower 3 miles of Wilson Creek, all of Bell Canyon, Quarry, and Skamokawa Creeks, the lower reaches of Nelson Creek, the lower 3 miles of the West Fork Elochoman, and the mainstem Elochoman above the West Fork confluence. Deciduous species dominate riparian corridors along a number of streams in the sub-basin. Manage riparian corridors to increase the percentage of conifers in riparian corridors.	Preserve healthy riparian corridors in the headwaters of all the sub-basins tributaries. Protect and enhance functional riparian corridors along Standard Creek (some of the best riparian habitat in the sub-basin).
Water Quality	**High:** Significant water quality problems occur in the Elochoman River and Skamokawa Creek and their tributaries	Maintain and restore riparian cover for all streams within the sub-basin, especially along lower Wilson Creek where temperatures are considerably higher than found in the upper reaches. Reduce livestock access to streams and riparian corridors. Water quality monitoring found elevated fecal coliform and nitrate levels, thought to originate from septic systems and agricultural activities, in surface and shallow groundwater in Skamokawa watershed. Identify sources of these water pollutants and reduce inputs to stream systems. Improve water quality and rearing conditions in Bell Canyon, Pollard, and Crippen Creeks.	Protect riparian corridors in all headwaters areas to maintain the supply of cool, clean water to critical downstream spawning and rearing areas. Protect and restore wetlands. Identify and protect cooler water refuges such as Falk Creek.

Prioritization of Limiting Factors and Identification of Potential Restoration and Preservation Needs*

Limiting Factor	Priority Rating	Potential Restoration Actions	Preservation Actions
Water Quantity	**Medium:** Both elevated peak and low flows present problems in the sub-basin.	By July median flows in the Elochoman dip below 40 c.f.s., which is less than 50% of optimal flows for steelhead and salmon spawning and rearing. Identify ways to augment low summer flows and enhance rearing habitat in the Elochoman River and other low flow limited habitats. Assess potential impacts on low flows in the Elochoman River from the City of Cathlamet's water withdrawals. Reduce road densities, and the direct connections between road drainage ditches and streams to reduce peak flows, promote groundwater recharge, and potentially enhance low summer flows. Restore and enhance off-channel rearing habitats that can provide refuge for juveniles during peak flows.	Protect fully forested and unroaded areas in the upper watershed from further development to reduce peak flows to downstream habitats and provide refuges for salmonids from elevated stream temperatures. Preserve floodplain connections and associated wetlands to provide off-channel refuge from high flows and additional flood capacity.
Biological Processes	**Medium:** Escapement is well below historic levels and the lack of nutrients may be limiting.	Increase contribution of marine–derived nutrients through increased use of carcasses. There have been reports of invasive aquatic plants in the lower reaches of streams in the sub-basin. Expand monitoring for invasive aquatic plants into the Elochoman River, Skamokawa Creek, Grays River and slough on Puget Island.	Preserve riparian corridors and wetlands with native vegetation.

* Restoration and Preservation Actions by Limiting Factor were prioritized based upon the Limiting Factors Report and will be circulated to TAG members for their approval.

Appendix E - Chinook River Sub-Basin Stock Summary And Habitat Priorities

Stocks and Priorities

SASSI and LCSCI Stocks	Priority	Other Anadromous Salmonids Present in the Sub-basin (LFA)
Grays River Chum Salmon (reintroduction program)	Tier 1	Fall Chinook
		Coastal Cutthroat
		Coho
		Winter Steelhead

Not all stocks are present in all parts of the subbasin. Use LFA maps or contact Gary Wade at the LCFRB for specific site information.

Prioritization of Limiting Factors and Identification of Potential Restoration and Preservation Needs*

Limiting Factor	Priority Rating	Potential Restoration Actions	Preservation Actions
Fish Passage	**Medium//High:** High Priority to address tide gate passage problems in the lower Chinook River. Medium priority to address passage problems in the smaller Columbia River tributaries and in Freshwater Creek.	The tidegates on the Chinook River under Highway 101 likely restrict passage during certain flows. These tidegates alter water exchange rates and tidal influences that may create thermal and dissolved oxygen barriers under certain conditions. Remove or replace the existing tidegates at the mouth of the Chinook to reduce fish passage problems, and manage tidegates to restore tidal flushing in the Chinook River estuary. Tidegates on the Wallicut River under Stringtown Road may block passage at certain flows. These potential barriers need assessment and repair. The City water supply dam also restricts passage on Freshwater Creek, blocking approximately ½ mile of potential anadromous habitat. Sea Resources places a weir in to restrict passage of hatchery fish into upstream habitats from mid-September to late November. Randomly selected hatchery and native brood stock from the hatchery, and a mix of natural and hatchery fish are passed above the hatchery. After late November, all fish have unlimited access to upstream habitats.	None

Prioritization of Limiting Factors and Identification of Potential Restoration and Preservation Needs*

Limiting Factor	Priority Rating	Potential Restoration Actions	Preservation Actions
		Some of the smaller tributaries to the Columbia in WRIA 28 upstream of the Chinook River may provide potential spawning and rearing habitat. However, there is limited information on passage and habitat conditions.	
Floodplain Conditions	**High:** Where surveys have been completed streams are often incised and floodplain connectivity is generally "poor" in the subbasin.	Dikes, dredging, the removal of logjams, and tidegates have altered floodplain connectivity along almost all lower reaches of the Chinook River. Continue efforts to identify and restore floodplain and estuarine habitat in the lower Chinook River. Above tidal influence (RM 2.5) to the hatchery (RM 4), diking occurs along approximately 1/3 of the channel length. Some of the stream channel within this reach is also incised. From the hatchery intake to the headwaters, approximately 40% of the channel is noticeably incised within a wide valley. Identify and restore off-channel and side channel habitats along these reaches.	Protect and enhance the Chinook River Estuary. The ongoing restorations efforts by Sea Resources and its numerous partners to restore estuarine function to over 80% of the historic estuary is the largest restoration effort planned in the Columbia River basin. This effort should be fully supported. Preserve and enhance off-channel and side channel habitat and associated wetlands wherever they occur. Survey stream channels near the hatchery on the Chinook River to determine if there are potential sites to restore off-channel habitat to provide refuge for juvenile salmonids. Determine how chinook and other salmon from the Chinook River and from upstream areas of the Columbia River are using the Chinook River Estuary to better target restoration efforts.
Sediment	**Medium:** Data is lacking on substrate conditions for most stream reaches; however,	In the 1970's, an extensive road network was built in the upper basin and most of the watershed was logged. Over 30 large landslides and debris torrents are evident in 1974 aerial photos. These moved a tremendous amount of sediment into the stream channels and estuary (Dewberry 1997). TAG members noted that debris torrents and road culvert failures are still contributing to	From the Sea Resources Hatchery to the forks are the major spawning grounds for most anadromous salmonids in the Chinook River watershed. Salmon recovery efforts in the Chinook River hinge on protection

Prioritization of Limiting Factors and Identification of Potential Restoration and Preservation Needs*

Limiting Factor	Priority Rating	Potential Restoration Actions	Preservation Actions
	excessive sediment fines are considered a problem in some stream reaches within the subbasin.	sediment loads in the basin, but that the extent of these problems is unknown and needs assessment. Assess and repair or decommission roads in the Chinook watershed that can contribute chronic fine sediments or may fail and lead to mass wasting and debris flows.	and enhancement of these productive spawning grounds. Above the tidal reaches (RM 2.5 to the hatchery (RM 4), TAG members noted that excessive substrate fines are likely a continuing problem. Chum spawning occurs in this area, and the area needs protection and enhancement. Protect and enhance functional riparian corridors and identify and protect unstable slopes to reduce sediment delivery to streams. Refuge areas should be established in the basin to protect critical spawning areas by establishing a more natural regime of sediment and organic matter dynamics within the Chinook River watershed.

Prioritization of Limiting Factors and Identification of Potential Restoration and Preservation Needs*

Limiting Factor	Priority Rating	Potential Restoration Actions	Preservation Actions
Channel/LWD Conditions	**High:** LWD levels and pool habitat are generally "poor" throughout the sub-basin. LWD recruitment potential is also low.	Construct log jams in the lower Chinook to increase habitat diversity for rearing salmonids and to provide benefits for other species such as herring. LWD is the principle pool-forming agent in many of the stream systems within this subbasin. Increase functioning LWD structures, or similar natural structures, in appropriate stream reaches through LWD placement projects and/or through recruitment (although recruitment potential is low for most streams). The lack of quality pool habitat combined with low summer flows and high water temperatures likely limits available rearing habitat in the subbasin. Develop and enhance pool habitat in appropriate reaches.	The same reach (RM 5 to Forks) that provides critical spawning habitat for most salmon in the Chinook River also provides critical rearing habitat for most salmonids using the watershed. Protect and enhance existing instream LWD and quality pool habitat. Protect existing mature riparian vegetation for LWD recruitment. LWD is often cleared from streams to reduce potential erosion. Maintain current appropriate pieces of LWD, and other natural structures, through increased education and enforcement.
Riparian	**High:** Riparian conditions are generally "poor" throughout the sub-basin. Deciduous species and reed canary grass dominate many of the riparian corridors.	Agricultural land uses have reduced or eliminated riparian cover along the lower reaches of the Chinook River. Eliminate livestock access and restore and maintain native riparian vegetation wherever possible. Target riparian restoration efforts along the most productive and/or degraded streams starting with the valley bottom and along critical spawning grounds above the hatchery. Deciduous species and reed canary grass dominate riparian corridors along many reaches of the Chinook. Manage riparian corridors to eliminate non-native species and increase the percentage of conifers in riparian corridors.	Preserve healthy riparian corridors wherever encountered in the subbasin, starting with the valley floor and along the productive spawning reaches.

Prioritization of Limiting Factors and Identification of Potential Restoration and Preservation Needs*

Limiting Factor	Priority Rating	Potential Restoration Actions	Preservation Actions
Water Quality	**Medium:** Water Quality data is lacking for the Chinook River and other Columbia River tributaries.	Maintain and restore riparian cover for all streams within the sub-basin, starting degraded reaches between RM 2.5 and 4.0. Increase water quality monitoring in the Chinook watershed to provide better guidance for restoration efforts.	Protect functional riparian corridors in all headwaters areas to maintain the supply of cool, clean water to critical downstream spawning and rearing areas. Protect and restore wetlands and their sources of water. Identify and protect cooler water refuges in the subbasin.
Water Quantity	**Medium:** Both elevated peak and low flows present problems in the sub-basin.	Hydrologic maturity should be improving for the Chinook River system with the re-growth of the forest after extensive logging in the 1970's. However, the high road density and loss of forest cover is likely increasing peak flows above historic levels. Reduce road densities, and the direct connections between road drainage ditches and streams to reduce peak flows, promote groundwater recharge, and potentially enhance low summer flows. Low flows are a natural condition for the rain and groundwater fed streams within WRIA 24. Streams, such as the Wallacut River, have minimal flow during summer months. Diversions at the Sea Resources Hatchery and from Freshwater Creek for the City of Chinook reduce flows and may reduce available rearing habitat. The impact of these diversions should be assessed and if needed adjustments in withdrawals made. Restore and enhance off-channel rearing habitats that can provide refuge for juveniles during peak flows, and pool habitats that can support rearing fish until water levels reconnect isolated habitats.	Protect fully forested and unroaded areas in the upper watershed from further development to reduce peak flows and sediment delivery to downstream habitats and provide refuges for salmonids from elevated stream temperatures. Preserve floodplain connections and associated wetlands to provide off-channel refuge from high flows and additional flood capacity.

Prioritization of Limiting Factors and Identification of Potential Restoration and Preservation Needs*

Limiting Factor	Priority Rating	Potential Restoration Actions	Preservation Actions
Biological Processes	**Medium:** Escapement is well below historic levels and the lack of nutrients may be limiting. Invasive species limits native riparian restoration.	Increase contribution of marine–derived nutrients through increased use of carcasses. Encourage beaver activity in the lower Chinook River. The activity of beaver will rapidly reconnect the stream channel with the valley floor, restoring considerable freshwater habitat. According to Dewberry (1997), this single action may have the greatest short-term benefit on juvenile fish production in the basin. Remove reed canary grass from riparian corridors and reestablish native vegetation.	Preserve riparian corridors and wetlands with native vegetation.

* Restoration and Preservation Actions by Limiting Factor were prioritized based upon the Limiting Factors Report and will be circulated to TAG members for their approval.
"Poor", "Fair" and "Good" comments refer to habitat criteria developed by the Conservation Commission for the Habitat Limiting Factors Analysis Reports.

Appendix F - Summary Of Ongoing Data Collection And Monitoring Activities In The Columbia River Basin

Summary of ongoing data collection and monitoring activities in the Columbia River Basin Field means field parameter, or temperature, DO, pH, Specific Conductance; TSS = Total Suspended Solids (evaporated); TDS = Total Dissolved Solids; SS=Suspended Sediment; Nut. = Nutrients; Majors = major ions (cations +anions); Bac-T=Bacteria; Benth=benthic invertebrates in wadeable streams; BOD, biological oxygen demand; COD, chemical oxygen demand; CBOD, carbonaceous biological oxygen demand; TOC=Total Organic Carbon; TOX, total organic halides; TE=Trace Elements; OC=organochlorines, including DDT and PCBs; Pests=Dissolved Pesticides; PAH, polycyclic aromatic hydrocarbons; D/F= Dioxins and Furans; TBT, tert-butyl tins; Alk, alkalinity; Note: TSS, TDS, and SS are indicated separately because of methods differences.

Program Name/ Description	Program Objectives	Time Frame		Spatial Coverage in Columbia Basin	Constituents	Remarks
		Period	Frequency			
Washington Department of Ecology (WDOE) - Contact: Bill Ehinger 360-407-6682						
• Ambient Monitoring	• Trend monitoring • Standards Compliance	Ongoing	Monthly	Yakima, Walla Walla, Snake, Cowlitz, E.F. Lewis, Kalama Rivers	• Field, TSS, Bac-T, Benth.	Analysis of toxics per formed irregularly
Oregon Department of Environmental Quality (ODEQ) - Contact: Greg Pettit 503-229-5983						
• Ambient Monitoring	• Trend monitoring • Standards Compliance	Ongoing	Monthly	Young's, Lewis and Clark, Skipanon, Klatskanine, Clatskanie, Willamette, Sandy, Columbia River @ marker 47 (RM 102.5) & other upper basin rivers.	• Field, TSS, Alk, Bac-T, Major ions, BOD, COD, chlorophyll, TOC, color, turbidity, TOX (Willamette Valley only)	No toxics regularly monitored. See ODEQ, 1994b
National Council of the Paper Industry for Air and Stream Improvement (NCASI) - Contact: Paul Wiegand 541-752-8801						
• Effluent monitoring	• Compliance testing	Ongoing	Daily	All mills	• TSS, BOD, CBOD, ??	No toxics

U.S. Army Corps of Engineers (USACE) - Contact: Mark Siipola 503-808-4885					
• Channel Deepening	• Measure contaminants in bottom sediments in navigation channel	One Time Study	• Columbia (RM 3 - 116), 89 sites • Lower Willamette, 43 sites • Navigational Channels only	• grain size, %volatile solids at all sites. • TE, pthalates, phenols, OC, PAH, TBT4, @ select sites	• Testing new screening technique using bioluminescense (P450 RGS) • Impact and gravity cores in Willamette
O&M (side channels)	• Maintain side channels	Ongoing	Every 5 yrs	Ilwaco, Chinook, Old Cowlitz, Lower Willamette	• grain size, %volatile solids at all sites. • TE, pthalates, phenols, OC, PAH, TBT4, @ select sites	•
Total Dissolved Gas	• Standards compliance	Ongoing		11 location in lower Columbia River	• TDG, Temperature	• With USGS
Port of Portland - Contact: Kathie Futornik 503-731-7236					
• Terminal 4 Cleanup	• Federal mandate to clean contaminated sediments	Proposed	One time	• Near Terminal 4 in Willamette R. (~RM 6), and near Swan Island	TBT, Metals,	• Awaiting clarification of cleanup requirements
U.S. Geological Survey, Water Resources Division (USGS, WRD) - Contact: Valerie Kelly 503-251-3244					
• NASQAN	• Long term monitoring, basin wide • Characterize loads and concentrations in water column and suspended sediments	1995 - ?	15 x /year	• 4 Sites in Columbia, 1 in Snake, 1 in Willamette	• Field, Nut, SS, Pests, TE • TE in suspended sediment	• No OCs, D/F, PAH • Also, one time sampling of bed sed. @ lower sites
• SPMD's	• Determine relative concentrations of hydrophobic compounds in water • Source delineation	1997	Low flow & some high flow	• 16 locations in Columbia and Willamette Rivers	• OCs, PAHs, D/F , Semivolatiles	• Data expected after spring, 1999

U.S. Geological Survey, Biological Resources Division (USGS, BRD) - Contact: Tim Bartish 970-226-9483						
• BEST	• Long term monitoring (?) • Document occurrence and distribution of contaminants in tissues in biota	1997	planned bi-annual	• 7 Sites in Columbia, 3 in Snake, 2 in Willamette, 1 each in Yakima, Salmon, Flathead	• 7 Biomarkers • OC, TE in whole fish	• Uses NASQAN & NCBP sites
U.S. Environmental Protection Agency (USEPA) - Contact: Pat Cirone, 206-553-1597						
• Contaminants in fish consumed by Native Americans	• Assess fish consumption exposure to toxics for tribes • Determine health risks to tribes	1997	One time	• Upper Columbia (above Bonneville) • 288 samples, > 90 sites	• >180 chemicals • D/F, OC, TE, PAH, PEST, Volatile & Semivolatiles	

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Appendix G. - Monitoring Strategy Components