

5 Elochoman Subbasin – Mill, Abernathy, & Germany



Figure 5-1. Location of the Mill, Abernathy, and Germany basins within the Lower Columbia River Basin.

5.1 Basin Overview

The Mill, Abernathy, and Germany basins comprise approximately 152 square miles, primarily in Cowlitz County with the remainder in Wahkiakum County. The basins are part of WRIA 25.

The Mill, Abernathy, and Germany basins will play a key role in the recovery of salmon and steelhead. The basins historically supported populations of fall Chinook, winter steelhead, chum, and coho. Today, Chinook, steelhead and chum are listed as threatened under the ESA. Coho salmon are a candidate for listing. Other fish species of interest are Pacific lamprey and coastal cutthroat trout – these species are also expected to benefit from salmon protection and restoration measures.

Mill, Abernathy, and Germany salmon and steelhead are affected by a variety of in-basin and out-of-basin factors including stream, Columbia River mainstem, estuary, and ocean habitat conditions; harvest; hatcheries; and ecological relationships with other species. Analysis has demonstrated that recovery cannot be achieved by addressing only one limiting factor. Recovery will require action to reduce or eliminate all manageable factors or threats. The deterioration of habitat conditions in the Columbia River mainstem, estuary, and plume affect all anadromous salmonids within the Columbia Basin. Direct harvest of listed salmon and steelhead is prohibited but sport and commercial fisheries focusing on hatchery fish and other healthy wild populations, primarily in the mainstem Columbia and ocean, incidentally affect ESA-listed Mill,

Abernathy, and Germany fish. Key ecological interactions of concern include effects of nonnative species; nutrient inputs from salmon carcasses; and predation by species affected by development including Caspian terns, northern pikeminnow, seals, and sea lions. Discussions of out-of-basin factors, strategies, and measures common to all subbasins may be found in Volume I, Chapters 4 and 7. This subbasin chapter focuses on habitat and other factors of concern specific to the Mill, Abernathy and Germany subbasins.

The Mill/Abernathy/Germany Basin is almost entirely comprised of private and state owned lands, the bulk of which is commercial timber land. Considerable logging occurred in the past without regard for riparian and instream habitat, resulting in sedimentation of salmonid spawning and rearing habitat (WDF 1990). Essentially none of the forest cover is in late-seral stages, however, as the forest matures, watershed conditions are recovering. The impacts of forest practices on riparian areas and sediment supply have most affected winter steelhead and coho spawning and rearing habitat in the middle and upper basin reaches.

Agricultural valleys extend up the mainstems of Abernathy and Germany creeks. The reaches within these broad valleys provide potentially productive habitat for all species, especially for chum and fall Chinook, which make heavy use of lower mainstem reaches. Channel confinement and riparian degradation are the limiting factors with the greatest impacts in these areas. There is not extensive agricultural use in the Mill Creek basin, however, rural residential development has been increasing in the lower basin over the last decade, which poses potential threats to fish habitat, primarily for fall Chinook and chum that make the most use of lower basin reaches.

The projected population change from 2000 to 2020 for unincorporated areas in WRIA 25 is 37% (LCFRB 2001). Current and expected growth will occur predominantly in the agricultural valleys along the major stream courses, resulting in land-use conversion from agricultural to residential uses. This pattern is already apparent in many areas. It will be important for land-use planning and critical areas policy to provide adequate protection of habitat and habitat-forming processes in sensitive areas.

5.2 Species of Interest

Focal salmonid species in Mill, Abernathy, and Germany creeks include fall Chinook, winter steelhead, chum and coho. The current health or viability of the focal populations ranges from very low for chum to low-medium for winter steelhead. Focal populations need to improve to a targeted level that contributes to recovery of the species (see Volume I, Chapter 6). The recovery goals call for restoring winter steelhead and chum to a high viability level, providing a 95% or better probability of population survival over 100 years. Fall Chinook and coho restoration goals of medium levels provide for a 75-94% probability of population survival over 100 years.

Other species of interest in these creeks include coastal cutthroat trout and Pacific lamprey. Regional objectives for these species are described in Volume I, Chapter 6. Recovery actions targeting focal salmonid species are also expected to provide significant benefits for these other species. Cutthroat will benefit from improvements in stream habitat conditions for salmonids. Lamprey are also expected to benefit from habitat improvements in the estuary, Columbia River mainstem, and the Mill, Abernathy, and Germany Subbasin although specific spawning and rearing habitat requirements of lamprey are not well known.

Table 5-1. Current viability status of Mill, Abernathy, and Germany populations and the biological objective status that is necessary to meet the recovery criteria for the Coastal strata and the lower Columbia ESU.

Species	ESA Status	Hatchery Component	Current		Objective	
			Viability	Numbers	Viability	Numbers
Fall Chinook	Threatened	No	Low	300-4,000	Medium	2,000-3,200
Winter steelhead	Threatened	Yes	Low+	50-500	High	600-1,500
Chum	Threatened	No	Very Low	50-100	High	1,100-3,000
Coho	Candidate	Yes	Low	unknown	Medium	unknown

Fall Chinook – The historical combined adult population in Mill, Abernathy, and Germany creeks is estimated from 5,000-7,500 fish. There is some question as to the historical significance of fall Chinook in these basins compared to other species. Current returns range from 300-4,000. The Abernathy fall Chinook hatchery program was discontinued, with the final adult hatchery returns in 1997. Spawning is concentrated in the lower 2 miles of Mill Creek, and the lower 3 miles of Abernathy and Germany creeks. Juvenile rearing occurs near and downstream of the spawning area. Juveniles emerge in early spring and migrate to the Columbia in spring and summer of their first year.

Winter Steelhead – The historical combined adult population in Mill, Abernathy, and Germany creeks is estimated at 2,000 fish. Current natural spawning returns to Abernathy and Germany creeks range from 50-500. Spawning in Mill Creek occurs in the mainstem, North Fork and unnamed tributaries. Spawning in Abernathy Creek occurs in the mainstem, Slide Creek, and Cameron Creek. Spawning in Germany Creek occurs in the mainstem, Loper Creek, and John Creek. Spawning time is March to early June. Juvenile rearing occurs both downstream and upstream of the spawning areas. Juveniles rear for a full year or more before migrating from the creeks.

Chum- The historical combined adult population in Mill, Abernathy, and Germany creeks is estimated from 6,500-40,000 fish. Current natural spawning returns are 50-100. Spawning

occurs in the lower reaches of Mill, Abernathy, and Germany creeks, with recent year spawning primarily concentrated in Abernathy and Germany creeks. Hatchery releases were discontinued in Germany Creek in 1983 and in Abernathy Creek in 1991. Juveniles emerge in the early spring and migrate to the Columbia with little rearing time in these creeks.

Coho – The historical combined adult population in Mill, Abernathy, and Germany creeks is estimated from 10,000-30,000 fish. The historical population is late stock which spawns from late November-March. Current returns are unknown but assumed be low. Natural spawning is presumed to occur in most areas accessible to coho in Mill, Abernathy, and Germany creeks, and also in nearby Coal Creek. Juvenile rearing occurs upstream and downstream of spawning areas. Juveniles rear for a full year in these creeks before migrating as yearlings in the spring.

Coastal Cutthroat – Anadromous and resident forms of cutthroat trout are present in Mill, Abernathy, and Germany creeks. Anadromous cutthroat counts at Abernathy trap have been very low at fewer than 15 fish since 1991. Anadromous cutthroat enter these creeks from August-April and spawn from January to April. Most juveniles rear 2-3 years before migrating from their natal stream.

Pacific lamprey – Information on lamprey abundance is limited and does not exist for Mill, Abernathy, and Germany populations. However, based on declining trends measured at Bonneville Dam and Willamette Falls it is assumed that Pacific lamprey have also declined in these creeks. The adult lamprey return from the ocean to spawn in the spring and summer. Spawning likely occurs in the small to mid-size streams of these creeks. Juveniles rear in freshwater up to seven years before migrating to the ocean.



Figure 5-2. Summary of habitat limiting factors, population status, expected population improvement trend with existing programs, and biological objectives depicted for the Mill, Abernathy, and Germany basins.

5.3 Potentially Manageable Impacts

Stream habitat, estuary/mainstem habitat, harvest, hatchery and predation effects have all contributed to reduced salmonid productivity, numbers, and population viability in the Mill, Abernathy and Germany Subbasin. The pie charts below represent the relative order of magnitude of quantifiable effects for each of these factors for each focal species. The preferred recovery scenario targets an equivalent reduction in each impact factor in proportion to the magnitude of the effect. Population-specific targets are discussed in further detail in Volume I, Chapter 6.

- Loss of tributary habitat quality and quantity is an important impact for all species, particularly for chum but less so for fall Chinook. Loss of estuary habitat quality and quantity is also important, accounting for relative impacts of about 20% for chum, fall Chinook and winter steelhead, and 10% for coho.
- Harvest accounts for the largest relative impact on fall Chinook and is moderately important to coho, but is a relatively minor factor for other species.
- Hatchery impacts are substantial for coho and fall Chinook, but of lesser importance for winter steelhead and chum.
- Predation impacts are moderate for winter steelhead and chum, but are relatively low for coho and fall Chinook.
- Hydrosystem access and passage impacts appear to be relatively minor for all species.

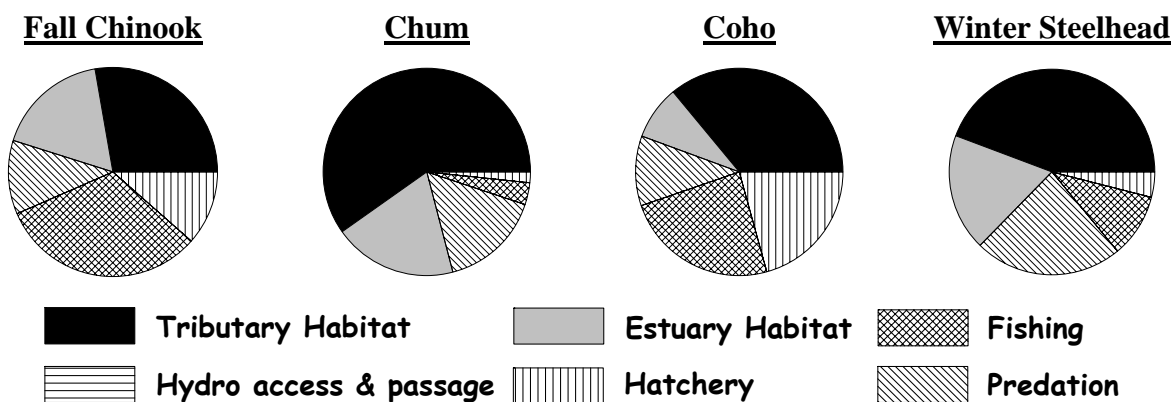


Figure 5-3. Relative contribution of potentially manageable impacts for Mill, Germany, and Abernathy populations.

5.4 Limiting Factors, Threats, and Measures

5.4.1 Hydropower Operation and Configuration

There are no hydro-electric dams in any of the Mill, Germany, or Abernathy basins. However, species in these basins are affected by mainstem Columbia hydro operations and flow regimes which affect habitat in migration corridors and in the estuary. Mainstem hydro factors and threats are addressed by regional strategies and measures identified in Volume I.

5.4.2 Harvest

Most harvest of wild Mill, Abernathy, and Germany creek salmon and steelhead occurs incidental to the harvest of hatchery fish and healthy wild stocks in the Columbia estuary, mainstem, and ocean. This mortality is very low for chum and steelhead, but is more significant for fall Chinook. Mill, Abernathy, and Germany fall Chinook are harvested in ocean and Columbia River commercial sport fisheries as well as in-basin sport fisheries. Harvest is controlled by an ESA harvest limit associated with Coweeman natural fall Chinook. No harvest of chum occurs in ocean fisheries, there is no directed Columbia River or tributary chum fisheries and retention of chum is prohibited in Columbia River sport fisheries. Chum can be impacted incidental to fisheries directed at coho and winter steelhead. Harvest of coho occurs in the ocean commercial and recreational fisheries off the Washington and Oregon coasts and Columbia River. There are no salmon sport fisheries in Mill, Abernathy, or Germany creeks. Wild coho impacts are limited by fishery management to retain marked hatchery fish and release unmarked wild fish. Incidental mortality of steelhead occurs in freshwater commercial fisheries directed at Chinook and coho and freshwater sport fisheries directed at hatchery steelhead. All recreational fisheries are managed to selectively harvest fin-marked hatchery steelhead and commercial fisheries cannot retain hatchery or wild steelhead.

Measures to address harvest impacts are generally focused at a regional level to cover fishery impacts accrued to lower Columbia salmon as they migrate along the Pacific Coast and through the mainstem Columbia River. The regional measures cover species from multiple watersheds which share the same migration routes and timing, resulting in similar fishery exposure. Regional strategies and measures for harvest are detailed in Volume I, Chapter 7. A number of regional strategies for harvest involve implementation of measures within specific subbasins. In-basin fishery management is applicable to steelhead and salmon while regional management is more applicable to salmon. Harvest measures with significant application to Mill, Abernathy, and Germany Subbasin populations are summarized in the following table:

Table 5-2. Regional harvest measures from Volume I, Chapter 7 with significant application to Mill, Abernathy, and Germany Subbasin populations.

Measure	Description	Comments
F.M17	Monitor chum handle rate in winter steelhead sport fisheries.	State agencies would include chum incidental handle assessments as part of their annual tributary sport fishery sampling plan. If winter steelhead fisheries continue in these basins.
F.M18	Monitor and evaluate commercial and sport impacts to naturally-spawning steelhead in salmon and hatchery steelhead target fisheries.	Includes monitoring of naturally-spawning steelhead encounter rates in fisheries and refinement of long-term catch and release handling mortality estimates. Would include assessment of the current monitoring programs and determine their adequacy in formulating naturally-spawning steelhead incidental mortality estimates.
F.M19	Continue to improve gear and regulations to minimize incidental impacts to naturally-spawning steelhead.	Regulatory agencies should continue to refine gear, handle and release methods, and seasonal options to minimize mortality of naturally-spawning steelhead in commercial and sport fisheries.
F.M24	Maintain selective sport fisheries in ocean, Columbia River, and tributaries and monitor naturally-spawning stock impacts.	Mass marking of lower Columbia River coho and steelhead has enabled successful ocean and freshwater selective fisheries to be implemented since 1998. Marking programs should be continued and fisheries monitored to provide improved estimates of naturally-spawning salmon and steelhead release mortality.

5.4.3 Hatcheries

As noted in the regional strategies, hatcheries can adversely affect wild salmon and steelhead populations in several ways. These include domestication or the reduction in the fitness of wild fish due to interbreeding with hatchery fish, direct competition between wild and hatchery fish for habitat and nutrients, and the introduction of disease. Hatcheries can also assist in recovery efforts by providing fish needed to reestablish extirpated populations or to augment wild populations that have reached critically low levels.

There are no production hatcheries operating in Mill, Abernathy, or Germany creek subbasins. Abernathy National Fish Hatchery currently operates as a fishery research facility. Small numbers of hatchery winter steelhead have been planted into Abernathy and Germany creeks since 1961 for harvest opportunity. There is currently no hatchery steelhead scheduled for release into these streams. The main threats from hatchery steelhead are potential domestication of the naturally-produced steelhead as a result of adult interactions or ecological interactions between natural juvenile salmon and hatchery released juvenile steelhead.

Regional hatchery strategies and measures are focused on evaluating and reducing biological risks and reducing the risks to natural populations. Any future artificial production programs within Mill, Abernathy, or Germany creek basins will be evaluated in detail through the WDFW Benefit-Risk Assessment Procedure (BRAP) relative to risks to natural populations. The resulting program specific actions will be developed, evaluated, and documented through the Hatchery and Genetic Management Plan for public review and consideration by NOAA Fisheries (details in programs Technical Foundation, Volume IV). Regional hatchery measures identified in Volume I, Chapter 7 with potential applications to hatchery programs within the Mill, Germany, and Abernathy creek subbasins are summarized in Table 5-3.

Table 5-3. Regional hatchery measures from Volume I, Chapter 7 with potential implementation actions in the Mill, Abernathy, and Germany creek subbasins.

Measure	Description	Comments
H.M32.	Juvenile release strategies to minimize interactions with naturally-spawning fish.	Release strategies are aimed at reducing or avoiding interactions with wild steelhead, fall Chinook, coho by release timing and release location strategies.
H.M34	Mark hatchery steelhead with an adipose fin-clip for identification and selective harvest.	Marking hatchery fish allows for identification of hatchery fish in the natural spawning grounds and at collection facilities which enables accurate accounting of wild fish. Marking also enables selective fisheries to retain hatchery fish and release wild fish.
H.M26,34	Hatchery program utilized for supplementation and enhancement of wild chum and coho populations.	Enhancement programs for natural chum and coho could be considered with appropriate brood stock at Abernathy Hatchery.
H.M8	Adaptively manage hatchery programs to further protect and enhance natural populations and improve operational efficiencies.	Abernathy Hatchery could be utilized for research, monitoring, and evaluation programs to provide information for regional application.

5.4.4 Ecological Interactions

Ecological interactions focus on how salmon and steelhead, other fish species, and wildlife interact with each other and the subbasin ecosystem. Mill, Germany and Abernathy salmon and steelhead are affected throughout their lifecycle by ecological interactions with non native species, food web components, and predators. Interactions are similar for Mill, Germany, and Abernathy populations to those of most other subbasin salmonid populations. Ecological Interactions are addressed by regional strategies and measures identified in Volume I.

5.4.5 Habitat – Estuary and Lower Columbia Mainstem

Conditions in the Columbia River mainstem, estuary, and plume affect all anadromous salmonid populations within the Columbia Basin. A variety of human activities in the mainstem and estuary have decreased both the quantity and quality of habitat used by juvenile salmonids. These include floodplain development; loss of side channel habitat, wetlands and marshes; and alteration of flows due to upstream hydro operations and irrigation withdrawals. Effects are similar for Mill, Germany, and Abernathy populations to those of most other subbasin salmonid populations. Effects are likely to be greater for chum and fall Chinook than steelhead and coho. Estuary and mainstem effects on Mill, Germany, and Abernathy salmon and steelhead populations are addressed by regional strategies and measures identified in Volume I and the Columbia Mainstem and Estuary Subbasin sections of Volume II.

5.4.6 Habitat – Subbasin Streams and Watersheds

Decades of human activity have significantly altered watershed processes and reduced both the quality and quantity of habitat needed to sustain viable populations of salmon and steelhead. Moreover, with the exception of fall Chinook, stream habitat conditions within the Mill/Abernathy/Germany Basin have the greatest impact on the health and viability of salmon and steelhead relative to the other limiting factors and threats discussed in this chapter.

Subwatersheds, reaches, and habitat attributes have been prioritized for protection and/or restoration based on the plan's biological objectives, fish distribution, critical life history stages, current habitat conditions, and potential fish population performance. Priority areas for habitat preservation and restoration are identified in Figure 5-4. A summary of the primary habitat limiting factors and threats are presented in Table 5-5. Habitat measures and related information are presented in Table 5-6. Results of IWA watershed process modeling are depicted for subwatersheds in Figure 5-5. Reach- and subwatershed-scale limiting factors generated from the technical assessment are included in Table 5-4. Details on species-specific spatial priorities and limiting factors at the subbasin level may be found in Volume II of the Technical Foundation. A description of the methodology used to generate composite (multi-species) reach and subwatershed priorities can be found in the introduction to this volume of the recovery plan.

The areas with the greatest current or potential contribution to focal salmonid population health and productivity are listed below. Tier 1 and 2 reaches within these priority areas are included in the list. The habitat limiting factors, threats, and measures included in this chapter focus primarily on the priority areas and the Tier 1 and 2 reaches within them. Tier 3, 4, and non-tiered reaches are considered secondary priority, but in many cases, these lower priority areas will also require restoration and preservation actions in order to achieve recovery objectives. Watershed process measures generally focus on the entire basin as opposed to being limited only to high priority areas because conditions in high priority areas are often influenced by cumulative watershed effects. High priority areas and reaches in the Mill/Abernathy/Germany Basin include the following:

- Lower Mill Creek & tributaries – Mill 1-5; SF Mill 1; Spruce 1-2; NF Mill 1-2
- Mainstem Abernathy Creek & tributaries – Abernathy 1-11; Cameron 1; Erick 2; Midway 5
- Mainstem Germany Creek – Germany 1-8, 10, 12-15

The following paragraphs provide a brief overview of each of these priority areas, including species most affected, land-use threats, and the general type of measures that will be necessary for recovery. Additional detail can be found in the tables and figures that follow.

While reach level habitat conditions often result from local factors, they are also affected or shaped by systemic watershed processes. Limiting factors such as temperature, high and low flows, sediment input and large woody debris recruitment are often affected by or result from upstream conditions and degraded watershed processes. Access to key reaches may also be affected by barriers that occur downstream of a reach. Accordingly, restoration of a priority reach may require action outside the targeted reach. The IWA analysis was used to identify potential upstream watershed areas that could influence reach level habitat attributes. EDT was used to allow a relative comparison of reaches and habitat attributes within a reach.

The reaches with the most current and potential production in the Mill Creek basin are in the lower mainstem (below the SF confluence and just upstream of the NF confluence), in lower SF Mill Creek, and in NF Mill Creek. The Mill Creek basin is nearly entirely forest land, with scattered rural residential development along the lower mainstem and lower SF Mill Creek. The primary impacts are related to basin-wide forest practices and recovery measures should therefore focus primarily on forestry related impacts.

The most productive reaches in Abernathy Creek are located in the lowest 3-4 miles of the mainstem and in the tributaries Erick and Midway creeks. These reaches suffer from basin-wide forest practices and from localized riparian and floodplain impacts related to agriculture and rural residential development. Successful restoration of habitat will involve riparian forest recovery, floodplain re-connection, and restoration of functional runoff and sediment supply processes from the entire basin.

The lower and middle mainstem Germany reaches (Germany 1-8) are used by all salmonid populations. These reaches are impacted by basin-wide forest practices and by local agriculture and rural residential development. The upper Germany Creek reaches (Germany 10-15) are utilized most by winter steelhead. These reaches are impacted most by upper basin forest harvest and road conditions. Germany Creek reaches will require stream corridor (riparian areas and floodplains) restoration as well as basin-wide recovery of functional runoff and sediment supply processes.

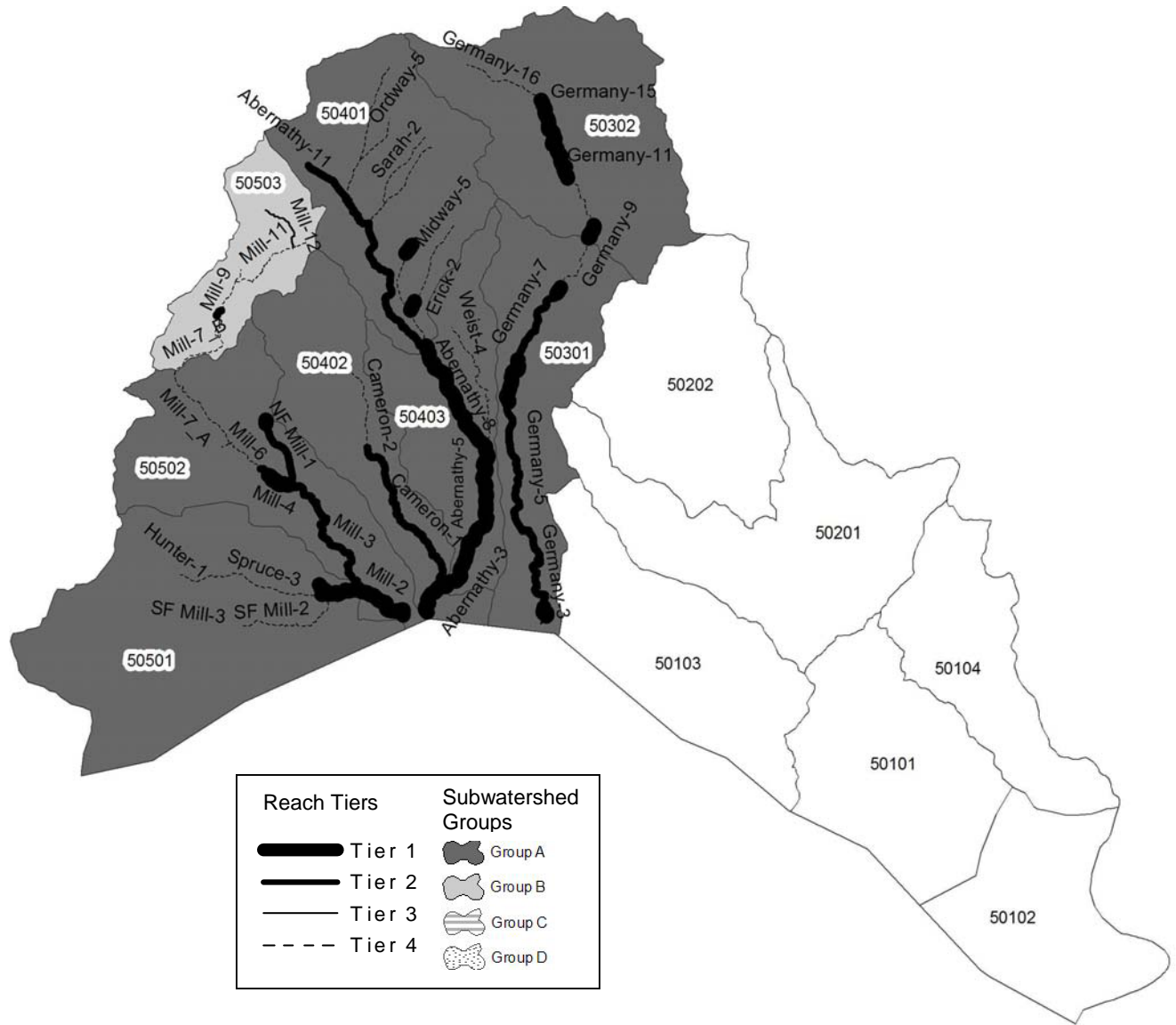


Figure 5-4. Reach tiers and subwatershed groups in the Mill/Abernathy/Germany Basin. Tier 1 reaches and Group A subwatersheds represent the areas where recovery actions would yield the greatest benefits with respect to species recovery objectives. The subwatershed groups are based on Reach Tiers. Priorities at the reach scale are useful for identifying stream corridor recovery measures. Priorities at the subwatershed scale are useful for identifying watershed process recovery measures. Watershed process recovery measures for stream reaches will need to occur within the surrounding (local) subwatershed as well as in upstream contributing subwatersheds.

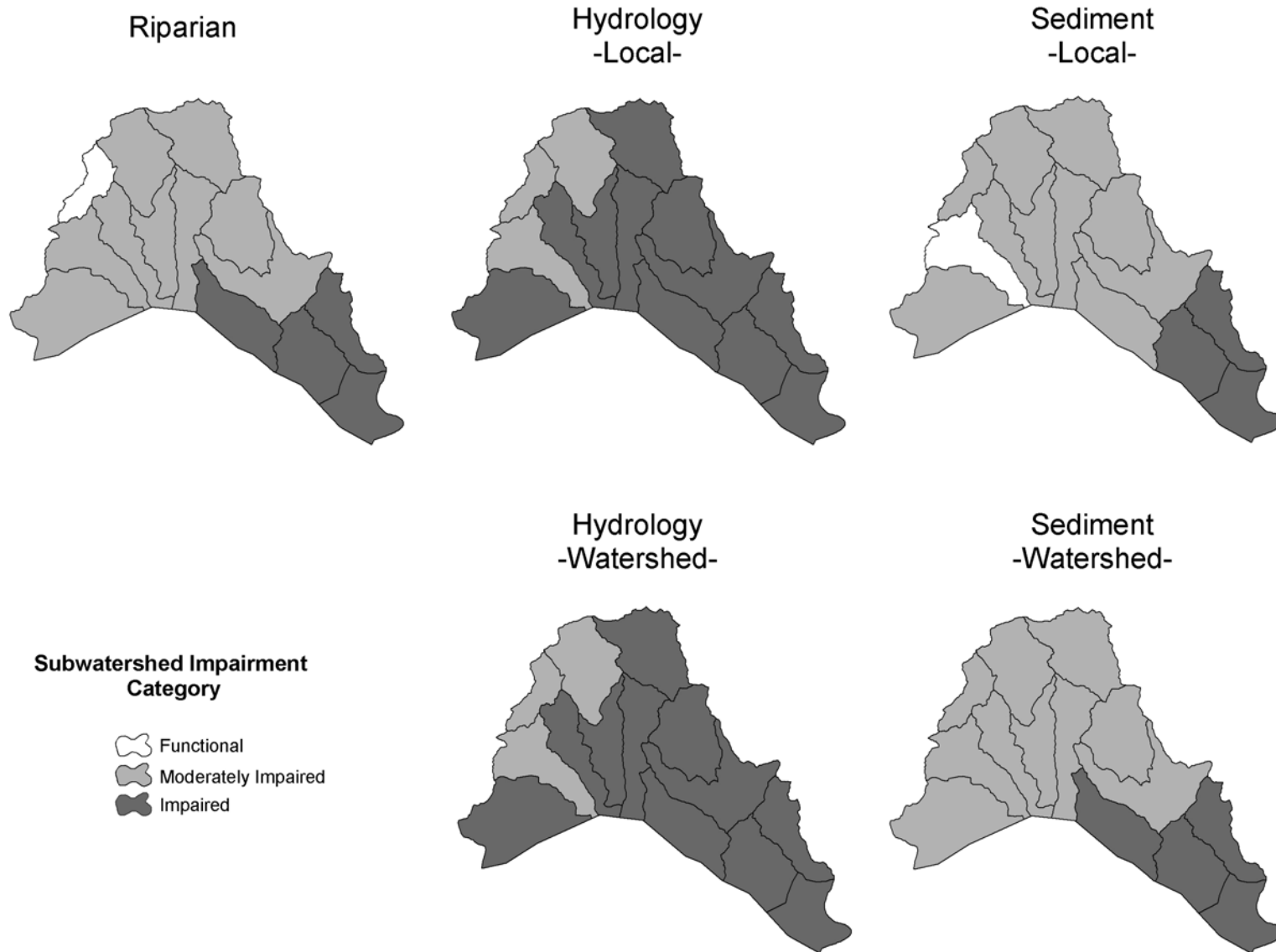


Figure 5-5. IWA subwatershed impairment ratings by category for the Mill/Abernathy/Germany Basin. Watershed process impairment ratings are based on landscape conditions that influence the hydrologic regime, the sediment regime, and riparian function. See Volume II and Volume V of the Recovery Plan Technical Foundation for additional information.

Table 5-4. Reach- and subwatershed-scale limiting factors in priority areas. The table is organized by subwatershed groups, beginning with the highest priority group. Species-specific reach priorities, critical life stages, high impact habitat factors, and recovery emphasis (P=preservation, R=restoration, PR=restoration and preservation) are included. Watershed process impairments: F=functional, M=moderately impaired, I=impaired. Species abbreviations: ChS=spring Chinook, ChF=fall Chinook, StS=summer steelhead, StW=winter steelhead.

Mill

Sub-watershed Group	Sub-watershed	Reaches within subwatershed	Species Present	High priority reaches by species	Critical life stages by species	High impact habitat factors	Preservation or restoration emphasis	Watershed processes (local)			Watershed processes (watershed)	
								Hydrology	Sediment	Riparian	Hydrology	Sediment
A	50501	Spruce-1 Spruce-2 Spruce-3 SF Mill-1 SF Mill-2 Trib1231995461938-1	StW	Spruce-1 Spruce-2 Trib1231995461938-1 SF Mill-1	spawning egg incubation fry colonization summer rearing winter rearing adult holding	channel stability habitat diversity temperature flow sediment	PR	I	M	M	I	M
			Chum	SF Mill-1	spawning egg incubation fry colonization adult holding	habitat diversity sediment	PR					
			Coho	Spruce-1 Spruce-2 Trib1231995461938-1 SF Mill-1	spawning egg incubation fry colonization summer rearing juvenile (age-0) migrant winter rearing adult holding	channel stability habitat diversity flow sediment food key habitat quantity	PR					
	50502	Mill-1 Mill-2 Mill-3 Mill-4 Mill-5 Mill-6 Mill-7 NF Mill-1 NF Mill-2 Trib1232393462311-1	StW	Mill-2 Mill-4 NF Mill-2	spawning egg incubation fry colonization summer rearing winter rearing adult holding	none	PR	M	F	M	M	M
			Chum	none								
			ChF	Mill-2	spawning egg incubation fry colonization adult holding	habitat diversity sediment	PR					
			Coho	Mill-2 Mill-4 Mill-5 NF Mill-2	spawning egg incubation fry colonization summer rearing juvenile (age-0) migrant winter rearing adult holding	habitat diversity	PR					
B	50503	Mill-7 Mill-8 Mill-9 Mill-10 Mill-11 Mill-12 Mill-13 Trib1232392462718-1 Trib1232190462807-1	Coho	Mill-8	egg incubation summer rearing winter rearing	none	PR	M	M	F	M	M

Abernathy

Sub-watershed Group	Sub-watershed	Reaches within subwatershed	Species Present	High priority reaches by species	Critical life stages by species	High impact habitat factors	Preservation or restoration emphasis	Watershed processes (local)			Watershed processes (watershed)	
								Hydrology	Sediment	Riparian	Hydrology	Sediment
A	50403	Abernathy-3 Abernathy-4 Abernathy-5 Abernathy-6 Abernathy-7 Abernathy-8 Trib1231566462579-1 Trib1231566462579-2 Weist-1 Weist-2 Weist-3	StW	Abernathy-4 Abernathy-5 Abernathy-7 Abernathy-8	egg incubation fry colonization summer rearing winter rearing	habitat diversity temperature sediment	PR	I	M	M	I	M
			Chum	Abernathy-3	spawning egg incubation fry colonization adult holding	habitat diversity sediment key habitat quantity	PR					
			ChF	none								
			Coho	Abernathy-5 Abernathy-7	egg incubation summer rearing winter rearing	channel stability habitat diversity flow sediment	PR					
	50402	Abernathy-1 Abernathy-2 Cameron-1 Cameron-2	StW	Abernathy-1 Abernathy-2	egg incubation summer rearing	channel stability habitat diversity temperature predation flow sediment	PR	I	M	M	M	M
			Chum	Abernathy-1 Abernathy-2	spawning egg incubation adult holding	habitat diversity sediment	PR					
			ChF	Abernathy-1 Abernathy-2	spawning egg incubation fry colonization adult holding	habitat diversity sediment	PR					
			Coho	Abernathy-2	egg incubation summer rearing winter rearing	channel stability habitat diversity temperature flow sediment	PR					
	50401	Abernathy-9 Abernathy-10 Abernathy-11 Erick-1 Erick-2 Erick-3 Midway-1 Midway-2 Midway-3 Midway-4 Midway-5 Ordway-1 Ordway-2 Ordway-3 Ordway-4 Ordway-5 Sarah-1 Sarah-2 Sarah-3	StW	Erick-2 Midway-5	egg incubation fry colonization summer rearing winter rearing	sediment	PR	M	M	M	M	M
			Coho	none								

Germany

Sub-watershed Group	Sub-watershed	Reaches within subwatershed	Species Present	High priority reaches by species	Critical life stages by species	High impact habitat factors	Preservation or restoration emphasis	Watershed processes (local)			Watershed processes (watershed)			
								Hydrology	Sediment	Riparian	Hydrology	Sediment		
A	50302	Germany-10	StW	Germany-10	egg incubation	habitat diversity	PR							
		Germany-11		Germany-12									summer rearing	flow
		Germany-12	Coho	Germany-13	winter rearing	sediment								
		Germany-14		Germany-15										
		Germany-15		Germany-16	none									
		Trib-1231107462883							I	M	M	I	M	
		Trib-1231123462853												
		Trib-1231127463253												
		Trib-1231209463005												
		Trib-1231264463102												
Trib-1231282461874-1														
Trib-1231282461874-2														
Trib-1231287463265														
Trib-1231292463165-1														
Trib-1231292463165-2														
	50301	Germany-1	StW	Germany-2	spawning	habitat diversity	PR							
		Germany-2		Germany-6									egg incubation	temperature
		Germany-3		Germany-8									fry colonization	sediment
		Germany-4		Trib-1231363462545-1									summer rearing	
		Germany-5	Chum	Germany-2	spawning	habitat diversity	PR							
Germany-6	Germany-2	egg incubation		sediment										
Germany-7	ChF	Germany-2	adult holding	habitat diversity	PR									
Germany-8		Germany-3	egg incubation	sediment										
Germany-9	Coho	Germany-2	adult holding	habitat diversity	PR									
Trib-1231221462726		Germany-2	spawning	habitat diversity	PR									
Trib-1231231462714		Germany-3	egg incubation	temperature										
Trib-1231363462545-1		Germany-8	fry colonization	sediment										
Trib-1231363462545-2		Trib-1231363462545-1	summer rearing											
Trib-1231363462545-3	juvenile (age-0) migrant		winter rearing											
			adult holding											

Table 5-5. Salmonid habitat limiting factors and threats in priority areas. Priority areas include the lower Mill Creek & tributaries (MI), mainstem Abernathy & tributaries (AB), and mainstem Germany & tributaries (GE). Linkages between each threat and limiting factor are not displayed – each threat directly and indirectly affects a variety of habitat factors.

Limiting Factors	MI			AB			GE		
	MI	AB	GE	MI	AB	GE	MI	AB	GE
<i>Habitat diversity</i>									
Lack of stable instream woody debris	✓	✓	✓						
Altered habitat unit composition	✓	✓	✓						
Loss of off-channel and/or side-channel habitats	✓	✓							
<i>Channel stability</i>									
Bed and bank erosion	✓	✓	✓						
Channel down-cutting (incision)	✓	✓							
<i>Riparian function</i>									
Reduced stream canopy cover	✓	✓	✓						
Reduced bank/soil stability	✓	✓	✓						
Exotic and/or noxious species	✓	✓	✓						
Reduced wood recruitment	✓	✓	✓						
<i>Floodplain function</i>									
Altered nutrient exchange processes	✓	✓	✓						
Reduced flood flow dampening	✓	✓	✓						
Restricted channel migration	✓	✓	✓						
Disrupted hyporheic processes	✓	✓	✓						
<i>Stream flow</i>									
Altered magnitude, duration, or rate of change	✓	✓	✓						
<i>Water quality</i>									
Altered stream temperature regime	✓	✓	✓						
<i>Substrate and sediment</i>									
Excessive fine sediment	✓	✓	✓						
Embedded substrates	✓	✓	✓						
<i>Agriculture / grazing</i>									
Clearing of vegetation								✓	✓
Riparian grazing								✓	✓
Floodplain filling								✓	✓
<i>Rural development</i>									
Clearing of vegetation							✓	✓	✓
Floodplain filling							✓	✓	✓
Roads – riparian/floodplain impacts							✓	✓	✓
<i>Forest practices</i>									
Timber harvests –sediment supply impacts							✓	✓	✓
Timber harvests – impacts to runoff							✓	✓	✓
Riparian harvests							✓	✓	✓
Forest roads – impacts to sediment supply							✓	✓	✓
Forest roads – impacts to runoff							✓	✓	✓
Forest roads – riparian/floodplain impacts							✓	✓	✓
Splash-dam logging (historical)							✓	✓	
<i>Channel manipulations</i>									
Bank hardening							✓	✓	✓
Channel straightening							✓	✓	✓
Artificial confinement							✓	✓	✓

Table 5-6. Habitat measures in priority areas, with reference to limiting factors addressed, threats addressed, target species, and estimated time until benefits would be realized (time). Tier 1 and 2 reaches, or other areas of known priority, are listed under the location column for some measures (i.e., stream corridor measures). Reaches not included in the table (Tier 3, 4, and non-tiered reaches) are considered secondary priority.

Location	Limiting Factors Addressed	Threats Addressed	Target Species	Time	Discussion
1. Protect and restore floodplain function and channel migration processes					
A. Set back, breach, or remove artificial channel confinement structures					
Mill Creek Mill 1-2; SF Mill 1 Abernathy Creek Abernathy 1-8 Germany Creek Germany 4-6	<ul style="list-style-type: none"> • Bed and bank erosion • Altered habitat unit composition • Restricted channel migration • Disrupted hyporheic processes • Reduced flood flow dampening • Altered nutrient exchange processes • Channel down-cutting (incision) 	<ul style="list-style-type: none"> • Floodplain filling • Channel straightening • Artificial confinement 	<ul style="list-style-type: none"> • All species 	2-15 years	Great potential benefit due to improvements in many limiting factors. This passive restoration approach can allow channels to restore naturally once confinement structures are removed. There are challenges with implementation due to private lands, existing infrastructure already in place, potential flood risk to property, and large expense.
2. Protect and restore off-channel and side-channel habitats					
A. Restore historical off-channel and side-channel habitats where they have been eliminated					
B. Create new off-channel or side-channel habitats (i.e. spawning channels)					
Mill Creek Mill 1-2; SF Mill 1 Abernathy Creek Abernathy 1-8 Germany Creek Germany 4-6	<ul style="list-style-type: none"> • Loss of off-channel and/or side-channel habitat • Altered habitat unit composition 	<ul style="list-style-type: none"> • Floodplain filling • Channel straightening • Artificial confinement 	<ul style="list-style-type: none"> • All species 	2-15 years	Good potential benefit especially for chum, which have lost a significant portion of historically available off-channel habitat for spawning. Potential benefit is limited by moderate probability of success with creation of new habitats. There are challenges with implementation due to private lands, existing infrastructure already in place, potential flood risk to property, and large expense.
3. Protect and restore riparian function					
A. Reforest riparian zones					
B. Allow for the passive restoration of riparian vegetation					
C. Livestock exclusion fencing					
D. Invasive species eradication					
E. Hardwood-to-conifer conversion					
Mill Creek	<ul style="list-style-type: none"> • Reduced stream canopy 	<ul style="list-style-type: none"> • Timber harvest – 	<ul style="list-style-type: none"> • All species 	20-100	High potential benefit due to the many limiting

Location	Limiting Factors Addressed	Threats Addressed	Target Species	Time	Discussion
Mill 1-5; SF Mill 1; Spruce 1-2; NF Mill 1-2 Abernathy Creek Abernathy 1-11; Cameron 1; Erick 2; Midway 5 Germany Creek Germany 1-8, 10, 12-15	cover • Altered stream temperature regime • Reduced bank/soil stability • Reduced wood recruitment • Lack of stable instream woody debris • Exotic and/or noxious species	riparian harvests • Riparian grazing • Clearing of vegetation due to rural development and agriculture		years	factors that are addressed. Riparian impairment is related to most land-uses and is a concern throughout the basin. Riparian protections on forest lands are provided for under current harvest policy. Riparian restoration projects are relatively inexpensive and are often supported by landowners. Whereas the specified stream reaches are the highest priority for riparian measures, riparian restoration and preservation should occur throughout the basin since riparian conditions affect downstream reaches. Use IWA riparian ratings to help identify restoration and preservation opportunities.
4. Protect and restore streambank stability A. Restore eroding streambanks					
Mill Creek Mill 1-2; SF Mill 1 Abernathy Creek Abernathy 1-8 Germany Creek Germany 4-6	• Reduced bank/soil stability • Excessive fine sediment • Excessive turbidity • Embedded substrates	• Artificial confinement • Clearing of vegetation • Roads – riparian/floodplain impacts • Riparian grazing	• All species	5-50 years	Most areas of bank instability are located in the lower portion of the basins where agricultural, residential, and recreation impacts have created localized areas of bank erosion. Bio-engineered approaches that rely on structural as well as vegetative measures are the most appropriate means of restoration. These projects have a high risk of failure if causative factors are not adequately addressed.
5. Protect and restore natural sediment supply processes A. Address forest road related sources B. Address timber harvest related sources C. Address agricultural sources					
Entire basin	• Excessive fine sediment • Excessive turbidity • Embedded substrates	• Timber harvest – impacts to sediment supply • Forest roads – impacts to sediment supply • Agricultural practices – impacts to sediment supply	• All species	5-50 years	High potential benefit due to sediment effects on egg incubation and early rearing. Improvements are expected on timber lands due to requirements under the new FPRs and forest land HCPs. There are challenges with implementation on agricultural lands due to few sediment-focused regulatory requirements for agricultural lands. Use IWA impairment ratings to identify restoration and preservation opportunities.

Location	Limiting Factors Addressed	Threats Addressed	Target Species	Time	Discussion
6. Protect and restore runoff processes					
<ul style="list-style-type: none"> A. Address forest road impacts B. Address timber harvest impacts C. Limit additional watershed imperviousness 					
<i>Entire basin</i>	<ul style="list-style-type: none"> Stream flow – altered magnitude, duration, or rate of change of flows 	<ul style="list-style-type: none"> Timber harvest – impacts to runoff Forest roads – impacts to runoff Clearing of vegetation (associated with agriculture and residential uses) 	<ul style="list-style-type: none"> All species 	5-50 years	High potential benefit due to flow effects on habitat formation, redd scour, and early rearing. Improvements are expected on timber lands due to requirements under the new FPRs and forest land HCPs. There are challenges associated with addressing runoff issues on developed lands due to continued increase in watershed imperviousness related to development and lack of adequate mitigation. Use IWA impairment ratings to identify restoration and preservation opportunities.
7. Protect and restore instream flows					
<ul style="list-style-type: none"> A. Water rights closures B. Purchase or lease existing water rights C. Relinquishment of existing unused water rights D. Enforce water withdrawal regulations E. Implement water conservation, use efficiency, and water re-use measures to decrease consumption 					
<i>Entire basin</i>	<ul style="list-style-type: none"> Stream flow – altered magnitude, duration, or rate of change of flows 	<ul style="list-style-type: none"> Water withdrawals 	<ul style="list-style-type: none"> All species 	1-5 years	Instream flow management strategies for the Mill/Abernathy/Germany basin have been identified as part of Watershed Planning for WRIA 25 (LCFRB 2004). Strategies include water rights closures, setting of minimum flows, and drought management policies.
8. Protect and restore water quality					
<ul style="list-style-type: none"> A. Restore the natural stream temperature regime 					
<i>Entire basin</i>	<ul style="list-style-type: none"> Altered stream temperature regime 	<ul style="list-style-type: none"> Riparian harvests Riparian grazing 	<ul style="list-style-type: none"> All species 	1-50 years	Primary emphasis for restoration should be placed on stream segments that are listed on the 2004 303(d) list.
9. Protect and restore instream habitat complexity					
<ul style="list-style-type: none"> A. Place stable woody debris in streams to enhance cover, pool formation, bank stability, and sediment sorting B. Structurally modify stream channels to create suitable habitat types 					
<i>Mill Creek</i>	<ul style="list-style-type: none"> Lack of stable instream 	<ul style="list-style-type: none"> None (symptom- 	<ul style="list-style-type: none"> Cho 	2-10 years	Moderate potential benefit due to the high

Location	Limiting Factors Addressed	Threats Addressed	Target Species	Time	Discussion
Mill 1-5; SF Mill 1; Spruce 1-2; NF Mill 1-2 Abernathy Creek Abernathy 1-11; Cameron 1; Erick 2; Midway 5 Germany Creek Germany 1-8, 10, 12-15	woody debris • Altered habitat unit composition	focused restoration strategy)	• Wnter steelhead		chance of failure. Failure is probable if habitat-forming processes are not also addressed. These projects are relatively expensive for the benefits accrued. Moderate to high likelihood of implementation given the lack of hardship imposed on landowners and the current level of acceptance of these type of projects.
10. Protect habitat conditions and watershed functions through land-use planning that guides population growth and development A. Plan growth and development to avoid sensitive areas (e.g., wetlands, riparian zones, floodplains, unstable geology) B. Encourage the use of low-impact development methods and materials C. Apply mitigation measures to off-set potential impacts					
Entire basin	Preservation Measure – addresses many potential limiting factors and threats		• All species	5-50 years	The focus should be on management of land-use conversion and managing continued development in sensitive areas (e.g., wetlands, stream corridors, unstable slopes). Critical areas regulations do not have a mechanism for restoring existing degraded areas, only for preventing additional degradation. Legal and/or voluntary mechanisms need to be put in place to restore currently degraded habitats.
11. Protect habitat conditions and watershed functions through land acquisition or easements where existing policy does not provide adequate protection A. Purchase properties outright through fee acquisition and manage for resource protection B. Purchase easements to protect critical areas and to limit potentially harmful uses C. Lease properties or rights to protect resources for a limited period					
Entire basin	Preservation Measure – addresses many potential limiting factors and threats		• All species	5-50 years	Land acquisition and conservation easements in riparian areas, floodplains, and wetlands have a high potential benefit. These programs are under-funded and have low landowner participation.

Program Gap Analysis

The Mill/Abernathy/Germany Basin (~152 sq mi) is located primarily in Cowlitz County; however, the middle and upper reaches of Mill Creek are in Wahkiakum County. The Mill/Abernathy/Germany Basin can be characterized as significantly forested with some rural residential. Agriculture occurs in the mainstem valleys of Abernathy and Germany Creeks, but not in Mill Creek.

- Large private industrial forestland comprising about 60 square miles is the largest land use.
- Department of Natural Resources forestlands encompass about 26 square miles.
- Small forestlands acreage is estimated to be 12 square miles.
- The eastern third of the basin has growing commercial, rural residential and suburban land uses that are heavily influenced by proximity to the Longview/Kelso urban center;

Protection Programs

Private industrial forest owners, the Department of Natural Resources, Cowlitz and Wahkiakum Counties, and other regulatory agencies implement protection programs in the Mill/Abernathy/Germany Basin. Protection programs in this analysis include those programs that protect habitat conditions or watershed functions through management policies and programs, regulatory measures, and acquisition of sensitive habitat or protective easements, and incentives. Major programs implementing protection measures are identified below.

Federal Programs

➤ *U.S. Army Corps of Engineers*

- Administers the Section 10 (Rivers and Harbor Act) and Section 404 (Clean Water Act) permit processes. Section 10 requires approval of any activity in, above, or below a navigable river, which affects course, location, condition, or capacity of navigable waters. Section 404 requires prior approval of dredging, filling, grading, clearing, and bank hardening. In waters used by listed fish species, the permits are subject to ESA Section 7 consultation with NOAA Fisheries to ensure that any approved action is adequately protective of the fish; [M.1A; M.2A; M.2B; M.4A; M.9A; M.9B]

State Programs

➤ *Department of Natural Resources*

- State Forest Land HCP:

State forestlands are managed under the provisions of a Habitat Conservation Plan (HCP). The Habitat Conservation Plan protects riparian areas through the use of buffers, mitigates impacts on watershed processes through harvest restrictions and new road construction standards that are more stringent than Forest Practices Rules. [M.3A; M.3B; M.5A; M.5B; M.6A; M.6B; M.8A]

- State Forest Practices:

Riparian zones and harvest restrictions represent significant protections under the State of Washington Forest Practices Rules, including the Forest and Fish Module. These rules

also establish standards for new road construction addressing management of runoff, sediment, and slope failure. [M.3A; M.3B; M.5A; M.5B; M.6A; M.6B; M.8A]

➤ ***Washington Department of Fish and Wildlife***

• Washington State Hydraulic Code

The Washington State Hydraulic Code is administered through the Washington Department of Fish and Wildlife. The purpose of this program is to protect stream conditions and habitat. The regulations apply to such activities as stream bank protection, instream construction, culvert installation, channel changes or realignments, debris removal, and water diversion facilities. Those proposing such actions must obtain a Hydraulic Project Approval (HPA) permit. [M.1A; M.2A; M.2B; M.4A; M.9A; M.9B]

- Habitat Program: The Department provides advice to local governments and landowners interested in measures to protect habitat values on their property. [M.1A; M.2A; M.2B; M.3A; M.4A; M.7A; M.7B; M.7C; M.8A; M.9A; M.9B; M.10A; M.10B; M.10C]

➤ ***Washington Department of Ecology***

- Water Resources Program/Water Rights: Department of Ecology, in consultation with the Department of Fish and Wildlife, has administratively closed selected areas within the lower Cowlitz basin to further surface and groundwater withdrawals (where groundwater is in continuity with surface water). Existing administrative closures by the Department of Ecology protect surface waters from further withdrawals. Formal rule making would strengthen the closures. The extent of unauthorized surface water withdrawals is unknown, but could exacerbate summer low flows on smaller tributaries. [M.7A; M.7B; M.7C; M.7D]

- Water Resources Program/Watershed Planning: In cooperation with the Lower Columbia Fish Recovery Board, other state and federal agencies, tribes, local governments, and citizens, the Department funds and participates in a state authorized watershed planning process for Water Resource Inventory Area (WRIA) 26 pursuant to RCW 90.82. The goal of the plan is to ensure adequate water for people and fish. The planning process is dealing with water quantity and quality, stream flows and fish habitat. Once approved by counties within the WRIA, the plan will be binding on state agencies and local governments. [M.6C; M.7A; M.7B; M.7C; M.7D; M.7E; M.8A]

➤ ***Conservation Commission/ Cowlitz- Wahkiakum Conservation Districts*** provide technical assistance and incentives (e.g., Conservation Reserve and Enhancement Program) to encourage agricultural landowners to protect riparian areas and stream habitat. The Cowlitz Conservation District has been actively involved in these watersheds. These programs could help address measure M.3A; M.3C; M.4A; M.5C; M.8A; M.9A; M.9B]

➤ ***Washington Department of Community Trade and Economic Development*** provided funding for the purchase of riparian easements. In 1999 Cowlitz County received \$1,000,000 grant for the purchase of easements along the lower reaches of Abernathy Creek. [M.11B]

Local Government Programs

➤ *Cowlitz County*

- Land Use:
 - ✓ The comprehensive plan that applies to the non-federal lands but contains no significant policies for the protection of watershed processes and stream habitat.
 - ✓ Zoning along State Highway 503 provides for one dwelling per 2 acres and one dwelling per 5 acres along non-county roads.
 - ✓ Cowlitz County has not adopted protective stream buffers.
 - ✓ Wetland buffers vary from 25' to 200' and are based upon soil type and wildlife utilization.
 - ✓ The County has not developed comprehensive ordinances for the protection of watershed processes or stream habitat conditions. [M.10A; M.10B; M.10C]
- Road Maintenance

The County has not developed or implemented a road maintenance program to protect habitat. [M.8A]
- Land Acquisition: The County acquired easements along the lower reaches of Abernathy Creek for protection and restoration of riparian habitat using a \$1 million grant from the Washington Department of Community Trade and Economic Development. The acquisition benefited ESA listed salmonids as well as fish research conducted at the U.S. Fish and Wildlife Service Abernathy Fish Technology Center. [M.11B]

➤ *Wahkiakum County*

- Comprehensive Planning and Land Use Zoning:
 - ✓ The County has adopted a comprehensive plan and zoning. The County land use program is subject to the Washington Growth Management Act (GMA), except for the requirement to adopt a Critical Areas Ordinance.
 - ✓ The County Critical Areas Ordinance provides for stream buffers from 25 to 200 feet depending on stream type and intensity of use. Wetland buffers also vary from 25 to 200 feet.
 - ✓ The County has adopted a Shoreline Master Program to regulate development. [M.10A; M.10B; M.10C]

Restoration Programs

Restoration programs in the Mill/Abernathy/Germany Basin are implemented by a variety of agencies, organizations, and private interests. Major programs implementing protection measures are identified below:

Federal Programs

No active programs.

State Restoration Programs

➤ *Department of Natural Resources*

- State Forest Land Habitat Conservation Plan (HCP): The Department manages state forest lands pursuant to a Habitat Conservation Plan (HCP). The HCP road maintenance and restoration objectives require barrier upgrades and road abandonment and/or other improvements. [M.3A; M.3B; M.5A; M.5B; M.6A; M.6B; M.8A]
- State Forest Practices Act:
 - Industrial forests within the lower NF Lewis Basin are governed by Forest and Fish regulations and have rigid schedules for maintaining and improving roads and removing barriers. Industrial landowners have 15 years to bring roads and barriers into compliance with regulations [M.3A; M.3B; M.5A; M.5B; M.6A; M.6B; M.8A]
 - Small private forest owners are governed by Forest and Fish regulations; however their road and barrier maintenance and improvement programs are tied to state funding. In the State 2003-05 Biennial Budget, 2 million dollars was allocated statewide to support small private forest owners [M.3A; M.3B; M.5A; M.5B; M.6A; M.6B; M.8B].
- ***Washington Department of Fish and Wildlife***
 - Habitat Program: The Department provides advice to local governments and landowners interested in measures to restoring watershed processes and stream habitat. [M.1A; M.2A; M.2B; M.3A; M.4A; M.7A; M.7B; M.7C; M.8A; M.9A; M.9B; M.10A; M.10B; M.10C]
- ***Washington Department of Ecology***
 - Water Quality Program: Abernathy and Germany Creeks are both listed on the WA State 303(d) listing for temperature impairment. [M.8A]
 - Water Resources Program/Watershed Planning:
The planning process for WRIA 25 is dealing with water quantity and quality, stream flows and fish habitat. Potential restoration efforts address improving summer low flows through conservation and acquisition of water rights. Once approved by counties within the WRIA, the plan will be binding on state agencies and local governments. [M.6C; M.7A; M.7B; M.7C; M.7D; M.7E; M.8A]
- ***Department of Transportation***
 - Road Maintenance Program
WSDOT has an ESA Section 4(d) Road Maintenance Program. The Maintenance Program uses trained crews to primarily manage roadside vegetation, litter control, and maintenance of safety rest areas associated with SR 4. [M.10A]
 - Barrier Replacement Program
In partnership with the County and conservation districts, WSDOT has provided over \$230,000 in funding for county culvert assessment, design and engineering.
- ***Salmon Recovery Funding Board (SRFB)/ Lower Columbia Fish Recovery Board (LCFRB)***

- Washington Salmon Recovery Act (RCW 77.85): The SRFB and the LCFRB jointly administer a grant program that allocates federal Pacific Salmon Recovery Funds and State funds for habitat protection and restoration projects by state and local agencies, nonprofit organizations, and landowners. To date the SRFB has provided \$240,000 for restoration activities in Abernathy Creek. [M.1A; M.2A; M.2B; M.3A; M.4A; M.8A]
- **Conservation Commission/ Cowlitz-Wahkiakum Conservation Districts** provides technical assistance (e.g., farm plans) and incentives (e.g., Conservation Reserve and Enhancement Program) to encourage agricultural landowners to restore riparian areas and stream habitat. The Cowlitz Conservation District has been active in the Mill, Germany, and Abernathy watersheds. These programs could help address measures M.3C, M.4A; M.5C; M.8A.

Local Government Restoration Programs

➤ *Wahkiakum County*

- Public Works Program: The County maintains an active and ongoing program of identifying and replacing culverts that are a barrier to fish passage.
- County Noxious Weed Control Board: The Board has three primary programs that address weed control in the Mill/Abernathy/Germany Basin; [M.3D]
 - Public education to prevent the spread of noxious weeds;
 - Survey of the County to assess emerging issues; and
 - Enforcement of noxious weed control

Community Restoration Programs

- **Lower Columbia Fish Enhancement Group** is one of many nonprofit enhancement groups authorized by state law. The group focuses on restoration projects and has participated in projects in the Mill, Germany, and Abernathy watersheds. [M.3A; M.4A; M.8A]
- **Columbia Land Trust** is a nonprofit organization whose mission is to preserve and restore unique landscapes, natural areas, and sensitive habitats. It is pursuing several projects in the Mill, Germany, and Abernathy watersheds. [M.11A; M.11B; M.11C]

Gap Analysis

Forest-related Programs: The Mill/Abernathy/Germany Basin is about 65 percent forestland. Accordingly, forestry programs have a substantial role in protecting and restoring watershed functions and habitat conditions at levels supporting recovery goals. Certainty of forestry-related protection and restoration programs is relatively high because programs are being implemented and, for the most part, fully funded. Program areas of concern include the continued potential for hydrologic impacts caused by past harvest practices. Monitoring of watershed processes and habitat conditions will be required to confirm the effectiveness of these measures.

Protection-related Programs: Lands in the Mill/Abernathy/Germany Basin have limited protection through Cowlitz County's regulatory authority. Wahkiakum County's land use regulations apply to only the middle and upper reaches of Mill Creek, an area largely protected by state forest practices rules. Cowlitz County land use programs lack effective provisions that commonly are used to direct growth away from sensitive habitat, preserve watershed processes, protect streams and wetlands, and manage stormwater. In addition, as in all lower Columbia subbasins, there are very limited protection mechanisms for agricultural practices relative to the protection riparian areas and hydrologic conditions.

Restoration-related Programs: Over a long period of time, improvements to the Mill/Abernathy/Germany Basin will occur as a result of improved forest management practices that are already in place. To the degree possible, restoration programs should focus on restoring floodplain function and channel migration, as well as restoring off- and side-channel habitats. Program areas of concern include the overall level of effort in terms of restoration activities to adequately address threats.

Table 5-7. Program Actions to Address Gaps

Action #	Lead Agency	Proposed Action
MAG.1	Cowlitz County	Develop and implement controls to adequately protect riparian areas to maintain currently functional and restored habitat around rivers, estuaries, streams, lakes, deepwater habitats, and intermittent streams. Require mitigation, where necessary, to offset unavoidable damage to habitat conditions in riparian management areas
MAG.2	Cowlitz County	Development and implement controls to protect historic stream meander patterns and channel migration zones and avoid hardening stream banks and shorelines
MAG.3	Cowlitz County	Development and implement controls and development standards to adequately protect wetlands, wetland buffers, and wetland function.
MAG.4	Cowlitz County	Develop and implement controls to address erosion and sediment run-off during (and after) construction to prevent sediment and pollutant discharge to streams, wetlands and other water bodies
MAG.5	Cowlitz County	Apply land use and resource protection code enforcement across jurisdictions in a consistent manner, using appropriate funding levels and application
MAG.6	Forest Managers LCFRB, and DFW	Identify and sequence early action forest-wide restoration projects that analysis indicates could provide significant benefits. In these cases, it may be appropriate to identify outside funding to initiate these early actions
MAG.7	LCFRB, USFS, WDNR, WSDOT, Counties, private property owners.	Develop and implement a coordinated and strategic barrier removal program based on watershed fish priorities and ensuring an effective and efficient sequencing of barrier removal work.
MAG.8	Cowlitz County	Utilize a combination of public outreach/education and, incentives, and to promote (1) stewardship practices for protecting habitat and water quality and (2) landowner support of and participation in habitat restoration efforts.
MAG.9	State of Washington (DOE, DFW)	Close the Mill/Abernathy/Germany Basin to further surface water withdrawals, including groundwater in connectivity with surface waters; curtail unauthorized withdrawals
MAG.10	LCFRB, WDFW, Cowlitz County, Cowlitz CD, LCFEG	Build capacity (e.g. technical and administrative skills, personnel and fiscal resources) needed to allow agencies and organizations to undertake protection and restoration projects, including noxious weed control in a reasonable period time.
MAG.11	SRFB, BPA, NOAA, USFWS, DOE, ACOE	Increase available funding for projects that implement measures and address underlying threats
MAG.13	State of Washington (Dept of Agriculture, and Department of Ecology)	Develop and implement agricultural practices and regulations to protect riparian conditions and water quality
MAG.14	Cowlitz Conservation District	Expand landowner incentive (e.g. CREP) and education plans to promote further habitat protection and restoration.
MAG.15	LCFRB, Cowlitz CD, Cowlitz County,	Address threats proactively by building agreement on priorities among the various program implementers
MAG.16	FEMA	Update floodplain maps using Best Available Science