3.13 DUNGENESS RIVER AND TRIBUTARIES RECOMMENDATIONS

Section 3.4 contains recommendations for instream flows, and Section 3.3 contains other recommendations for small rural and urban streams, habitat restoration, salmon recovery, and related environments (e.g., riparian corridors, wetlands, estuaries) for all WRIA 18 streams and rivers. Sections 3.1 and 3.2 contain water quantity and water quality recommendations that also apply to all WRIA 18 subbasins.

3.13.1 Dungeness River (WRIA# 18-0018)

Issue: The Lower Dungeness River (the lower 11 river miles) has been heavily impacted by construction of levees and bank hardening (other riverbank protection structures); clearing of riparian vegetation; construction of bridges that constrict the river; gravel extractions; and water diversions. In the Upper Dungeness River, sediment input from unstable soils on steep slopes and forest management practices (particularly forest road management) have produced excessive sediments loads in the river. These have led to such effects as channel braiding and aggradation; disconnection of the river from its floodplain; blocking of access to productive side channel habitat; scouring of redds; and seasonal low flows that can severely impair salmonid stocks. The DQ Plan (1994) identified a "gap" between stream flows needed to meet biological requirements and out-of-stream uses. The gap has been narrowed by actions taken under the DQ Plan, but remains an issue for the Dungeness River.

Puget Sound Chinook, Hood Canal/Eastern Strait of Juan de Fuca summer chum, and Puget Sound bull trout are *federally listed* as *threatened* under the Endangered Species Act. Fall coho, Upper Dungeness pink, and summer and winter steelhead are *state-listed* as *depressed*. Spring/summer chinook, lower Dungeness River pink, and Hood Canal/Eastern Strait of Juan de Fuca summer chum are *state-listed* as *critical*.

Existing Conditions and Current Actions

The Dungeness River is one of the principal drainages occurring in WRIA 18. The Dungeness is a short, steep river draining 270 square miles. The mainstem extends 31.9 miles and its primary tributary, the Gray Wolf River, adds another 17.4 miles. In addition, there are an additional 256 miles of tributaries in the basin. Seven anadromous salmonid species are indigenous to the Dungeness River (chinook, coho, pink, chum, steelhead, cutthroat, and bull trout).

The Dungeness River has an extensive history of watershed management and planning (described in Section 1.2) which has included a broad range of studies of river processes, habitat, and salmonid stocks (summarized in Section 2.8). The Dungeness River Management Team (DRMT) has worked to implement recommendations from the original Dungeness-Quilcene (DQ) Plan since its publication in 1994. Recent major studies and actions include a Trust Water Agreement (TWA) (1998) (see Section 2.3) to reduce irrigation diversions from the river, allocate saved water to a trust water right and allocate trust water to instream flows and agricultural uses; a comprehensive irrigation water conservation plan (Montgomery Water Group 1999); a hydrogeologic assessment (Thomas et al. 1999); a study of river physical processes, impacts and restoration issues in the lower Dungeness (Bountry et al. 2002); a study of surface-

water groundwater interactions (Simonds and Sinclair 2002); a study of Dungeness side channel instream flows and their relation to mainstem flows (Bureau of Reclamation 2003); an assessment of geomorphic conditions in the Kinkade Island reach (Bureau of Reclamation, in preparation); an Environmental Impact Statement on the Water Conservation Plan; and a groundwater model (Department of Ecology, 2003).

The USFWS performed an instream flow study for the lower Dungeness River using the Instream Flow Incremental Methodology (IFIM) during 1988-1989 (Wampler and Hiss 1991). Two study sites were selected to represent instream habitat found in river reaches from RM 1.8 to 2.5 and RM 3.3 to 6.4, respectively. Both reaches lie below the five irrigation diversions on the river. Predictions for the amount of usable habitat area under different flow conditions were calculated for steelhead (spawning, juvenile and adult), bull trout (dolly varden) juvenile, coho (spawning and juvenile), chinook (juvenile, spring chinook spawning and adult), and pink salmon (spawning). In December 1992, the Dungeness Instream Flow Group (including the USFWS, Jamestown S'Klallam Tribe, NMFS, WDFW, and Ecology) was reconvened to complete the evaluation and interpretation of the instream flow study. Based on this review, the Dungeness Instream Flow Group set Dungeness River flow targets for optimum fish habitat for each month. The Dungeness River Restoration Work Group (DRRWG) met again in January 2002 and affirmed that the IFIM results and recommendations remain valid and useful for the Dungeness River. IFIM results were used to set a minimum low flow recommendation which would provide optimal levels of habitat area for priority species and life stages, as defined in Hiss, 1993a. It should be noted that August through October is considered a critical period due to the fact that both irrigation withdrawals and salmon migration and spawning continue at a time of naturally diminishing flows. (*See page 2.8-46 to 2.8-54 for more information on the IFIM study and instream flows*). Biologists have also noted through observations in recent years that low flows force salmon to spawn nearer to the middle of the channel, making the redds more susceptible to scouring during high winter flows.

The Limiting Factors Analysis (LFA), (Haring 1999), found that the primary fish access concern in the mainstem Dungeness River is that low stream flows during late summer/early fall impede adult salmon migration and decrease usable juvenile habitat in more than 9 miles of river (PSCRBT 1991, Lichatowich 1990, Orsborn and Ralph 1992). As the rate of flow is artificially lowered in August and September, the potential for development of barriers to upstream passage caused by shallow riffles is increased, preventing adult pink and chinook from reaching preferred spawning grounds (Wampler and Hiss 1991).

Spawning habitat is substantially reduced in reaches that have been subject to water withdrawals, as compared to pre-withdrawal habitat conditions. Surveys, such as the 1997-1998 study conducted by the Jamestown S'Klallam Tribe (Hirschi and Reed, 1998), and spot checks in the lower river have substantiated this by indicating a number of locations where juvenile salmonids become trapped in pools or other low spots along the margin of the wetted channel. Consequently, some trapped juveniles perished as water depths dropped and temperatures exceeded 68º F.

There are a number of side channels in the lower river (from downstream of the Railroad Bridge to the Ward Bridge) with good water quality, but the value of these side

channels is decreased as access is cut off due to low flow (Orsborn and Ralph 1994). The LFA reviewed the IFIM study, and stated: “It is apparent that it is necessary to maintain the entire river flow in the channel during the lowest flow periods for full benefit to salmon.”

Other limiting factors identified in the LFA include bedload aggradation in some portions of the lower river between the mouth and the railroad bridge; and loss of side channel access due to diking and other constructions.

Desired Conditions and Outcomes: *(Derived from the Goals of the Dungeness River Management Team, revised and adopted in 2002.)*

- Land use and river processes are integrated to prevent loss of life and property from flooding.
- Riparian and aquatic ecosystems within the Dungeness River watershed and estuary areas are restored to mutually benefit wild and native salmonids and human residents.
- Water quality and quantity in the Dungeness River Watershed Area are protected and enhanced to support all beneficial uses, including an adequate clean water supply for current and future human needs and a higher productive capacity of fish and wildlife habitats.
- Cooperation and coordination occurs among all levels of government and citizens in protecting ground and surface water quality and quantity.
- Information on technical studies, issues and projects occurring in the Dungeness River watershed planning area is exchanged among agencies and citizens.
- Public participation and education about the watershed occurs so as to develop and encourage a community stewardship ethic and help prevent or resolve conflict.
- Recommendations of relevant plans and strategies for the Dungeness River endorsed by the DRMT are implemented.

Recommendations

Although all DQ Plan Chapter 6 recommendations address the Dungeness River system in some way, many are related to other topics addressed by recommendations in this watershed plan and are repeated in the sections to which they are most closely related (e.g., irrigation water management, groundwater quantity, etc.). The DQ recommendations that most closely focus on Dungeness River habitat and flows are included in this section.

A. Water Quality: The Dungeness River is included in a comprehensive program of water quality recommendations presented in Section 3.2.

B. Habitat: Many of the habitat recommendations presented in Section 3.3 for WRIA 18 as a whole also apply to the Dungeness River.

1. Dungeness River Management: The DRMT and DRRWG should seek funding and continue their work on comprehensive river restoration through

the strategic restoration elements identified following review of the Dungeness-Quilcene plan, Dungeness River Watershed Area Plan, the "Blue Book," Limiting Factors Analysis, and the Clean Water Strategy.

These 10 strategic elements are also described in the 2003 publication, "Restoring the Dungeness: An Overview of the Dungeness Restoration Strategy, 2003," and include the following:

a. Restoration of the lower river floodplain and delta to river mile 2.6
b. Protection of existing functional habitat through conservation easements and land purchase from willing land owners (river mile 2.6 to 11.3)
c. Floodplain restoration/constriction abatement
d. Water conservation, instream flow protection and water quality improvement/protection
e. Restoration of functional riparian and riverine habitat
f. Large woody debris placement
g. Nearshore habitat protection and restoration
h. Barrier removal
i. Stock recovery/rehabilitation/hatchery reform
j. Sediment management/source control

A description of the Limiting Factors Analysis is included in the Appendix. While the 10 strategic elements describe most of the habitat recommendations for the Dungeness River, what follows was added by the DRMT as additional habitat recommendations to this WRIA 18 plan:

2. Restoration Projects:
   a. Complete a chapter for restoration of Dungeness chinook as part of the Puget Sound salmon recovery plan to be submitted and approved by the Federal services with ESA jurisdiction, subject to the availability of funding and personnel.
   b. Incorporate an adaptive management approach in implementing recommended restoration projects.
   c. Monitor and evaluate results of restoration projects.
   d. Update habitat restoration recommendations as new scientific information develops.
   e. Continue to develop and implement restoration projects that restore river and estuarine function.

3. Land Protection:
   a. Review the "Recommended Land Protection Strategies for the Dungeness River" from the DRRWG containing biological recommendations for the

purchase and protection of land or conservation easements from willing sellers and protection of riparian parcels along the Dungeness River.

b. Seek funding to help land protection entities to cover costs related to helping landowners establish conservation easement agreements or donations, and the endowment fund needed to protect and monitor agreements in perpetuity.

c. Review and implement opportunities to purchase critical riparian parcels of the Dungeness River for flood hazard reduction and habitat restoration and protection.

4. Flood hazard management:

   Complete and implement the comprehensive Dungeness River flood hazard reduction plan that is integrated with habitat restoration planning and protection strategies. (Currently in progress; draft has been completed, 2003.)

5. Road maintenance and restoration:

   a) Provide necessary maintenance/restoration on forest roads in the upper watershed to minimize potential of sediment delivery downstream. Numerous roads have remaining areas that are at high risk of failure, and should receive immediate attention, and consideration for abandonment.

   b) Reduce forest road densities to less than 2.4 miles per square mile, which is the identified road density threshold of concern identified in the Federal Watershed Analysis.

6. Recreational/off-road-vehicle (ORV) trail development:

   a) Assure that any recreational/ORV trails in the vicinity of the River (or crossing it) fully account for protection of salmon spawning, habitat and water quality.

   b) ORV activity should be located as far from the River, tributary surface waters, wetlands and critical wildlife habitat as possible.

7. Riparian vegetation:

   a) Identify and correct areas affected by unrestricted animal access.

   b) Restore suitable riparian vegetation and riparian-adjacent upland vegetation.

8. Side channels:

   Protect and restore critical side channel habitat per studies conducted by the Bureau of Reclamation (2003) and Hirschi and Reed (1998).

C. Fish Propagation and Hatchery Reform: Pursue implementation of recommendations of the Hatchery Science Review Group for the Dungeness system as follows:

1. Continue the chinook restorative captive brood program with broodstock on hand; size the hatchery program to riverine carrying capacity.
2. Conduct additional studies to evaluate chinook life history phases, distribution and migration patterns, as well as riverine carrying capacity; consider these in relation to habitat quality and type.
3. Develop an alternative recovery plan; consider a phase-in of a new program that does not involve captive broodstock, but continues the goal of maintaining genetic resources and reduces the risk of extinction.
4. Seek new water sources to provide warmer rearing water than presently exists at the Dungeness Hatchery.
5. Remove the intake barrier at Canyon Creek to allow passage of adult and juvenile chinook to historic spawning/rearing habitat; open nearby side channel to provide important off-channel rearing habitat.
6. Assure that hatchery coho production is not increased above present levels.
7. Evaluate the effects of naturally spawning hatchery-origin coho on the stability of chinook and pink salmon redds.
8. Secure funding sources should be sought for the continued operation of the Dungeness and Hurd Creek hatcheries, subject to the HSRG recommendations for operation and modification of the facilities.

D. Instream Flows:

1. The DQ Plan recommended that the Department of Ecology set instream flows for the Dungeness River derived from IFIM studies (Wampler and Hiss 1991). Based on DRRWG review of the Dungeness River IFIM, including selection of species, life stages, reaches and channels, the Dungeness River Management Team recommends that minimum instream flows be established at the Schoolhouse Bridge gage (RM 0.5, below all irrigation diversions) at the flow levels recommended by the Dungeness Instream Flow Group (Wampler and Hiss 1991; Hiss and Lichatowich 1990; Hiss 1993a):

   a. November through March: 575 cfs
   b. April through July: 475 cfs
   c. August through October: 180 cfs

   These recommended minimum flows are not based on seasonal, historic Dungeness River flows. Rather, they represent the flows required to maintain optimal potential fish habitat area. They were derived from overlapping habitat preference flow values for the highest-ranking species and life stages, as detailed in *Recommended Instream Flows for the Lower Dungeness River* (Hiss, 1993a). Table 3.13-1 summarizes the ranking process for how the recommended flows were determined. (*For an in-depth account of how the recommended flows were developed, please refer to the referenced Hiss document*.) The recommended flows serve as a biological benchmark against which the flow effects of any future water management and water right decisions should be evaluated (Hiss 1993a).

Note that the August through October (critical months) flow recommendation provides 100 percent of the habitat area expressed as "weighted usable area" (WUA) for chinook and pink spawning and migration, two of the most threatened or critical stocks in the Dungeness, and the two highest ranked species-life stage combination identified in the IFIM study (1991). (*Please see Section 2.3.2 and Appendix 3-C for discussion of the relationship between instream flows set by rule and existing senior water rights.*)

2. Manage future development to protect instream flows and trust water rights.

3. Negotiate flows for late season that consider water conservation measures, variations in snow pack and weather, and the ability of the water users association to manage diversions and water use. *See Section 3.1.8 on irrigation water management for additional recommendations*.

4. Assess water savings and the IFIM recommendations periodically with the participation of the DRMT, Water Users, Tribe, and the Departments of Ecology and Fish and Wildlife.[1]

E. Gravel Movement and Channel Structure:

1. Continue to evaluate potential effects of gravel movement on aquatic habitat and on flood hazard as identified in studies conducted by the U.S. Geological Survey and Bureau of Reclamation.

2. Manage gravel movement where appropriate to promote channel stability, enhance fish habitat, and reduce flood hazard.

F. Fisheries Harvest Management:

1. Fish management actions should reflect the need to protect and rebuild stocks while instream flow protections and habitat improvement projects are implemented. Results of captive program should be evaluated before reinitiating program.

2. State and Tribal fish managers should work with DRMT to present information on harvest management practices and their relationship to salmon recovery efforts.

3. Goals should be established for threatened and critical species reflecting the need to maintain genetic diversity and spatial distribution in the watershed through natural fluctuations over time.

4. The status of SASSI stocks currently designated as unknown, and occurring primarily in the Dungeness or eastern Strait of Juan de Fuca, should be determined. Appropriate measures should be taken for their conservation.

[1] DQ recommendation C.2.1.3.c, modified

Table 3.13-1 Monthly ranking of species and life stages, maximum habitat area flow (cfs), and recommended flows based on rank of species and life stages.

Month(s)	Species	Stage	Status Rank[A]	Stage Rank[B]	Reliability[C]	Total Score	Maximum Hab. Flow[D]	Species combined[E]
Jan	Coho	Spawn	1	1	1	3	575	575
	Steelhead	Rear	1	1	1	3	475	
	Chinook	Rear	1	0	1	2	475	
	Dolly V.	Rear	0	0	1	1	650	
Feb-Mar	Steelhead	Spawn	1	1	1	3	600	575[F]
	Steelhead	Rear	1	1	1	3	475	
	Chinook	Rear	1	0	1	2	475	
	Dolly V.	Rear	0	0	1	1	650	
Apr-Jun	Chinook	Rear	1	1	1	3	475	475
	Steelhead	Rear	1	1	1	3	475	
	Steelhead	Spawn	1	0	1	2	600	
	Coho	Rear	0	1	0	1	375	
Jul	Chinook	Rear	1	1	1	3	475	475
	Steelhead	Rear	1	1	1	3	475	
	Chinook	Migr.	1	0	1	2	575	
	Steelhead	Migr.	1	0	1	2	80	
	Coho	Rear	0	1	0	1	375	
Aug	Chinook	Spawn	1	1	1	3	220	180
	Pink	Spawn	1	1	1	3	150	
	Steelhead	Rear	1	1	1	3	130	
	Chinook	Rear	1	0	1	2	50	
	Chinook	Migr.	1	0	1	2	240	
	Chum	Spawn	1	0	1	2	220	
	Coho	Rear	0	0	0	0	30	
Sep	Pink	Spawn	1	1	1	3	150	180
	Chinook	Spawn	1	1	1	3	220	
	Chum	Spawn	1	1	1	3	220	
	Steelhead	Rear	1	1	1	3	130	
	Chinook	Migr.	1	0	1	2	240	
Oct	Pink	Spawn	1	1	1	3	150	180
	Chum	Spawn	1	1	1	3	220	
	Steelhead	Rear	1	1	1	3	130	
Nov-Dec	Coho	Spawn	1	1	1	3	575	575
	Chum	Spawn	1	1	1	3	575	
	Steelhead	Rear	1	1	1	3	475	
	Dolly V.	Rear	0	0	1	1	650	

From: Hiss, 1993a

[A] Scored "1" for "considered depleted," "0" for "not considered depleted" (or for insufficient information)
[B] Spawning ranked higher than rearing or migration from August through March; rearing ranked higher than spawning or migration from April-July.
[C] Coho rearing ranked lower than other species and life stages.
[D] Upper-reach flows corresponding to peak habitat area using all channels from November through July; or upper-reach flows using only the main channel from August through October.
[E] Desired optimum flow was chosen intuitively from overlapping peak regions of the habitat preference curves presented in Wampler and Hiss (1991) for highest-ranking species and life stages.
[F] For simplicity, the previous month's recommended flow was substituted for 600 cfs.

3.13.2 Matriotti Creek (WRIA# 18-0021)

Issue: Matriotti Creek is one of the largest low-elevation tributaries to the lower Dungeness River, entering the left bank (looking downstream) at RM 1.9. Coho, summer and fall chum, and pink salmon, along with winter steelhead, are identified as the anadromous stocks known to exist in Matriotti Creek. The Limiting Factors Analysis (LFA), (Haring, 1999), has identified water quality and/or habitat recommendations to address on this stream. Matriotti Creek is listed on the 303(d) list for bacteria and is the subject of a TMDL study and clean-up plan.

Existing Conditions and Current Actions

Matriotti Creek is extensively altered from its historic condition, even after a more recent history of accomplishment of several restoration projects. It has been channelized through most of its length, with poor substrate quality and severely depleted LWD except in the few restored areas. This channelization has significantly diminished the creek's functioning floodplain, eliminating meanders and cutting it off from extensive historic wetland complexes. The stream has also been historically exposed to direct animal access and has suffered the typical consequences of poor riparian vegetation, elevated sediments, and high fecal coliform levels (that have resulted in it being included on the 303(d) list since 1998. A TMDL for Matriotti Creek has been prepared by Ecology (2002). This creek has been the site of extensive restoration efforts by the North Olympic Salmon Coalition (NOSC) and the Clallam Conservation District (CCD). As a tributary of the Dungeness River, Matriotti Creek is included in the ESU for Hood Canal/Eastern Strait of Juan de Fuca summer chum habitat.

Matriotti Creek has historically been closely integrated within the irrigation network, and as a result it is subject to flow impacts from irrigation use and from alterations to irrigation-based recharge. This has also resulted in substantial stormwater inputs to the Creek, including excessive sediments, via the irrigation network. The Olympic Game Farm in the lower part of the watershed has historically been a significant source of pollutants to the creek, though much remediation and improvement has occurred recently. A portion of Matriotti Creek's headwaters is protected by a conservation easement.

Desired Conditions and Outcomes

- Tributary flows to Matriotti Creek intercepted by the Dungeness Irrigation Company ditch (between Hooker and Atterberry roads) are restored.
- Limiting factors identified by Haring (1999) addressed to the extent feasible through action by appropriate agencies and local jurisdictions.
- A stream with properly functioning water quality and habitat conditions adequate to support healthy populations of all naturally-occurring anadromous stocks.

Recommendations

A. Water Quality: The Department of Ecology TMDL for Matriotti Creek should be implemented.

B. Habitat:

1. As part of rulemaking for small stream minimum flows, Matriotti Creek's current 3 cfs minimum used to condition water rights should be revisited.

2. Limiting Factors Analysis Recommendations for Matriotti Creek should be implemented, which include:
   a. County should adopt and implement a stormwater strategy for this rapidly developing watershed, including tributaries, that will remediate current stormwater effects and minimize additional future effects
   b. Restore functional channel conditions between Runnion Road and Old Olympic Highway
   c. Identify and correct areas affected by unrestricted animal access
   d. Cease the release of fine-sediment-laden stormwater from irrigation delivery systems to Matriotti Creek
   e. Complete comprehensive barrier inventory for Matriotti Creek, prioritize, and implement correction measures
   f. Develop and implement a short-term LWD strategy to provide LWD presence and habitat diversity until full riparian function is restored
   g. Restore functional riparian zones throughout watershed
   h. Refer restoration of two tributary flows to Matriotti Creek (between Hooker and Atterberry roads) to the HB2514 Planning Unit for resolution

3.13.3 Other Dungeness Tributaries

Issue: Other Dungeness River tributaries include Bear (the Bear Creek which runs under Taylor Cutoff Road), Canyon, and Hurd creeks, which enter the Dungeness below RM 11.0; and Caraco, Gold, and Silver creeks and the Gray Wolf River in the upper watershed located inside Olympic National Forest and Olympic National Park. Bear, Canyon, and Hurd creeks have had significant structural and flow alterations due to hatchery and irrigation intake facilities. Habitat alterations in the upper-watershed tributaries are related to forest practices and road construction.

Existing Condition and Current Actions

The WRIA 18 Limiting Factors Analysis (Haring 1999) provides a comprehensive statement of habitat and water quality concerns and needs for the Dungeness tributaries. Additionally, the Dungeness Watershed Analysis, prepared by the USDA/Forest Service and updated in 2003, contained detailed descriptions of conditions and prescriptions for the upper Dungeness tributaries.

Desired Conditions and Outcomes

- Limiting factors identified by Haring (1999) addressed to the extent feasible through action by appropriate agencies and local jurisdictions.

- Tributaries with properly functioning water quality and habitat conditions adequate to support healthy populations of all naturally occurring anadromous stocks.
- Implementation of Dungeness Watershed Analysis prescriptions to reduce sediment input in the upper watershed.

Recommendations

A. Bear Creek (the Bear Creek that runs under Taylor Cutoff Road): Limiting Factors Analysis Recommendations for Bear Creek should be implemented, which include:

1. Monitor fish passage conditions at and downstream of the low irrigation dam; maintain function of the Bear Creek alluvial fan.
2. Prevent fish from entering areas where they may be stranded by interruptions in irrigation flow.
3. Identify and correct areas affected by unrestricted animal access, fence and revegetate to reestablish functional riparian zones throughout the watershed
4. Seek changes to irrigation structures to avoid discharge of sediment-laden stormwater flows into Bear Creek. Develop and implement a short-term LWD strategy to provide LWD presence and habitat diversity until full riparian function is restored.

B. Canyon Creek: Limiting Factors Analysis Recommendations for Canyon Creek should be implemented, which include:

1. At a minimum, restore fish passage past the water intake dam, with dam removal as the preferred option to restore biological processes.
2. Evaluate restoration potential of historic lower portion of Canyon Creek, through the terrace immediately adjacent to the Dungeness River; implement as practicable.
3. Evaluate the potential to stabilize active slide upstream of dam.
4. Restore natural sediment transport downstream of dam.
5. Introduce LWD to the channel downstream of the dam to retain river gravels, provide habitat diversity, and restore spawning habitat.
6. Protect intact riparian zones upstream of the dam; restore functional riparian zones downstream of the dam.

C. Hurd Creek: Limiting Factors Analysis Recommendations for Hurd Creek should be implemented, which include:

1. Develop and implement a short-term LWD strategy to provide LWD presence and habitat diversity until full riparian function is restored.
2. Restore functional riparian zones throughout watershed, particularly on WDFW-owned hatchery property.

D. Caraco Creek: Limiting Factors Analysis and Watershed Analysis Recommendations for Caraco Creek should be implemented, which include:

1. Reduce the forest road density in the Caraco Creek watershed. Seek decommissioning of roads by removing culverts, improving natural slope hydrology, stabilizing fillslopes, and using erosion control measures.
2. Maintain remaining forest roads in a manner that minimizes potential of mass wasting and fine-sediment erosion. Stabilization and upgrading consists of replacing culverts to accommodate 100-year flows, fish passage, and reduction of potential for diversions and plugging.

E. Gold Creek: Limiting Factors Analysis and Watershed Analysis Recommendations for Gold Creek should be implemented, which include:

1. Maintain forest roads in a manner that minimizes potential of mass-wasting and fine-sediment erosion. Stabilization and upgrading consists of replacing culverts to accommodate 100-year flows, providing adequate fish passage and reducing the potential for diversions and plugging.
2. Identify and map deep-seated failures and areas prone to shallow-rapid landslides; prevent land use activities (roads and harvest) that will exacerbate sediment contribution from these areas.
3. Restore natural channel characteristics in gabion-controlled section of lower basin.
4. Maintain >60% of watershed in a condition that provides hydrologic maturity (>age 25) (Wild Salmonid Policy).
5. Restore forest road density to <2.4 mi/mi^2, which is the threshold density of concern identified in the Federal Watershed Analysis; confine roads to areas not sensitive to mass failures.
6. Seek remediation to the Gold Creek slide. Provide evaluation and erosion control treatments to reduce accelerated mass movement and sedimentation.

F. Gray Wolf River: Limiting Factors Analysis and Watershed Analysis Recommendations for the Gray Wolf River should be implemented, which include:

1. Maintain riparian condition in Gray Wolf canyon.
2. Evaluate the forest road network in the watershed and implement actions necessary to prevent entry of fine sediment and mass wasting events (i.e., landslides) to the Gray Wolf River.

G. Silver Creek: Limiting Factors Analysis and Watershed Analysis Recommendations for Silver Creek should be implemented, which include:

1. Restore stability of slide-prone areas; ensure road cross-drainage is maintained; consider abandonment of roads located on active and potential slide areas; provide sediment retention BMPs on active slides where practicable.
2. Avoid future road construction on slide prone areas.