APPENDIX B

WRIA 1 NEAR-TERM (10 YEAR) ACTIONS

Action #1: Restore anadromous fish passage

Work on Action #1 is categorized into two elements: a) Middle Fork Diversion Dam, and b) Canyon Creek (North Fork Nooksack) at ~RM 0.3.

A. Restore passage at diversion dam to middle and upper Middle Fork Nooksack River (above river mile 7.2) and its accessible tributaries

- **Goal**: Restore full anadromous use in formerly utilized habitat in the Middle Fork and its accessible tributaries. Associated actions include release of North/Middle Fork chinook fingerlings from Kendall Hatchery to accelerate recolonization, and building and operating new kokanee hatcheries as restored anadromous use will affect the State's primary kokanee hatchery program at Lake Whatcom.

- **Limiting factor(s) addressed**: Access

- **Background**: The City of Bellingham's (Bellingham) water supply diversion dam is located at river mile 7.2 on the Middle Fork Nooksack River. Water is diverted at the dam into a tunnel/pipe that extends approximately nine miles then discharges to the southeast end of Lake Whatcom to augment the municipal water supply for Bellingham. The structure is owned, operated, and maintained by Bellingham, and has been in operation since 1963. No fish passage was required by either the Washington Departments of Fisheries or Game at the time of construction. Consequently, ten miles of mainstem habitat and numerous tributaries have been nearly completely inaccessible to anadromous fish since. Anecdotal accounts indicate that a very few adult salmonids have been successful in passing over the dam at moderate flows, although this is estimated to be very rare. Downstream of the diversion dam is a 0.5 mile long bedrock gorge that limits use by weaker swimming species including chum. Passage through the gorge cannot occur at high flows, but does occur at low and moderate flows.

  The proposed project is intended to restore fish passage at the diversion dam site. A project team of the fisheries co-managers (Nooksack Tribe, Lummi Nation and WDFW) and the City of Bellingham has been working on the project since early 2002. The team's preferred option is to construct an alternate water supply withdrawal system to replace the function of the dam and then remove the existing diversion dam. A second option is to build a fish ladder attached to the existing water supply diversion dam. Either option would restore fish passage to habitat that is mostly located on Federal and State lands with the remaining 10% protected through forest practices regulations.

  WDFW supports the restored anadromous use to the Middle Fork above the diversion, with the understanding that kokanee brood facilities to replace Lake Whatcom production needs to be funded and constructed as close as possible to restoring passage to avoid or minimize the duration of kokanee hatchery production reductions. Lake Whatcom Hatchery is the primary

source of kokanee (non-anadromous *Oncorhynchus nerka*), for Washington State. The hatchery traps adult spawners returning to Brannian Creek, taking an average of 11 million eggs per year, which are used to stock 36 lakes and reservoirs. Kokanee are an extremely popular recreational fishery, (accounting for 246,000 angler trips valued at $36 million) with 56% of the fisheries directly supported by the Lake Whatcom program. Lake Whatcom Hatchery is currently certified as a pathogen free hatchery facility enabling the transfer of kokanee eggs and fish to other fish health management zones in Washington, as well as to other states and internationally without extensive disease testing. Restoring anadromous use above the diversion somewhat increases the likelihood of fish viruses occurring in Lake Whatcom. An interagency panel of fish pathologists evaluated this risk and determined that there is only a low risk of virus transfer by anadromous fish through the pipeline to fish in the lake.

Regardless, requirements of the Salmonid Disease Control Policy of the Fisheries Co-managers of Washington State (disease policy) mean that the Lake Whatcom Hatchery will lose its pathogen free water certification status once anadromous fish again use the habitat above the diversion. Loss of the pathogen free water certification triggers a disease policy requirement to test all adults from which eggs or offspring are intended to be transferred out of the local fish or egg health management zone. If test results are negative, eggs or offspring can be transferred, but this level of testing is infeasible. Consequently, restoring anadromous use will substantially alter the current kokanee program, and WDFW has determined that the best long-term solution to maintaining the current sport fisheries is to develop new kokanee hatchery operations on other lakes.

- **Status**: Bellingham and the co-managers have worked with a primary consultant to determine feasibility and cost estimates for a fish ladder alternative and for a dam removal and redesigned intake alternative. Feasibility reports have been 90% completed for both of these alternatives. The redesigned intake alternative has undergone hydraulic testing in late 2004 and early 2005. Bellingham requested assistance from the Army Corps of Engineers (ACOE) for Section 206 funding in 2003, and ACOE accepted the project and was actively engaged until Section 206 funding was cut in fiscal year 2004 and there was no funding available for new projects. Future ACOE involvement and funding is anticipated when Section 206 program funding increases, optimally in FY 2005 (the fall of 2004). This can provide a maximum of $5 million. The fish passage project was allocated $1.6 million in the 2004 State budget. USFWS's FRIMA program has contributed $190,000. Designs should be completed and permitting initiated in 2005; construction is anticipated in summer 2006.

  In 2001, WDFW began annual releases of 200,000 Kendall Hatchery reared native North/Middle Fork early chinook fingerlings into the Middle Fork Nooksack River to ensure adults return to the middle and upper Middle Fork once passage is restored. In 2001, these chinook were released at river mile 5 near Mosquito Lake Road Bridge, downstream of the dam. After 2001, the fingerlings have been released above the diversion dam at RM 9.6. Middle Fork releases are not held for acclimation prior to release but are released from the transport truck into a quiet river pool. Three-year-old returns from the 2001 release were recorded in the lower Middle Fork in 2003 during spawn surveys.

The Legislature funded WDFW to initiate a feasibility study to identify sites that could be used to replace the Lake Whatcom kokanee egg supply. Twenty-two Washington lakes and reservoirs were evaluated, and the recommended option was for multiple brood lakes plus constructed additional hatchery capacity. Five primary brood lakes were identified as the best candidates for future production sites; three in western Washington (Alder, American, and Summit) and two in eastern Washington (Rimrock and Sullivan).

In order for each site to be used as a state wide kokanee source the site and brood stock must be determined to be free of reportable fish pathogens. This requires three-year disease screening at each site, and adult kokanee at the five lakes were tested in the fall of 2003 and will be again in 2004 and 2005. Additionally, kokanee were spawned and fry reared and released at a number of the candidate hatchery sites to begin the process of developing kokanee brood stocks to support future egg takes. Funding to complete engineering work of the new facilities is being requested in WDFW's 2005-07 budget request. If funded, this work should be completed in 2006. Construction funding will be sought in the 2006 supplemental budget and if funded, new facilities should be on line in 2008-09 and (under the best case) be able to replace Lake Whatcom production in 2010.

- **Estimated costs**: The estimated costs for restoring passage at the diversion dam are $3,000,000 to $6,600,000 depending on final feasibility. Releasing chinook fingerlings in the Middle Fork is part of the existing Kendall Hatchery program and not expected to require additional funding. Once fish passage is restored and adult chinook begin using the habitat, spawning ground survey efforts will need to expand to cover the upper Middle Fork and its chinook tributaries to accurately estimate escapements and hatchery and wild contributions to them. This new expense is estimated to cost $75,000 per year. The estimated start up costs, including capitol improvements, for the kokanee hatchery replacement recommended option is $5,004,000 with an annual operating cost estimated at $194,000. Additional to securing additional funding to restore passage at the dam, securing the kokanee funding is the most serious issue that may affect timely completion of this Action.

- **Anticipated benefits for chinook**: This project will improve the spatial distribution, productivity, and ultimately the abundance of the North/Middle Fork chinook population. This well-protected habitat constitutes approximately 29% of the habitat formerly available to this population. There are 10 miles of mainstem habitat and tributary habitats considered suitable for chinook include Clearwater, Warm, Wallace, Sisters and possibly Ridley and Rocky Creeks. Several smaller tributaries appear suitable for coho, steelhead, and anadromous bull trout, which are each expected to recolonize naturally. A pink salmon observed jumping at the dam suggests some pink salmon use may also occur. An EDT model run in 2003 estimated a 30.8% increase in North/Middle Fork chinook population abundance, a 12.1% increase in population productivity, and a 47.6% increase in diversity index using a conservative estimate of habitats that will be occupied. These are the largest population responses to any single restoration action modeled. While fluvial bull trout continue to use the middle and upper Middle Fork, this will restore spatial connectivity and gene flow in this formerly connected population and the full range of life history diversity. Improved screens at the diversion intake may reduce juvenile entrainment, and ramping the diversion may reduce downstream juvenile stranding for all salmon and trout species, increasing

productivity. Productivity may also increase for anadromous salmon and trout by enabling them to spawn in more productive areas, instead of in areas prone to redd loss during high discharge events such as in the gorge downstream of the dam.

- **Actions**:
  - Finalize feasibility and begin plans and specifications
    - Lead: City of Bellingham/Northwest Hydraulic Consultant
  - Acquire funding for construction
    - Lead: City of Bellingham
    - Partners: Nooksack Tribe, Lummi Nation, WDFW
  - Initiate permitting
    - Lead: City of Bellingham
    - Partners: Nooksack Tribe, Lummi Nation, WDFW, permitting agencies
  - Implementation
    - Lead: City of Bellingham
    - Partners: ACOE may be major partner in construction.
  - Release chinook fry above diversion dam to seed habitat. Evaluate effectiveness of releases in re-seeding habitats.
    - Lead: WDFW
    - Partners: Nooksack Tribe, Lummi Nation
  - Acquire funding to implement alternative kokanee program (not prerequisite to restoring passage, but important to minimize duration of program interruptions)
    - Lead: WDFW
    - Partners: Nooksack Tribe, Lummi Nation, City of Bellingham

B. Canyon Creek (North Fork) at ~RM 0.3

- **Goal**: Provide for salmonid passage at the bedrock and boulder cascade at river mile 0.3 and restoration of habitat forming processes in the alluvial fan reach of Canyon Creek, a right bank tributary of the North Fork Nooksack River. In the short term, restore unimpeded access to 4.1 miles of important chinook tributary habitat; over the longer term, restore habitat conditions in the lower 0.9 river miles of Canyon Creek from the mouth of the bedrock canyon to the confluence with the North Fork while reducing or eliminating the need for intervention to protect private and public property from flood damage.

- **Limiting factor(s) addressed**: Access

- **Status/Timeline**: Short-term passage improvements have been made at the lower bedrock constriction in the past and additional work may be needed during the next couple summers (i.e., 2005-2006); the broader restoration plan for Canyon Creek is anticipated to be developed in 1 to 2 years and will include analysis of how passage can be maintained in the long-term while habitat recovers from past disturbances.

- **Estimated costs**:
  - Interim measures and planning - $245,000
  - Implement restoration plan - $50,000 - $1,500,000
  - See additional detail below.

- **Anticipated benefits for chinook**:
  - Unimpeded access restored to 4.1 miles of historic anadromous habitat with the lower approximately 1 mile being historically important tributary spawning for listed chinook.
  - Promotes habitat diversity (tributary versus mainstem) that is essential to support chinook life-history diversity and spatial structure to provide some resilience against losses during large mainstem events (e.g., large flood).
  - Provide for improved incubation to alevins survival as habitat conditions improve on the alluvial fan reach of Canyon Creek. This will contribute to improved freshwater survival and productivity for the North Fork early chinook population.
  - Provide for improved forage base potentially increasing productivity by restoring pink salmon distribution.
  - Restore unimpeded access by other anadromous salmonids including bull trout, coho, and steelhead.

- **Actions**:
  - Evaluate anadromous fish passage at the lower bedrock constriction created, in part, by actions designed to move the Canyon Creek thalweg to the left bank and away from existing development for flood hazard reduction purposes. Produce alternatives and feasibility design(s) for improving fish passage at this site in the short-term (1-5 years). Implement interim measures during summer/fall 2005 & 2006 as necessary to provide unimpeded adult salmonid passage pending selection, funding, and implementation of a preferred long-term alternative.
    - Lead: Whatcom County
    - Partners: Whatcom Land Trust, WDFW, Lummi Nation, Nooksack Tribe, USFS
    - Partners' roles: provide technical assistance in evaluating and selecting a preferred passage alternative; assistance with preparation of biological information necessary for permit acquisition; assistance with scoping interim measures.
    - Timeline:
      - Conduct alternatives analysis – May/June 2005
      - Seek funding for long-term solutions – Summer/fall 2005
      - Monitor barrier(s), provide interim measures to aid passage if necessary – Summer 2005 & 2006
    - Estimated costs:
      - Passage improvement alternative analysis and feasibility design for preferred short-term alternative - $$15,000-$75,000
      - Implement interim measures, if necessary - $5,000 - $10,000/year
    - Commitments/Conditions:
      - Whatcom County successfully acquired the Logs Resort property in 2004. The County removed all structures from the site and the grounds were mulched and re-seeded with native woody vegetation seed mix.
      - Existing funding (i.e. a combination of Salmon Recovery Funding Board grant monies held by the Whatcom Land Trust and a Nooksack Tribe contribution to Whatcom County) are not sufficient to cover full cost of feasibility design, permitting, and construction both interim measures and long-term measures. Whatcom County will seek funding to conduct feasibility analysis of existing

project concepts including risk transfer related to removal of existing flood control levees. Existing funding will likely target interim measures to provide passage during the 2005 spawning period. Timeline for analysis is during the May/June 2005.

— Acquire funding, initiate permitting, complete final designs, and implement preferred fish passage alternative.
  > Lead: Whatcom County
  > Partners: Whatcom Land Trust, Nooksack Tribe, Lummi Nation, WDFW, USFS
  > Partners' roles: Policy assistance in obtaining project funding, technical assistance for permits and in constructing passage improvements; assistance obtaining landowner permission
  > Timeline:
    o Feasibility designs – Spring/Summer 2005
    o Obtain funding – Summer/Fall 2005
    o Final design and permitting – Winter 2005/2006
    o Implement preferred alternative – 2006 to 2007 (contingent on alternatives developed, funding, and sequencing of restoration plan discussed below, and construction "fish window")
  > Estimated costs: $150,000 - $275,000
  > Commitments/Conditions:
    o Conditioned on landowner permission
    o Conditioned on need to provide passage (i.e., if site conditions change and passage is deemed to no longer be an issue by salmon co-managers)
    o Conditioned on ability to implement passage alternatives as first phase of multiple phase restoration strategy and that resources will be available to complete all phases of project design.

— Develop a Canyon Creek restoration plan that identifies the physical and biological conditions necessary to promote recovery of habitat functions within the anadromous reaches of Canyon Creek over time and that represent subsequent phases of restoration begun with the passage phase described above. This plan constitutes a specific area of detail within the larger restoration planning activities described in Action #2. Actions to be considered may include: additional land acquisition to reduce risk to human life and safety while restoring Canyon Creek's ability to move more broadly on the historic alluvial fan; removing (fully or partially) or setback of the existing levee to provide for larger floodplain area and sediment storage; reconstruction of the stream channel and floodplain so that they reflect the channel geometry and are sized in scale to the watershed; riparian replanting; and, moving the creek out of current location at lower point of bed control and partial barrier. The success of all potential restoration actions on the Canyon Creek alluvial fan are influenced or controlled, in part, by both natural upstream watershed conditions and land management actions or legacies on private, state, and federal forest lands as well as the residential development that currently exists or is possible on the lower hazard areas of the alluvial fan [see: http://www.co.whatcom.wa.us/publicworks/pdf/riverflood/canyon_creek_final.pdf]. Continued actions within the Canyon Creek watershed, such as road drainage

improvement and active road drainage management, road decommissioning, timber harvest, and anthropogenic sediment source reduction will all contribute to and determine the ultimate success of habitat recovery within the anadromous reaches. The range of design options available is determined in part by the outcome of current and future land acquisition efforts on the alluvial fan and the risks a given restoration option may present to existing capital improvements.

> Lead: Whatcom County
> Partners: Whatcom Land Trust, Nooksack Tribe, Lummi Nation, WDFW, Ecology, WDNR, WSDOT, USFS, private landowners (forest and residential).
> Partners' roles: Identification of project objectives, project scoping, technical assistance in helping Lead and consultants identify viable alternatives, review of alternatives and feasibility design.
> Timeline:
  - Identify project objectives and likely scope – Spring 2005
  - Identify funding for plan – Summer- fall 2005
  - Restoration plan development – Spring 2006
  - Implement Plan – Summer 2006 - 2008+
> Estimated Costs:
  - Development of funding proposals - $10,000
  - Restoration plan development - $125,000
  - Restoration plan implementation - $75,000 to $1,500,000
> Commitments/Conditions:
  - Timelines are conditioned on the successful acquisition of funding for final design and construction by January 2006.
  - Conditioned on public or WLT acquisition of additional priority properties.
  - Conditioned on landowner permission
  - Will need the commitment from WRIA 1 Salmon Recovery Board that this project remains a high priority relative to other chinook projects prior to expenditure of construction funds.

Action #2: Habitat restoration in the forks, mainstem, and major early chinook tributaries

- **Goal**: Restore self-sustaining properly functioning conditions (wood loading, riparian function, habitat quantity and diversity, water quality, etc.) where possible in Nooksack early chinook habitats, including 115 miles in the Nooksack River and Forks, and 90 miles in tributaries to the Forks.

- **Limiting factor(s) addressed**: Sediment supply, channel conditions, floodplain conditions, riparian conditions, water quality, estuarine/nearshore conditions

- **Status/timeline**: Restoration planning is complete for the South Fork Nooksack Acme-to-Saxon reach (RM 8 – RM 13) and in progress for the South Fork Nooksack Acme-to-Confluence reach (RM 0 – RM 8) and upper South Fork Saxon (RM 13 - RM 31). Nooksack Tribe is seeking funding for reach assessment and restoration planning for the North Fork

(RM 36 – RM 57.6). Restoration plans for the Middle Fork and Nooksack River are expected within 3-4 years and will be linked to on-going instream flow negotiations (Middle Fork, Action #5) and must be carefully coordinated with and completed with the concurrence of on-going flood hazard management programs. Forestry land use management and some effectiveness monitoring is in progress. Additional effectiveness and validation monitoring will be required to ensure desired future conditions are being met.

- **Estimated cost**: Listed under individual actions.

- **Actions**:
  - Technical analysis of watershed conditions and processes: Conduct technical analysis of impacts to watershed conditions and processes—including hydrologic regime, sediment and temperature regimes—to inform restoration planning and resource protection efforts. Considerable information already exists, including landslide inventories, land use/land cover information, streamflow records, forest road network maps, DEMs, hydrography, etc. Additional needs include: sediment source, routing, and storage conceptual models or, were appropriate, detailed sediment budgets; update and refinement of landslide inventory data ; quantification of road network impacts and repair priorities; evaluation of stream flow records and identification of hydrologically degraded sub-basins, assessment of floodplain wetland function, and evaluation of relative importance of basin-scale vs. reach-scale processes in controlling South Fork stream temperatures.
    - Leads: Nooksack Tribe, Lummi Nation
    - Partners: WDFW, Whatcom County, Ecology (for TMDLs)
    - Partners' role: Support technical analysis
    - Timeline: 2005 – 2006
    - Estimated cost: $500,000
    - Commitments/conditions: Ability to secure funding. Some analysis (~50%?) likely to be accomplished with existing tribal natural resources program staff.
  - Restoration planning: Conduct reach-level assessment to describe current conditions and desired future conditions (e.g., habitat quantity and diversity, wood loading, water temperature, floodplain connectivity and conditions, riparian function). Plan, prioritize, and sequence needed project and community actions. Conduct public education and outreach and seek Whatcom County Flood Control Zone District Advisory Committee and landowner support for projects.
    - Leads: Nooksack Tribe, Lummi Nation
    - Partners: Whatcom County, WDFW, WCFCZDAC, affected small cities
    - Partners' role: Provide information and support for assessment and community outreach and education
    - Timeline: 2005 (South Fork Acme-Saxon), 2005-2006 (South Fork Acme-Confluence), 2006 (North Fork and upper South Fork), 2007 – 2008 (Middle Fork and lower Nooksack).
    - Estimated cost (for those plans not yet funded): $1.4 million (estimated $20,000/mile over 72 miles)
    - Commitments/conditions: Ability to secure funding and community support. Meeting timeline may require hiring additional technical staff and/or subcontracting some of the technical work and public outreach and education.

- Land acquisition: Acquire lands where necessary to protect functional habitat from degradation. Acquire lands for unforeseen but important restoration opportunities (i.e., those not currently identified in this section) as they arise.
  - Lead: Whatcom Land Trust
  - Partners: Whatcom County (River and Flood Division, Parks Department), WDNR, Fisheries co-managers,
  - Partners' role: Assist in securing funding and/or identification of parcels at risk for degradation
  - Timeline: 2005 – 2014
  - Estimated cost: $20 million (estimated $2 million/year x 10 years based on average annual requests for funding for such projects). Cost estimate to be refined based on result of Whatcom Land Trust's assessment of acquisition priorities and landowner willingness in the Nooksack River watershed.
  - Commitments/conditions: Ability to find willing landowners and to secure funding.
- Restoration project implementation: Design and implement site-specific restoration projects. Project concepts that are desired to be implemented over the next 10 years are presented by geographic area or reach in Table B-1, 10-Year Implementation Scenario,. Their projected effects on Nooksack early chinook are presented in Tables B-3 and B-4. EDT was used to model the effects of these actions to Nooksack early chinook. Please note that implementation of actions in the nearshore marine environment were not included in the scenario model. The results of the 10-year scenario assume *full effectiveness* of actions implemented. In other words, the results do not represent the habitat potential after 10 years, but the habitat potential after projects are fully effective, e.g., planted trees have grown to maturity. Revision of these estimates is anticipated after refinement of scenarios and/or modification of the actions considered. It must be noted that a number of the identified projects may affect communities and key infrastructure along the river. A concerted effort will be needed to gain community understanding and the support of community members and elected officials for those projects and to ensure that community needs are addressed coincident with salmon recovery priorities.
  - Lead: Nooksack Recovery Team partners
  - Timeline: 2005 – 2014
  - Estimated cost: $60 to 64 million.
  - Commitments/Conditions:
    - Timely completion of restoration plans
    - Development and adequate funding to implement a coordinated public outreach and education plan
    - Landowner consent
    - Whatcom County River and Flood Division, FCZDAC, and affected cities approval for projects dealing with bank hardening, levees, dikes/seawalls, or that are expected to affect flood hazard or channel movement.
- CREP program implementation: Implement Conservation Reserve Enhancement Program to maximize benefit to Nooksack early chinook.
  - Lead: Whatcom Conservation District
  - Partners: Fisheries co-managers
  - Partners' roles: Assist in geographic prioritization.
  - Timeline: 2005- 2014

- > Costs: To be determined (covered under current CREP program).
- > Commitments/conditions: Continued funding of CREP program, availability of willing landowners.

— Forestland management: Minimize effects of forested land use on Nooksack early chinook habitat by minimizing anthropogenic impacts to mass wasting frequency and magnitude, hydrology, riparian conditions, etc.

- > *Implement Forest and Fish report (FFR) rules:* Develop site-specific prescriptions to protect riparian function along fish-bearing channels and minimize effects of activity on mass wasting potential; employ Road management and abandonment plans (RMAP) to minimize road-induced mass wasting and to mitigate the effects of the road network on hydrology; monitor compliance.
  - o Lead: WDNR
  - o Partners: Nooksack, Lummi, private landowners, Ecology, and WDFW
  - o Partners roles: Provide technical expertise in development and review of site-specific prescriptions and RMAPs.
  - o Timeline: 2005 - 2014
  - o Costs: TBD. To be covered by program costs.
  - o Commitments/conditions: Successful FFR implementation will depend upon the leadership of DNR, and the commitment of FFR stakeholders to providing technical expertise.
- > *Conduct effectiveness and validation monitoring of FFR rules, and identify gaps in the FFR framework.* Effectiveness monitoring is needed to evaluate the effectiveness in achieving resource objectives of existing rules such as road BMPs, mass-wasting prescriptions, and riparian management zone prescriptions. Monitoring is especially important for assessing the effectiveness of type N_p buffers in maintaining the processes and functions of non fish-bearing headwater streams. Identify regulatory gaps in the FFR framework with potential to negatively impact early chinook habitat. Potential deficiencies identified include:
  1. FFR rules are typically implemented at the site scale with little consideration of overall watershed context. The assumption of this approach is that site-specific resource protection is the most effective way to achieve resources objectives at the watershed scale. However, incremental impacts can additively or synergistically combine into cumulative watershed effects with potentially adverse effects to salmonids. It will be necessary to validate the effectiveness of FFR rules for achieving resource objectives at the watershed scale by assessing cumulative watershed effects in the Nooksack River basin.
  2. DNR does not require landowners that harvest less than 2 million board feet of timber per year to do detailed RMAPs. The lack of detailed RMAP development and enforcement for small landowners may result in increased sedimentation to fish-bearing waters.
  3. FFR rules do not provide buffers for type N_s stream channels. Type N_s channels are the majority of the channel network and are important for stream temperature and sediment routing.
  - o Lead: CMER (Cooperative Monitoring, Evaluation, and Research Committee)
  - o Partners: Nooksack, Lummi, other FFR stakeholders

- Partners' roles: Track CMER, conduct on-the-ground monitoring. CMER is responsible for assessing FFR rule effectiveness for the entire state. However, individual FFR stakeholders can also perform effectiveness monitoring to inform CMER and the adaptive management process. To date, Nooksack Natural Resources (NNR) has participated in the design of a study to assess road BMPs and RMAP effectiveness.
- Status: The validation of FFR rules is not a high priority in the CMER work plan and needs to be elevated.. Nooksack Indian Tribe staff plan to contribute to validation monitoring by conducting a headwater stream survey to document processes, functions, and the effect of management on headwater streams.
- Timeline: 2004 - 2014
- Costs: To be determined. Some monitoring to be covered under tribal Forest and Fish program. CMER has $4 million annually to fund monitoring.
- Commitments/conditions: Commitment to and coordination of local monitoring efforts by other partners is needed. Action depends on continued funding of tribal Forest and Fish programs at equal or greater than current levels.

> *Refine FFR rules through adaptive management*: Apply results of effectiveness and validation monitoring through adaptive management process to refine the FFR rules to achieve resource objectives.

- Leads: CMER; FFR Policy; Forest Practices Board
- Partners: Nooksack, Lummi, other FFR stakeholders
- Partners' roles:
- Timeline:
- Costs: TBD. To be covered under Forest and Fish process.
- Commitments/conditions: Assumes continued funding for Forest and Fish implementation and oversight.

Table B-1: Actions included in the 10-Year Implementation Scenario.

In June 2004, the fisheries co-managers (Lummi Nation, Nooksack Tribe, and WDFW) compiled a list of restoration projects that could potentially be accomplished within the next ten years and used the EDT model to project the effects of these actions in 2030. The projects have not been prioritized or sequenced. Most of the actions identified are associated with Action Item #2; however, to the extent that they will lead to on-the-ground actions in the next 10 years, other action items are also included.

Note: These specific actions have not been agreed to by all affected parties. Inclusion in this list is not intended to imply landowner consent for specific projects. Securing landowner agreements will be necessary for design and implementation of specific projects. It is also assumed that development of reach specific habitat recovery plans will occur in close coordination with Whatcom County's River and Flood Division and Flood Control Zone District Advisory Committee and any affected small cities to ensure consistency with flood hazard management projects and strategies and community needs. Action #3(below) is an integral element of Action #2.

Proposed Restoration Strategy	Name	Implementation Status[1]	Description	Objectives	Reaches Affected
Nooksack River Estuary					
Historically includes the Nooksack and Lummi delta and riverine-tidal wetlands (RM 0 to RM 4.5 - Lummi-Nooksack divergence). Dikes and loss of distributary channel and blind channel network has reduced quantity of key habitat (56 ha historical vs. 15 ha current condition). Loss of channel complexity and the loss of estuarine and riverine tidal wetlands have reduced quality of habitat.					
Marietta estuary/wetland restoration	Marietta estuary/wetland restoration	2	Setback levees on LB of river between mouth of river and Slater Road, and seaward dikes.	Restore floodplain and estuarine channel-forming processes in tidally influenced lower river.	Nooksack Estuary
Lower Nooksack River and Tributaries					
Includes the Nooksack River upstream of Lummi/Nooksack divergence (RM 4.5) to Everson (RM 18.1) - Reaches Nooksack 2 - 6. Historically the river banks were typically higher than the surrounding valley bottom, valley bottom was floodplain forest with extensive wetlands (scrub-shrub with beaver dams - Collins and Sheikh). River channel was a single-thread meandering channel. Avulsions were infrequent. Currently the channel is tightly confined to a simplified single channel by natural and artificial levees. Meanders have been cut off and wetlands have been mostly ditched and drained for farmland (those that do exist are disconnected from the river by levees and flood gates). Flooding of these areas is a common problem (5 yr occurrence); restoration strategies would have a higher likelihood of implementation if can be demonstrated that project alleviates or is neutral regarding flood risk. Restoration actions are limited because of flood hazard issues. Instream restoration is limited to improving in-channel structure with smaller accumulations of wood (historic-scale wood jams may raise water surface elevation and increase flood risk and may not be considered an option in short term scenario). Long-term restoration should include levee setbacks, wood jam placement and restoration of riparian areas in and adjacent to channel migration areas. Proposed integration of salmon recovery needs into floodplain management planning will improve likelihood of implementation of such actions over the longer term. Off-channel restoration is possible in places that can also be important for flood relief. It should be noted that some of these actions are complementary with those under action #7, restoration of lowland and coastal tributaries and identify actions necessary to provide benefits to early chinook rearing uses or to protect/restore water quality and quantity in early chinook habitats.					
Increase channel complexity by placing LWD accumulations at strategic locations	Small Scale Wood Lower Nooksack mainstem	1	Placement of wood along river margins; anchored to piling wing-walls or other instream structures. Structures placed to increase channel complexity along bank of river at multiple locations.	LWD to improve complexity and backwater habitat along edge of channel; increase habitat quality for juvenile rearing.	Nooksack 2 - 4A

Proposed Restoration Strategy	Name	Implementation Status[1]	Description	Objectives	Reaches Affected
Passive restoration through BMP's - stormwater, filter strips	BMP Lower Tributaries (Water Quality)	4	Implement best management practices in agricultural and urban areas, e.g., filter strips, stormwater management, pesticide and nutrient application in agricultural and urban areas	Decrease input of toxic contaminants, nutrients, fine sediments; increase riparian filtration	Kamm 1 - 3; Tenmile 1 - 6; Bertrand 1 - 4; Fishtrap 1 - 3, DoubleDitch1; Anderson1; Smith1
Whiskey-Schneider off-channel and slough habitat restoration	Whiskey-Schneider Creek Restoration	1	Multiple lower tributary slough habitat restoration. Whiskey Creek: remove flood-gate, daylight slough/creek, improve channel to expand habitat and connect flood plain wetlands. Schneider Creek: remove / relocate flood-gate to connect Keefe Lake Complex to river.	Improve lower mainstem habitat complexity by restoring tributary slough habitat.	Nooksack 3
Restore Kamm Creek riparian, channel structure, and wetland habitat	Kamm Creek Restoration	2	Small-scale riparian restoration with a few CREP projects; restore Northwood wetland.	Increase riparian shading, overhanging vegetation and leaf litter (improve benthos production, water temperatures but narrow buffer width, small-scale treatment so limited improvement in riparian function). Primary benefit to late timed chinook and coho utilizing off-channel habitat. Includes benefit to juvenile rearing early chinook in side-channel/slough habitat associated with mainstem.	Kamm 1-3
Restore Fishtrap Creek riparian, channel structure and wetland habitat	Fishtrap Creek Restoration	1	Limited riparian improvement expected given existing land use, but some CREP projects likely. Set back levee on 2-mile reach between Guide Meridian and River road.	Increase riparian shading, overhanging vegetation and leaf litter (improve benthos production, water temperatures but narrow buffer width, small-scale treatment so limited improvement in riparian function). Primary benefit to late timed chinook and coho utilizing off-channel habitat. Includes benefit to juvenile rearing early chinook in side-channel/slough habitat associated with mainstem.	Fishtrap1, Fishtrap2A, Fishtrap2B, Fishtrap3, DoubleDitch1
Restore Bertrand Creek riparian, channel structure and wetland habitat	Betrand Creek Restoration	2	Bertrand CIDMP/Watershed Improvement District to facilitate limited riparian improvement - anticipate some small-scale improvement (i.e., narrow buffer width, smaller vegetation) over 30% of length. Set back levees on lower 0.5 mile of channel.	Increase riparian shading, overhanging vegetation and leaf litter (improve benthos production, water temperatures but narrow buffer width, small-scale treatment so limited improvement in riparian function). Primary benefit to late timed chinook and coho utilizing off-channel habitat. Includes benefit to juvenile rearing early chinook in side-channel/slough habitat associated with mainstem.	Bertrand 1 - 4
Restore Tenmile Creek riparian, channel structure and wetland habitat	Tenmile Creek Restoration	4	Community-based restoration with Tenmile Creek partnership - anticipate 20-30' riparian buffer over ~70% of length.	Increase riparian shading, overhanging vegetation and leaf litter (improve benthos production, water temperatures but narrow buffer width, small-scale treatment so limited improvement in riparian function). Primary benefit to late timed chinook and coho utilizing off-channel habitat. Includes benefit to juvenile rearing early chinook in side-channel/slough habitat associated with mainstem. Consider improving channel complexity / open water habitats in 1.5 miles of Barret lake.	Tenmile 1 -– 6

Proposed Restoration Strategy	Name	Implementation Status[1]	Description	Objectives	Reaches Affected
Upper Nooksack River and Tributaries					
Includes the Nooksack River upstream of Everson (RM 18.1) to the forks (RM 36.6) - Reaches Nooksack 7A - 8. Wide channel migration zone, Nooksack River had/has a branching or "anatomosing" pattern, with multiple channels and sloughs, and forested islands. Avulsions were frequent and LWD jams abundant. Currently the channel is confined in places by bank armoring, which reduces channel migration and degrades bank conditions. However, some portions of the river retain a wide migration zone. Riparian forest is absent in some places and is made of small trees in other places and large jams are lacking. Islands are not well established - mostly gravel or small brush – are transient and channels shift frequently. Restoration actions should focus on restoring riparian floodplain forest (banks and forested islands). These reaches have the same issues regarding LWD placement (potential to change flood hazard or property damage). However some opportunities for constructing large jams are available in these reaches because of wider channel migration zone. Implicit in the strategies described below is on-going coordination and joint plan development with flood hazard reduction efforts being done through Whatcom County's River and Flood Division and the Flood Control Zone District Advisory Committee. The small cites along the river or affected by flood overflow from the Nooksack (i.e. the City of Sumas) will also be consulted to ensure the needs of their communities are recognized and their support obtained as detailed reach habitat recovery plans and projects are developed.					
Purchase if necessary and restore riparian and floodplain areas for restoration (including removing bank hardening and setback of levees)	Riparian/floodplain restoration (Upper Nooksack)	1	Purchase if necessary and restore riparian and floodplain areas for restoration (including removing hardened bank protection and levee setback). Action focuses on planting of conifer and hardwood species within the channel migration zone. Ensure the long-term recruitment of LWD to the mainstem channel and shading primarily to side channels and sloughs. Riparian restoration is assumed to be at locations that are part of the current channel migration zone or locations that have a high likelihood of being included in the migration zone (after removal of bank hardening).	Restoration of riparian vegetation within the CMZ for long-term recruitment of LWD to channel, stable banks, and mainstem and side channel shading.	Nooksack 7A - 8
Large scale LWD placement	Large scale LWD placement (Upper Nooksack)	1	Action focuses on placement of large LWD to provide stable log jams to creating deep, complex pools. Placement of jams will also provide "nodes" that allow for the forested island development necessary to restore historic anastomosing channel pattern at multiple (as yet undefined) locations in the Nooksack from RM 23.5 (Everson) to forks. Action also includes setback or removal of bank revetments where necessary to restore historic floodplain processes.	Promote formation of anastomosed channel morphology with stable forested islands; also restore habitat types (primary pools and backwater pools) and restore channel complexity and diversity.	Nooksack 7A - 8
Anderson Creek	Anderson Creek Restoration	1	Active and passive riparian restoration possible in lower reaches	Increase riparian shading, overhanging vegetation and leaf litter (improve benthos production, water temperatures but narrow buffer width, small-scale treatment so limited improvement in riparian function)	Anderson1, Anderson2, Anderson3, Anderson4
Smith Creek	Smith Creek Restoration	1	Active riparian restoration possible	Increase riparian shading, overhanging vegetation and leaf litter (improve benthos production, water temperatures but narrow buffer width, small-scale treatment so limited improvement in riparian function)	Smith1, McCauley1, McCauley2, Mitchell1
Anderson Creek Fish Passage	Anderson Creek Fish Passage Mt Baker Highway	1	Regular maintenance of fishway to ensure passage	Restore full passage to upper Anderson Creek	Mt Baker Highway Crossing;

Proposed Restoration Strategy	Name	Implementation Status[1]	Description	Objectives	Reaches Affected
Reduce impacts of forest management.	Riparian timber managed land (Low Nooksack Tribs)	4	Passive riparian corridor restoration through riparian corridor protection; upgrade or decommission forest roads; eliminate logging and other activities on unstable slopes. Applies to forested upper watersheds of Anderson and Smith Creeks.	Riparian restoration; reduce anthropogenic sediment input, etc	Anderson 5; Smith1, McCauley1, McCauley2, Mitchell1
North Fork Nooksack River and Tributaries					
NF Nooksack River from mouth (RM 36.6) to the Nooksack Falls (RM 65.1) - Reaches NF Nooksack 1 - 11B. Lower reaches include a wide channel migration zone with few hydromodifications (occasional hardened bank on outside of bends). Bridges strongly constrain NF at Hwy 9 (NF1 reach), Mosquito Lake Rd. (NF2a), and SR542 (NF7A) . SR542 and other river-adjacent roads confine the river on outside of some meander bends and along certain stretches. Riparian logging and clearing and increased sediment inputs from upslope timber harvest have contributed to the highly braided, frequently shifting channel seen today. Restoration should focus on restoring riparian forests, improving active channel stability by strategic placement of wood, and reducing inputs of fine and coarse sediment from management activities in the upper watershed. Long-term restoration should include re-routing of SR542 in areas where it strongly confines the river as per the WSDOT corridor analysis.					
Multiple Large scale LWD placement	Large scale LWD placement (NF Nooksack)	2	Action focuses on placement of large wood jams to restore historic anatomosing channel pattern and improve channel stability by increasing channel and floodplain roughness at multiple locations in the NF Nooksack from confluence to Glacier Creek confluence.	Restore channel complexity, floodplain connectivity &anastomosing channel morphology with stable forested islands and channel complexity. Improve incubation success and create primary & backwater pools.	NF Nooksack 1 - 8C
Multiple Large scale LWD placement (Upper NF Nooksack)	Large scale LWD placement (Upper NF Nooksack)	2	Placement of wood piles and/or jams to improve channel stability and restore historic anastomosing channel pattern at multiple (as yet undefined) locations in the NF Nooksack from Canyon Creek confluence to falls.	Restore channel complexity, floodplain connectivity & anastomosing channel morphology with stable forested islands and channel complexity. Improve incubation success and create primary & backwater pools.	NF Nooksack 10 - 11B
Riparian corridor restoration - plantings and protective measures of existing riparian forest	Riparian restoration (NF Nooksack mainstem)	2	Floodplain riparian corridor restoration - plantings and protective measures of riparian corridor along the NF Nooksack from confluence to Gallop Creek (non-timber managed lands). Purchase at-risk property if necessary, encourage land owners to set back fences and riparian plantings.	Restoration of riparian vegetation within the CMZ for long-term recruitment of LWD to channel, channel stability and complexity.	NF Nooksack 1 - 8B
Riparian corridor restoration - plantings and protective measures of existing riparian forest	Riparian restoration (NF Nooksack tributaries)	4	Tributary riparian corridor restoration - plantings and protective measures of riparian corridor in Racehorse, and Maple creeks (non-timber managed lands).	Restoration of riparian vegetation within the CMZ for long-term recruitment of LWD to channel, channel stability and complexity.	Racehorse and Maple Creeks
Reduce effects of forest management on sediment and hydrologic regime.	Forest Rd management NF Nooksack Watershed	4	Continue programs to upgrade or decommission forest roads on state and federal forests; eliminate logging and other activities on unstable slopes. Affects all reaches of NF Nooksack River and upper tributaries.	Reduce anthropogenic coarse and fine sediment inputs to mainstem channel and reduce hydrological impacts.	NF Nooksack 1 - NF Nooksack 11B

Proposed Restoration Strategy	Name	Implementation Status[1]	Description	Objectives	Reaches Affected
Passive riparian restoration through riparian protection on forested lands.	Riparian timber managed lands (NF Nooksack)	4	Passive riparian corridor restoration through protection of riparian corridor on managed forest lands.	Restoration of riparian vegetation for long-term recruitment of LWD to channel, stable banks, and shading.	NF tribs except Kendall Creek; downstream effects on NF Nooksack mainstem
Restore tributary habitat Canyon Creek (dike setback, LWD, riparian restoration).	Canyon Creek Restoration	1	Set back lower extent of levee, place large wood, restore riparian areas within CMZ.	Restore channel complexity, riparian corridor, and improve chinook passage into Canyon Creek, an important large tributary for early chinook.	NF CanyonCr1
Middle Fork Nooksack River and Tributaries					
MF Nooksack River from mouth (RM 0) to the upper extent of chinook potential (Ridley Creek confluence - RM 17.4) - Reaches MF Nooksack 1 - 9. Lower reaches includes a wide channel migration zone with few hydromodifications (occasional hardened bank on outside of bends). Restoration should focus on restoring riparian forests and improving channel complexity with wood placement, and reducing inputs of fine and coarse sediment from the upper watershed. The upper MF Nooksack reaches are tightly confined by the valley walls and are less impacted by land use. Primary restoration is to provide access upstream of the MF Diversion Dam (access to reaches 6- 9; 10.2 miles).					
Restore passage MF Diversion Dam	Restore Passage MF Diversion Dam	3	Ladder and screen water intake.	Provide passage of adult chinook to upper Middle Fork and tribs and safe downstream passage juveniles (all life stages).	MF Diversion Dam
Instream flow agreement MF including Bellingham Diversion	MF Nooksack Instream flow agreement	2	Provide adequate instream flows for adult early timed chinook in the lower MF Nooksack.	Adequate flows and habitat quantity during summer and early fall for early spawning chinook	MF Nooksack 1 - 3
Riparian/Floodplain corridor restoration - plantings and protective measures of existing riparian forest	Riparian restoration (Lower MF Nooksack mainstem)	1	Floodplain riparian corridor restoration - plantings and protective measures of riparian corridor along the MF Nooksack from confluence to Mosquito Lake Rd (non-timber managed lands). Purchase at-risk property, encourage land owners to set back fences, and riparian plantings.	Restoration of riparian vegetation within the CMZ for long-term recruitment of LWD to channel, stable banks, and mainstem and side channel shading.	MF Nooksack 1 - 3
Passive riparian restoration through riparian protection on forested lands.	Riparian timber managed lands (MF Nooksack)	4	Passive riparian corridor restoration through protection of riparian corridor on managed forest lands. Includes tributaries and mainstem reaches within timber managed lands.	Restoration of riparian vegetation for long-term recruitment of LWD to channel, stable banks, and shading.	MF Nooksack 1 - 9 and tributaries
Reduce effects of forest management on sediment and hydrologic regime.	Forest Rd management MF Nooksack Watershed	4	Continue program to upgrade or decommission forest roads on state and federal forests; eliminate logging and other activities on unstable slopes.	Reduce anthropogenic coarse and fine sediment inputs to mainstem channel and reduce hydrological impacts.	MF Nooksack 1 - 9

Proposed Restoration Strategy	Name	Implementation Status[1]	Description	Objectives	Reaches Affected
South Fork Nooksack River and Tributaries					
SF Nooksack River from mouth (RM 0) to the upper extent of chinook potential (RM 31) - Reaches SF Nooksack 1 - 10. Lower reaches historically included a wide channel migration zone with numerous side channels and sloughs and frequent channel-spanning wood jams. Riprap has confined channel to a single thread and greatly reduced the amount of slough and side-channel habitat. High temperatures are during summer months are a primary limiting factor. Lack of wood has reduced the quantity and quality of pools – existing pools are shallow and lacking in cover. Restoration should focus on creating thermal refugia (deep, complex pools in areas of cool groundwater/hyporheic inflow), restoring riparian forests, setting back riprap to restore channel migration, and promoting the island braided morphology (i.e., complex channel with stable forested islands) channels by the strategic placement of wood jams. The upper SF Nooksack (upstream of Skookum Creek) is not artificially confined except for bridges at RM 20.4 and 30 (another at RM 25 is less of a constraint). Issues in these reaches are stream-adjacent landslides, lack of large wood creating jams for channel complexity, and sedimentation from upslope forest management. Engagement of the community in restoration planning and implementation in the lower reaches will be essential to the success of habitat restoration. The on-going outreach efforts for the Lower Hutchinson project in the Saxon to Acme reach are currently being expanded at the request of the community and should provide a template for community interaction both in the South Fork and elsewhere in WRIA 1.				
Multiple Large scale LWD placement (Acme to mouth of SF Nooksack)	Large scale LWD placement (Lower SF Nooksack)	2	Action focuses on placement of large LWD to provide stable log jams to create deep, complex pools in areas of cool groundwater/hyporheic/ tributary inflow, reconnect isolated floodplain channels, and restore historic anastomosing channel pattern at four locations - Jones Creek, south of Strand Rd, River Farm, and Black Slough-Potter Rd. Pending landowner agreement, action may also include setback or removal of bank hardening where necessary and agreed to by the County to restore historic floodplain processes.	Restore channel complexity, floodplain connectivity and island braided morphology through removal/setback of riprap, placement of large log jams, and riparian restoration. Create primary and backwater pools; and increase thermal refugia by using stable log jams to creating deep, complex pools in areas of cool groundwater/hyporheic/tributary inflow.	SF Nooksack 1 - 3
Multiple Large scale LWD placement (Acme-Saxon reach)	Large scale LWD placement (Acme-Saxon Reach)	3	Action focuses on placement of large LWD to provide stable log jams to creating deep, complex pools in areas of cool groundwater/hyporheic/tributary inflow. Placement of jams to reconnect floodplain channels and restore historic anastomosing channel pattern at two locations - Hutchinson Creek and Rothenbuhler/Nesset. Action also includes setback or removal of bank revetments where necessary and agreed to by the County and feasible to restore historic floodplain processes.	Restore channel complexity, floodplain connectivity and island braided morphology through removal/setback of riprap, placement of large log jams, and riparian restoration. Create primary and backwater pools; and increase thermal refugia by using stable log jams to creating deep, complex pools in areas of cool groundwater/hyporheic/tributary inflow.	SF Nooksack 4 & 5
Multiple Large scale LWD placement (Upper SF Nooksack)	Large scale LWD placement (Upper SF Nooksack)	2	Action focuses on placement of large LWD to provide stable log jams to improve habitat diversity, create deep, complex pools in areas of cool groundwater/hyporheic/ tributary inflow to function as thermal refugia.	Improve habitat diversity and floodplain connectivity through large wood placement. Create primary and backwater pools.	SF Nooksack 6 - 10
Purchase or conservation easements on floodplain property if necessary; riprap removal or setback to restore channel migration zone in the Lower SF Nooksack.	Riparian restoration (Lower SF Nooksack)	2	Action focuses on planting of conifer and hardwood species within the potential channel migration zone. This action will provide for the long-term recruitment of LWD to the mainstem channel and shading primarily to side channels and sloughs (although assumes some benefit to mainstem channel). This action focuses on treatment of mainstem from Highway 9 Bridge near Acme to mouth of SF Nooksack. Riparian restoration is assumed to be at locations that are part of the current channel migration zone or locations that have a high likelihood of being included in the migration zone (after eventual removal of bank hardening).	Restoration of riparian vegetation within the CMZ for long-term recruitment of LWD to channel, stable banks, and mainstem and side channel shading.	SF Nooksack 1 - 3

Proposed Restoration Strategy	Name	Implementation Status[1]	Description	Objectives	Reaches Affected
Purchase or conservation easements on floodplain property; riprap removal or setback to restore channel migration zone in the SF Nooksack between Acme and Saxon.	Riparian restoration (Acme-Saxon Reach)	4	Action focuses on planting of conifer and hardwood species within the channel migration zone. Ensure the long-term recruitment of LWD to the mainstem channel and shading primarily to side channels and sloughs. This action focuses on treatment of mainstem from Saxon Bridge to Highway 9 Bridge near Acme. Riparian restoration is assumed to be at locations that are part of the current channel migration zone or locations that have a high likelihood of being included in the migration zone (after eventual removal of bank hardening).	Restoration of riparian vegetation within the CMZ for long-term recruitment of LWD to channel, stable banks, and mainstem and side channel shading.	SF Nooksack 4 & 5
Floodplain riparian corridor restoration - passive riparian restoration through riparian protection on forested lands.	Riparian timber managed lands (Upper SF Nooksack)	4	Floodplain riparian corridor restoration - plantings and protective measures of existing riparian forest on managed forest lands.	Restoration of riparian vegetation within the CMZ for long-term recruitment of LWD to channel, stable banks, and mainstem and side channel shading.	SF Nooksack 6 - 9
Passive riparian restoration in tributaries through riparian protection on forested lands.	Riparian timber managed lands (SF Nooksack tribs)	4	Riparian corridor restoration - plantings and protective measures of existing riparian forest on managed forest lands.	Restoration of riparian vegetation along tributaries - plantings and protective measures ot existing riparian forest for stream shading (moderate downstream temperatures) and LWD recruitment to stream.	SF tribs
Reduce effects of forest management on sediment and hydrologic regime.	Forest Rd management SF Nooksack Watershed	4	Continue programs to upgrade or decommission forest roads on state and federal forests; eliminate logging and other activities on unstable slopes. Affects riparian areas along all reaches of SF Nooksack River and tribs upstream of Skookum Creek.	Reduce coarse and fine sediment inputs to mainstem channel	SF Nooksack 1 - 9; tributaries to South Fork
LWD placement to buttress and/or redirect channel from toe of landslides adjacent to the South Fork	Reduce landslide impacts to SF Nooksack mainstem	2	LWD placement to buttress and/or redirect channel from toe of landslides adjacent to the South Fork. Construct log jams using wood brought onto site (construct historic jams) and/or place wood piles to serve as jam anchors.	Reduce coarse and fine sediment inputs to mainstem channel	SF Nooksack 8 - 10

[1]Implementation Status:
1 – Project in conceptual stage; assessment and restoration planning needed.
2 – Assessment and restoration planning complete or in progress.
3 – Design of specific projects in progress or complete.
4 – Projects/program being implemented.

Table B-2: Nooksack EDT Reaches. This table describes the reaches referred to in Table 3.

Area	Stream Name	EDT Reach Code	Length (mi)	Gradient (%)	Confinement Class	Description
Nooksack Mainstem Below Forks	Nooksack River (mainstem)	Nooksack2	2.44	0.1%	Unconfined	Lummi River (RM 4.5) to Tenmile Creek Confluence (RM 6.9)
		Nooksack3	3.4	0.1%	Unconfined	Tenmile Creek Confluence (RM 6.9) to Wiser Lake Creek confluence (RM 10.2)
		Nooksack4A	2.22	0.1%	Unconfined	Wiser Lake Creek confluence (RM 10.2) to Bertrand Creek confluence (RM 12.6)
		Nooksack4B	0.63	0.1%	Unconfined	Bertrand Creek confluence (RM 12.6) to Fishtrap Creek confluence (RM 13.2)
		Nooksack5	4.77	0.3%	Unconfined	Fishtrap Creek confluence (RM 13.2) to Kamm Ditch/Stickney Slough confluence (RM 18.1)
		Nooksack6	5.36	0.1%	Unconfined	Kamm Ditch/Stickney Slough (RM 18.1) confluence to Everson Ave.
		Nooksack7A	5.1	0.3%	Unconfined	Everson Ave. to Anderson Creek confluence (RM 28.2)
		Nooksack7B	0.76	0.1%	Unconfined	Anderson Creek confluence (RM 28.2) to Smith Creek confluence (RM 29.3)
		Nooksack7C	1.46	0.1%	Unconfined	Smith Creek confluence (RM 29.3) to Mt. Baker Highway bridge at Nugents Corner
		Nooksack8	5.94	0.3%	Unconfined	Nugents Corner to South Fork confluence (RM 36.6)
Lower Nooksack Tributaries	Tenmile Creek	TenMile1	0.49	0.3%	Unconfined	Mainstem Nooksack to beaver dam ~0.2 miles above Barrett Rd.
		Tenmile2	1.69	0.3%	Unconfined	Beaver dam ~0.2 miles above Barrett Rd. to just upstream of Barrett Lake
		Tenmile3	2.42	0.3%	Unconfined	Just upstream of Barrett Lake to 0.5 miles upstream of Hemmi Rd. W (downstream of Old Guide Rd.)
		Tenmile4A	1.69	0.3%	Unconfined	0.5 miles upstream of Hemmi Rd. W (downstream of Old Guide Rd.) to tributary confluence just downstream of CM 7
		Tenmile4B	0.17	0.3%	Unconfined	Tributary confluence just downstream of CM 7 to 0.10 miles downstream of E. Hemmi Rd.
		Tenmile5	1	0.3%	Unconfined	0.10 miles downstream of E. Hemmi Rd. to 0.25 miles upstream of Laurel Rd.
	Tenmile Creek Trib	Tenmile6	2.08	0.8%	Unconfined	Tributary confluence just downstream of CM 7 to just upstream of Hannegan Rd.
	Bertrand Creek	Bertrand1	0.58	0.3%	Unconfined	Mainstem Nooksack to confluence with trib/ditch at CM 0.5
		Bertrand2	2.72	1.5%	Moderately Confined	Confluence with trib/ditch at CM 0.5 to confluence with WRIA 206

Area	Stream Name	EDT Reach Code	Length (mi)	Gradient (%)	Confinement Class	Description
	Bertrand Trib 0206	Bertrand3	1.46	1.5%	Moderately Confined	Confluence with WRIA 206 to where becomes straight ditch near Lynden gun club (0.8 miles downstream of W. Badger Rd.)
	Bertrand Creek	Bertrand4	5.69	1.5%	Unconfined	Confluence with WRIA 206 to Canadian border
	Fishtrap Creek	Fishtrap1	2.54	0.1%	Unconfined	Mainstem Nooksack to between Guide Meridian and Kok Rd.
		Fishtrap2A	0.94	0.1%	Unconfined	Between Guide Meridian and Kok Rd. to Double Ditch confluence
		Fishtrap2B	3.11	0.3%	Unconfined	Double Ditch confluence to Badger Rd.
		Fishtrap3	2.89	0.3%	Unconfined	Badger Rd. to Canadian border
	Double Ditch Drain	DoubleDitch1	4.63	0.8%	Unconfined	Fishtrap Creek confluence to Canadian border
	Kamm Ditch	Kamm1	1.99	0.1%	Unconfined	Stickney Slough from Mainstem Nooksack to Kamm Ditch
		Kamm2	1.37	0.3%	Unconfined	upper end of Stickney Slough to just upstream of Kamm Rd.
		Kamm3	0.74	0.8%	Unconfined	just upstream of Kamm Rd. to just downstream of Badger Rd.
	Scott Ditch	ScottDitch1	4.1	0.3%	Unconfined	Abandoned river side channel; Nooksack to Noon Rd (sec 34/35 boundary)
		ScottDitch2	1.9	0.3%	Unconfined	Abandoned river side channel; Noon Rd (sec 34/35 boundary) to extent potential chinook.
	Anderson Creek	Anderson1	1.56	0.3%	Unconfined	Mainstem Nooksack to Roberts Rd.
		Anderson2	0.5	0.8%	Unconfined	Roberts Rd. to old railroad grade upstream of Goshen Rd.
		Anderson3	1.54	0.8%	Unconfined	Old railroad grade upstream of Goshen Rd. to Smith Rd.
		Smith Rd Culvert (Anderson)				Smith Road Culvert on Anderson Creek; not a barrier
		Anderson4	1.86	0.8%	Unconfined	Smith Rd. to Mt. Baker Hwy
		Mt Baker Hwy (Anderson)				Mt Baker Highway Crossing on Anderson Creek
		Anderson5	1.21	1.5%	Confined	Mt. Baker Hwy to confluence with WRIA 0230
	Silver Creek	SilverCr1	2.15	0.8%	Moderately Confined	Mainstem Nooksack to just below Sandy Lane
	Smith Creek	Smith1	2.89	0.8%	Unconfined	Mainstem Nooksack to confluence with McCauley Creek
	McCauley Creek	McCauley1	1.52	0.8%	Unconfined	Confluence with Smith Creek to Mitchell Creek
		McCauley2	0.19	0.8%	Unconfined	Confluence with Mitchell Creek to 0.2 miles above confluence
	Mitchell Creek	Mitchell1	0.99	0.8%	Unconfined	Confluence with McCauley Creek to ~ 1 mile above confluence

Area	Stream Name	EDT Reach Code	Length (mi)	Gradient (%)	Confinement Class	Description
NF Nooksack Mainstem	North Fork Nooksack	NF Nooksack1	3.47	0.3%	Unconfined	South Fork confluence (RM 36.6) to Middle Fork confluence (RM 40.5)
		NF Nooksack2A	0.68	0.3%	Unconfined	Middle Fork confluence (RM 40.5) to Bells Creek confluence (RM 40.81)
		NF Nooksack2B	1.9	0.3%	Unconfined	Bells Creek confluence (RM 40.81) to RM 43
		NF Nooksack3	1.88	0.8%	Unconfined	RM 43 to Racehorse Creek confluence (RM 45.1)
		NF Nooksack4A	0.34	0.8%	Unconfined	Racehorse Creek confluence (RM 45.1) to Bear Creek (RM 45.5, between Racehorse and Kendall hatchery)
		NF Nooksack4B	1.44	0.8%	Unconfined	Bear Creek (RM 45.5, between Racehorse and Kendall hatchery) to RM 46.7 (~ 1 mile upstream of Kendall hatchery)
		NF Nooksack5	2.88	0.3%	Unconfined	RM 46.7 (~ 1 mile upstream of Kendall hatchery) to Maple Creek confluence (RM 49.7)
		NF Nooksack6A	1.58	0.8%	Moderately Unconfined	Maple Creek confluence (RM 49.7) to RM 51.2 (confluence with WRIA 0423)
		NF Nooksack6B	1.32	0.8%	Moderately Unconfined	RM 51.2 (confluence with WRIA 0423) to Boulder Creek confluence (RM 52.2)
		NF Nooksack7A	2.85	0.1%	Unconfined	Boulder Creek confluence (RM 52.2) to Canyon Creek confluence (RM 55)
		NF Nooksack7B	0.11	0.1%	Unconfined	Canyon Creek confluence (RM 55) to RM 55.1 (0.2 miles upstream of Mt. Baker Hwy bridge)
		NF Nooksack8A	0.89	0.8%	Moderately Unconfined	RM 55.1 (0.2 miles upstream of Mt. Baker Hwy bridge) to Cornell Creek confluence (RM 56.2)
		NF Nooksack8B	1.53	0.8%	Moderately Unconfined	Cornell Creek confluence (RM 56.2) to Gallop Creek confluence (RM 57.4)
		NF Nooksack8C	0.24	0.8%	Moderately Unconfined	Gallop Creek confluence (RM 57.4) to Glacier Creek confluence (RM 57.6)
		NF Nooksack9	4.5	1.5%	Confined	Glacier Creek confluence (RM 57.6) to Boyd Creek confluence (RM 62.1)
		NF Nooksack10	1.26	1.5%	Moderately Confined	RM 62.1 (Boyd Creek confluence) to RM 63 (just below gage station)
		NF Nooksack11A	0.37	1.5%	Moderately Confined	RM 63 (just below gage station) to Deadhorse Creek confluence (RM 63.4)
		NF Nooksack11B	1.53	1.5%	Moderately Confined	Deadhorse Creek confluence (RM 63.4) to Nooksack Falls(RM 65.1)
NF Nooksack Tributaries	Racehorse Creek	Racehorse1	1.37	1.5%	Moderately Confined	North Fork to Racehorse Falls
	Kendall Creek	Kendall1	0.56	0.3%	Unconfined	North Fork to Kendall hatchery

Area	Stream Name	EDT Reach Code	Length (mi)	Gradient (%)	Confinement Class	Description
		Kendall Hatchery Weir				Kendall Hatchery Weir; Kendall Creek
		Kendall2	1.23	0.3%	Unconfined	Kendall hatchery to WRIA 407 confluence at Kendall CM 1.1
		Kendall3	1.02	0.3%	Unconfined	WRIA 407 confluence at Kendall CM 1.1 to 0.6 miles above Wheeler Road (~CM 1.9)
	Bear Creek	Bear1	1.84	1.5%	Confined	North Fork to Bear Creek ~CM 2.6
	Maple Creek	MapleCr1	1.3	1.5%	Unconfined	North Fork to Maple Falls
	Boulder Creek	BoulderCr1	0.58	3.0%	Moderately Confined	North Fork to Boulder Creek ~CM 0.6
	Canyon Creek	NF CanyonCr1	0.86	0.3%	Unconfined	North Fork to Canyon Creek ~CM 0.9 (downstream of falls)
		NF CanyonCr2	1.62	3.0%	Confined	Canyon Creek ~CM 0.9 (downstream of falls) to ~CM 2.5
	Cornell Creek	Cornell1	1.2	0.8%	Moderately Unconfined	North Fork to confluence with West Cornell (0.3 miles above Mt. Baker Hwy)
	McDonald Creek	McDonald1	0.6	0.8%	Unconfined	NF Nooksack to cascades (CM 0.6)
	Glacier Creek	Glacier1	1.82	0.8%	Unconfined	North Fork to Thompson Creek confluence (CM 1.8)
		Glacier2	0.96	0.8%	Unconfined	Thompson Creek confluence (CM 1.8) to Deep Creek confluence (CM 2.55)
		Glacier3	0.88	0.8%	Unconfined	Deep Creek confluence (CM 2.55) to Falls at CM 3.6
	Boyd Creek	Boyd1	0.4	1.5%	Moderately Unconfined	North Fork to 0.10 miles above the road
	Deadhorse Creek	Deadhorse1	0.14	3.0%	Confined	North Fork to Cascades above road (CM 0.15)
	Wells Creek	Wells1	0.92	3.0%	Confined	North Fork to Wells Creek (CM 0.9)
		Wells2	0.16	3.0%	Confined	Wells Creek (CM 0.9) to falls (CM 1.1)
MF Nooksack Mainstem	Middle Fork Nooksack	MF Nooksack1	0.72	0.3%	Unconfined	North Fork confluence to Canyon Lake Creek confluence (RM 0.9)
		MF Nooksack2A	2.99	0.8%	Unconfined	Canyon Lake Creek confluence (RM 0.9) to Porter Creek confluence (RM 3.9)
		MF Nooksack2B	0.15	0.8%	Unconfined	Porter Creek confluence (RM 3.9) to RM 4.05
		MF Nooksack3	1.29	0.8%	Unconfined	RM 4.05 to Mosquito Lake Road bridge (RM 5)
		MF Nooksack4	2.16	1.5%	Confined	Mosquito Lake Road bridge (RM 5) to the canyon at RM 6.8 (0.7 miles downstream of diversion dam)
		MF Nooksack5	0.68	3.0%	Confined	RM 6.8 (0.7 miles downstream of diversion dam) to Middle Fork diversion (RM 7.2)

Area	Stream Name	EDT Reach Code	Length (mi)	Gradient (%)	Confinement Class	Description
		MF Diversion Dam				Diversion Dam on MF Nooksack River. Complete barrier to upstream migrants
		MF Nooksack6	1.49	3.0%	Confined	Middle Fork diversion (RM 7.2) to Clearwater Creek confluence (RM 9.1)
		MF Nooksack7A	3.73	1.5%	Confined	Clearwater Creek confluence (RM 9.1) to Sisters Creek confluence (RM 12.4)
		MF Nooksack7B	0.43	1.5%	Confined	Sisters Creek confluence (RM 12.4) to Warm Creek confluence (RM 12.9)
		MF Nooksack7C	1.67	1.5%	Confined	Warm Creek confluence (RM 12.9) to Wallace Creek confluence (RM 14.5)
		MF Nooksack7D	1	3.0%	Confined	Wallace Creek confluence (RM 14.5) to Green Creek confluence (RM 15.3)
		MF Nooksack8	1.19	3.0%	Confined	Green Creek confluence (RM 15.3) to RM 16.7 (0.5 miles upstream of Rankin Creek)
		MF Nooksack9	0.72	3.0%	Confined	RM 16.7 (0.5 miles upstream of Rankin Creek) to Ridley Creek confluence (RM 17.4)
MF Nooksack Tributaries	Canyon Cr	MF CanyonCr1	0.33	0.3%	Moderately Unconfined	Middle Fork to Canyon Lake Creek ~CM 0.25 (Mosquito Lake Rd.)
		MF CanyonCr2	0.98	0.8%	Moderately Unconfined	Canyon Lake Creek ~CM 0.25 (Mosquito Lake Rd.) to WRIA 0341 confluence at CM 1.2
	MF Side Channel (Peat Bog Cr)	PeatBog1	0.8	0.8%	Unconfined	Middle Fork to upper extent chinook utilization
	Porter Creek	Porter1	0.89	1.5%	Moderately Unconfined	Middle Fork to 0.10 miles upstream of Mosquito Lake Rd.
	Clearwater Creek	Clearwater1	1.29	3.0%	Confined	Middle Fork to Cascades at Clearwater Creek ~CM 1.3
	Sisters Creek	Sisters1	0.8	2.5%	Confined	Middle Fork to Sisters Creek ~CM 0.8
	Wallace Creek	Wallace1	0.3	3.0%	Confined	Middle Fork to Wallace Creek ~CM 0.3 (just above the road)
	Warm Creek	Warm1	0.19	2.5%	Confined	Middle Fork to Warm Creek ~CM 0.2 (just above the road)
SF Nooksack Mainstem	SF Nooksack	SF Nooksack1	2.12	0.1%	Moderately Unconfined	North Fork confluence to Black Slough confluence (RM 2.5)
		SF Nooksack2	1.59	0.1%	Moderately Unconfined	Black Slough confluence (RM 2.5) to Sygitowicz confluence (RM 4.0)
		SF Nooksack3	4.22	0.1%	Moderately Unconfined	Sygitowicz confluence (RM 4) to Jones Creek confluence (RM 8.4, 0.3 miles downstream of Hwy 9 bridge)
		SF Nooksack4	2.09	0.3%	Moderately Unconfined	Jones Creek confluence (RM 8.4, 0.3 miles downstream of Hwy 9 bridge) to Hutchinson Creek confluence (RM 10.1)

Area	Stream Name	EDT Reach Code	Length (mi)	Gradient (%)	Confinement Class	Description
		SF Nooksack5	4.47	0.3%	Moderately Unconfined	Hutchinson Creek confluence (RM 10.1) to Skookum Creek confluence (RM 14.3)
		SF Nooksack6	2.45	0.8%	Moderately Unconfined	Skookum Creek confluence (RM 14.3) to Cavanaugh Creek confluence (RM 16.5)
		SF Nooksack7A	3.5	0.3%	Moderately Unconfined	Cavanaugh Creek confluence (RM 16.5) to Plumbago Creek confluence
		SF Nooksack7B	0.06	0.8%	Moderately Unconfined	Plumbago Creek confluence to Deer Creek confluence
		SF Nooksack7C	0.19	0.8%	Moderately Unconfined	Deer Creek confluence to RM 20.6 (0.10 miles downstream of Larson's bridge)
		SF Nooksack8	4.79	1.5%	Confined	RM 20.6 (0.10 miles downstream of Larson's bridge) to RM 25
		SF Nooksack9	3.01	3.0%	Confined	RM 25 to Howard Creek confluence (RM 27.5)
		SF Nooksack10	3.92	3.0%	Moderately Confined	Howard Creek confluence (RM 27.5) to RM 31
SF Nooksack Tributaries	Black Slough	BlackSlough1	1.7	0.3%	Unconfined	South Fork to railroad grade
	Sygitowicz Cr	Sygitowicz1	0.66	3.0%	Moderately Confined	South Fork to Sygitowicz ~CM 0.7 (0.2 miles upstream of Hillside Rd.)
	Hutchinson Creek	Hutchinson1	0.77	0.8%	Unconfined	South Fork to Hutchinson Creek ~CM 0.8
		Hutchinson_Gorge				Gorge - slight passage reach
		Hutchinson2	0.73	2.5%	Confined	Hutchinson Creek ~CM 0.8 to 1.5 (Lower Gorge reach)
		Hutchinson3	3.3	1.5%	Moderately Confined	Hutchinson Creek ~CM 1.5 to 4.9 (beginning of gradient break)
	Skookum Creek	Skookum1	0.38	3.0%	Confined	South Fork to Skookum Creek ~CM 0.4
		Skookum2	2.01	3.0%	Confined	Skookum Creek ~CM 0.4 to Falls at ~CM 2.4
	Cavanaugh Creek	Cavanaugh1	0.47	1.5%	Confined	South Fork to Cavanaugh Creek ~CM 0.5
	Plumbago Creek	Plumbago1	0.2	1.5%	Moderately Confined	South Fork to cascades at Plumbago Creek ~CM 0.2
	Deer Creek	Deer1	0.53	1.5%	Moderately Confined	South Fork to falls at Deer Creek ~CM 0.7

Table B-3: EDT Model Results of 10-Year Implementation Scenario - South Fork early chinook.

SF Nooksack Chinook

Scenario	Diversity Index	Productivity	Capacity	Abundance
Current	42%	1.4	1,215	317
Template	100%	19.3	16,227	15,386
PFC FW	96%	11.1	8,197	7,457
10 yr Plan	87%	5.0	3,483	2,784

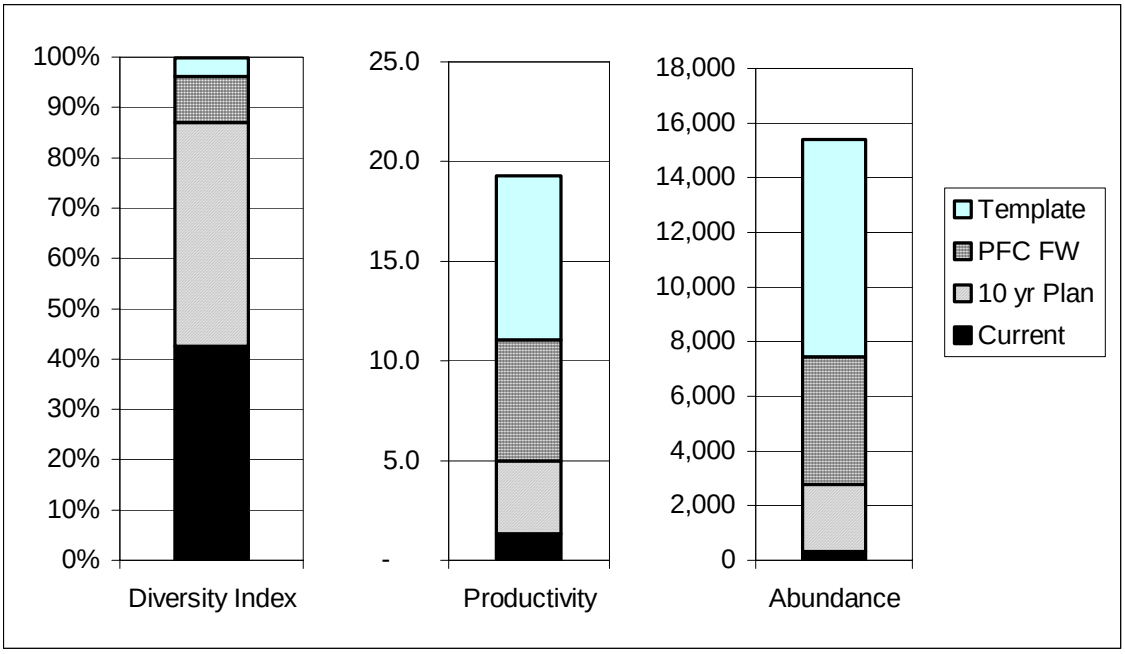
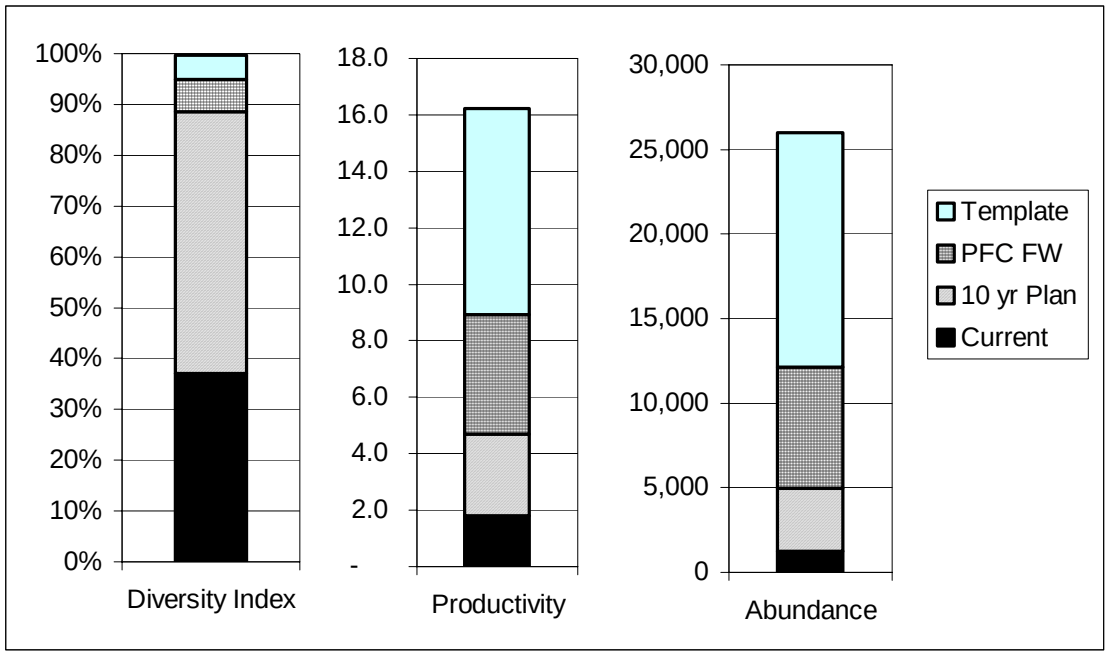


Table B-4: EDT Results of 10-Year Implementation Scenario - North Fork/Middle Fork early chinook.

NF & MF Nooksack Chinook

Scenario	Diversity Index	Productivity	Capacity	Abundance
Current	37%	1.8	2,723	1,219
Template	100%	16.2	27,680	25,973
PFC FW	95%	8.9	13,648	12,118
10 yr Plan	89%	4.7	6,342	4,988



Action #3: Integrate salmon recovery needs into floodplain management planning

- **Goal**: Improve habitat diversity and key habitat conditions to meet chinook life-history needs in what were historically the most productive reaches in the Nooksack River watershed (e.g., improve mainstem, forks, and estuary) in a manner that recognizes the importance and continued value of floodplain-appropriate land uses.

- **Objective**: Develop and implement a strategic process that explicitly integrates salmonid habitat and human needs and that places a priority on projects that maximize mutual benefit in as part of on-going flood hazard management programs and projects. Inherent to this objective is a systematic shift in County resources over time away from reactive flood projects done by individual sponsors and toward proactive flood projects sponsored by the Flood Control Zone District.

- **Limiting factor(s) addressed**: Channel conditions, floodplain conditions, riparian conditions

- **Status/Timeline**: This action has three sequential components. First, establish and support on-going technical coordination between Whatcom County, cities, the salmon co-managers and others, as appropriate, so that the annual list of flood hazard reduction projects is informed regarding fish protection and restoration needs and that flood project designs support restoration objectives. Second, conduct the technical assessments over the next 1-5 years necessary to identify or refine habitat restoration priorities by limiting factor, location, and opportunity and coordinate these results with updates or changes to the flood hazard reduction program. Third, explicitly integrate salmon recovery needs into floodplain management and begin implementing priority restoration projects within 3 to 5 years. Initial restoration projects identified using existing data and priorities may be implemented within 1 to 2 years.

- **Estimated cost**: Identified by individual actions below.

- **Actions**:
  - Coordination with on-going flood projects: Whatcom County will work with the Technical Advisory Committee (TAC) of the WRIA 1 SRB to ensure that existing habitat restoration and protection priorities (see WRIA 1 LE 2004) are available for use and guidance in developing the annual list of flood hazard reduction and maintenance projects. The intent is to ensure that flood projects are aligned with habitat restoration opportunities wherever feasible. The goal is to protect, or produce a net benefit to, fish habitat quality and quantity. “Bio-engineering” or other “softer alternatives” to traditional bank hardening such as described in Integrated Streambank Protection Guidelines (WDFW et al. 2003) or other available literature should be utilized in project designs. Coordination with the ACOE will be necessary to apply non-structural alternatives as appropriate at repair sites within the ACOE program. Project impacts are to be fully mitigated were feasible and mitigation methods will be monitored for effectiveness. Where off-site mitigation is warranted, sites will be chosen with the intent of supporting overall salmon recovery priorities.

- > Anticipated results towards meeting recovery targets:
  - o No net loss of or a measurable improvement in mainstem habitat diversity and complexity at a project scale as determined by project monitoring.
  - o Programmatic measures will be refined and adopted by the County and applicable permitting agencies. This will provide consistency across projects to measurably restore habitat functions while also reducing permit processing time.
- > Lead: Whatcom County
- > Partners: Flood Control Zone District Advisory Committee (FCZDAC), Diking Districts, Lummi Nation, Nooksack Tribe, WDFW, cities, state and federal agencies (ACOE, FEMA, Federal Services) as applicable.
- > Partners' roles: Staff WRIA 1 TAC and provide technical guidance to County/FCZD.
- > Timeline:
  - o Pre-project scoping meetings TAC and County River and Flood – fall and winter annually
  - o Annual flood project list reviewed by FCZD CAC and recommendations made to County Council – annually in the spring
  - o Project monitoring will occur as per HPA conditions. Monitoring reports will be stored in the Whatcom County Public Works River and Flood Section library and be made available for public and agency use.
- > Estimated cost: Agency TAC participation - $75,000/year
- > Commitments/Conditions:
  - o Formation of an interdisciplinary WRIA 1 SRB TAC composed of co-manager, County, city, and other agency/government staff or consultants with specialized expertise not otherwise available.
  - o Annual flood project list is approved by the FCZD/County Council.
  - o Commitment of the ACOE to work as TAC team member and on project basis to help implement projects that meet overall goals of this action item.

— Coordinate restoration project work plan development: The County will coordinate the work of the WRIA 1 Salmon Recovery Board's (SRB) technical advisory committee (TAC) with that of the Whatcom County Public Works River and Flood Division to assist the WRIA 1 SRB in refining and implementing the restoration project work plan for those reaches of the Nooksack River mainstem, forks, and estuary with existing flood infrastructure. This SRB work plan will address restoration project needs that are beyond the mandate of the Flood Control Zone District (FCZD) and provide an assurance that projects proposed under either the FCZD or restoration areas are integrated with the approach and projects under Action #2.

— Channel migration limits: Delineate and formally adopt channel migration limits (where bank hardening may only occur along the outside edge of the limits, not within them) using historic channel geometry, past migration areas, and by likely areas of future migration. Final meander limits will strive to mutually address salmon recovery, flood management, and Shoreline Management Program objectives to the extent feasible. Local regulatory processes, flood infrastructure repair and maintenance, infrastructure planning and maintenance, and habitat restoration projects will use the adopted limits. This will provide for improved ability for physical and biological (ecological) processes to form and maintain properly functioning habitat within the designated channel migration zone

Whatcom County is currently in the process of delineating channel migration zones. The River and Flood Division contracted with University of Washington researchers to delineate historic channel locations and current or likely migration locations and rates in the mainstem and major reaches of the three forks of the Nooksack River. This report (Collins and Sheikh, 2004) provides essential geomorphic data and served as the starting point to inform the establishment of meander limits for use in flood planning. It is being used by County Planning and River and Flood and their consultants in development of channel migration zones under the Shoreline Management Program update that is due for completion by the end of 2005.

> Anticipated results towards meeting recovery targets:
  - o Identification of priority reaches for protection (i.e., habitat forming processes largely intact) and restoration (i.e., habitat functions impaired, but large fish benefit possible if available restoration tools are applied).
  - o Opportunity to inform policy makers and guide regulatory changes that will allow for proactive protection and for strategic restoration of channel and habitat forming processes within the affected rivers and streams.
  - o Greater certainty that long-term flood hazard management and salmon restoration objectives will be compatible and will contribute toward recovery objectives.
> Lead: Whatcom County
> Partners: Affected cities, Salmon Co-managers, other WRIA 1 Salmon Recovery Board members, ACOE, Federal Services
> Timeline:
  - o CMZ delineations – Fall 2005
  - o Technical/public/policy review and approvals – Fall 2005
  - o Finalize meander limits – Late fall 2005
> Estimated cost: $250,000
> Commitments/Conditions:
  - o Conditioned on implementation of action item #4
  - o Conditioned on results of public process necessary to adopt limits for flood, shorelines, and salmon recovery objectives

— Hydraulic modeling of Nooksack River: Continue development of hydraulic models for Nooksack River mainstem and forks to evaluate flood elevation and routing and to provide a basis for future quantitative modeling of restoration project scenarios (e.g., levee setback or removal, in-channel LWD placement, side channel access).

> Anticipated results towards meeting recovery targets:
  - o Improved habitat diversity and complexity in mainstem areas that will improve habitat conditions for key lifestages such as redd survival and juvenile cover for rearing and shelter high stream velocities during flood flows.
  - o Reduction of juvenile “flushing” at high flows and redd scour by providing flood overflow paths that will reduce discharges and velocities within the active channel.
> Lead: Whatcom County
> Partners: Salmon Co-managers, other WRIA 1 Salmon Recovery Board members, ACOE, Federal Services
> Timeline:
  - o Instream flow modeling and decision support system (DSS) tools – mid-2005

- Hydraulic modeling – on-going through 2007
- > Estimated cost: TBD
- > Commitments/Conditions:
  - Conditioned on continued funding to complete flood hydraulic modeling
  - Conditioned on availability and resources to run instream flow models for mainstem areas and ability to run model scenarios to determine changes in habitat quantity and distribution.

— Major capital/infrastructure projects: Inform owners of major pieces of capital infrastructure (e.g., highways, oil and gas pipelines, water intakes) of TAC analysis, restoration priorities, and channel migration limits. Involve the owners in scoping long term habitat restoration options in reaches limited by infrastructure in order to evaluate alternatives and feasibility design of major capital projects that may be initiated within a 5 to 10 year planning horizon. Examples include: movement of significant infrastructure such as roads, bridges, railroads, water, oil, and gas pipelines. Work with the owners, public agencies, and adjacent landowners to identify other factors (e.g., scheduled pipeline maintenance or replacement, bridge replacement) that may affect timing, project scope or priority. Begin to implement priority alternatives where feasible.

- > Anticipated results towards meeting recovery targets:
  - Reduce man-made constraints to channel migration in priority restoration reaches
  - Improved ability to increase habitat diversity and restore habitat forming/maintaining functions at a reach scale
- > Lead:
  - WRIA 1 TAC will coordinate project identification, prioritization, and recommend additional studies needed.
  - Individual project lead varies based on ownership and/or jurisdiction (WSDOT and Whatcom County (roads), Burlington Northern Santa Fe (railroad), City of Bellingham, Williams & Texaco (pipelines)
- > Partners: WRIA 1 SRB members, private landowners and businesses
- > Timeline: TAC produces master plan by December 2009
- > Estimated cost: TBD, estimated total cost $20-30 million
- > Commitments/Conditions:
  - Conditioned on substantial State or Federal funding that is necessary to implement the projects identified.
  - Conditioned on landowner and/or infrastructure owner agreement and participation

— Riparian function associated with flood control structures: Develop WRIA 1 goals and policies to re-establish functional riparian vegetation along mainstem areas while retaining ability to maintain flood management infrastructure and respond to flood emergencies until such time as flood management related infrastructure is no longer needed (such as if levees are removed, if setback levee allows for riparian buffer, etc.). Sequencing of this action with the actions described above is essential. For example, greater long-term benefit and certainty will be gained by restoring riparian vegetation at a site after levee setback if setback is a preferred option at that location.

- > Anticipated results towards meeting recovery targets:
  - Improved riparian functions
- > Lead: Whatcom County

> Partners: Salmon Co-managers, ACOE, Whatcom Conservation District, Diking Districts, Nooksack Salmon Enhancement Association
> Timeline:
  - Continue on-going riparian efforts
  - Develop riparian work plan – Spring 2006
> Estimated cost: TBD
> Commitments/Conditions:
  - Continued funding of CREP program
  - Local resources to support CREP
  - State and federal financial support
  - Conditioned on ACOE willingness to work to find effective solutions tailored to local flood management and habitat restoration needs.

— Public Outreach. Engage the general community and affected cities in developing a restoration vision. Seek landowner and city agreements for reach restoration plans and projects.
> Anticipated results towards meeting recovery targets:
  - Community support of reach restoration objectives and specific projects and project benefits.
> Lead: Whatcom County and Salmon Co-managers
> Partners: FCZD, Drainage and Diking Districts, Whatcom Conservation District
> Timeline:
  - On-going for South Fork
  - Will occur sequentially as other reach plans are geared up.
> Estimated cost: $75,000/year
> Commitments/Conditions:
  - Whatcom County and Salmon Co-managers will work to jointly develop outreach Plan.
  - Dependent on consistent funding
  - Dependent on ability to adjust foundation outreach plan and effort to meet needs of specific communities along the river.

Action #4: Integrate salmonid habitat protection and county critical areas ordinance and shoreline management program

- **Goal**: Evaluate local CAO and SMP for opportunities to improve protection of habitats of ESA listed and other salmonids using the best available science (BAS) standard; develop recommended revisions to the applicable ordinances; and, incorporate these recommendations into the update process. Define and protect the baseline (existing ecological function) to prevent continued degradation of salmonid habitat by providing for consistent and clear regulatory standards across local jurisdictions for the protection of fish habitat and related functions in the freshwater and marine shorelines areas of Whatcom County.

- **Limiting factor(s) addressed**: Floodplain conditions, riparian conditions, water quality, estuarine/nearshore conditions

- **Status/Timeline**: Identification of County CAO and SMP BAS gaps has been completed. A draft CAO is currently working its way through the approval process with County adoption anticipated by June 2005. The SMP update is also ongoing and is on schedule for policy adoption by the end of 2005. Some cities (e.g., Lynden and Sumas) have recently completed updates to their respective Critical Areas Ordinances. Recommended changes coming from this process may be incorporated into the next cycle of updates for those two cities or other small cities on an approximate 7-year update cycle.

- **Estimated cost**: See individual actions below.

- **Actions**
  - Identify habitat baseline conditions and habitat recovery targets within the January 30, 2004 draft WRIA 1 Salmonid Recovery Plan to be used in salmonid restoration and to provide guidance to regulatory updates (CAO and SMP). The intent was to ensure the draft Plan's suitability as a BAS document available to guide the CAO and SMP update processes regarding habitat priority areas, functions, and limiting factors for native salmonids.
    - Anticipated results towards meeting recovery targets:
      - Technically defensible basis for identifying protection and restoration priorities and project sequencing.
      - Community acceptance of the "roadmap" to recovery
    - Lead: Whatcom County/Nooksack Tribe
    - Partners: Bellingham, small cities, Ecology, Lummi, WDFW
    - Partners' roles:
      - Contribute technical expertise
      - Policy level endorsement of concepts, commitments and actions
    - Timeline:
      - BAS document –completed fall 2004
      - Public education, review and comment – September through December 2004
      - Policy endorsement – January to March 2005
    - Estimated cost: $100,000
    - Commitments/Conditions:
      - Whatcom County, the cities, and the salmon co-managers will work collaboratively after April 30, 2005 submittal to Shared Strategy to complete all sections of the WRIA 1 Salmonid Recovery Plan document to ensure that technical background and technical and policy guidance is available to the community for recovery of native salmonids in WRIA 1 with an emphasis on ESA listed chinook salmon.
      - The small cities may need additional staff or financial resources to participate in document review, education of policy staff, and application of technical information to a regulatory setting.
      - A focused public outreach program will be needed to improve chance for political level acceptance of the Plan as the guiding document.
  - Appoint members to and coordinate Technical Advisory Group to provide technical recommendations for County CAO and SMP updates.

- > Anticipated results toward meeting recovery targets: Brings local and consultant expertise in tailoring recommendations that will have measurable positive benefit in achieving targets. Informs CAO/SMP update process with best available science and technical information with the basin to help guide the development of policies and regulations that ensure no net loss of ecological functions. Help guide technical review and assessment associated with the development of an inventory and characterization of ecosystem-wide processes (county-wide/landscape scale) as well as shoreline functions (shorelines jurisdiction/reach scale), a best available science record, restoration plan, mitigation banking strategy, and the development of shoreline area designations.
- > Lead: Whatcom County
- > Partners: Nooksack, Lummi, WDFW, Bellingham, small cities, WDNR, Ecology, ACOE, Port of Bellingham, Whatcom Conservation District, NRCE
- > Partners' roles: Provide technical assistance and resources
- > Timeline:
  - o County CAO – June through March 2005
  - o County SMP – April through December 2005
- > Estimated cost: Covered by existing Ecology grant and Whatcom County Planning budgets.
- > Commitments/Conditions: Whatcom County has committed to completing this as per grant schedule.

— Prepare revisions to the WRIA 1 Salmonid Recovery Plan to better integrate salmon recovery guidance with the County CAO and SMP using committee and staff recommendations. Route updated version of the plan through the public review process.

- > Anticipated results towards meeting recovery targets:
  - o Provide greater certainty that baseline habitat functions will not continue to degrade over time by identifying protection and restoration needs, priorities, and habitat benchmarks.
  - o Provide key information to regulators that will inform mitigation needs and priorities during the regulatory implementation process.
- > Lead: Whatcom County
- > Partners: Bellingham, small cities, Ecology, Nooksack, Lummi, WDFW
- > Partners' roles: Assist County in garnering public support.
- > Timelines:
  - o CAO – spring 2005
  - o SMP- Fall 2005
- > Estimated cost: TBD
- > Commitments/Conditions: This is conditioned on the fact this is a public process culminating in a political decision that can be informed, but not bound, by technical recommendations.

— Prepare revisions to the Salmonid Recovery Plan to better integrate salmon recovery guidance with the various city CAOs and SMPs using committee and staff recommendations. Route updates through the public review process.

- > Anticipated results towards meeting recovery targets:

- Provide greater certainty that baseline habitat functions will not continue to degrade over time by identifying protection and restoration needs, priorities, and habitat benchmarks.
- Provide key information to regulators that will inform mitigation needs and priorities during the permitting process

> Leads: Each city constitutes the lead for their jurisdiction (Bellingham, Blaine, Ferndale, Lynden, Everson, Nooksack, and Sumas)
> Partners: Whatcom County, Ecology, Nooksack, Lummi, WDFW
> Partners' roles: Assist cities in garnering public support for changes proposed in future update processes.
> Timeline: TBD
> Estimated cost: TBD
> Commitments/Conditions:

- This is conditioned on the fact this is a public process culminating in a political decision that can be informed, but not bound, by technical and policy recommendations
- Conditioned on small cities having resources necessary to complete and implement updates already scheduled or to make mid-cycle changes as appropriate.
- This action is conditioned on the fact that the CAO and SMP are only two tools to protect salmon habitats from a net loss and that this does not ensure recovery of degraded habitat functions. These updates to local regulations are essential, yet the are only a part of the regulatory puzzle necessary for recovery and that responsible state and federal agencies must also evaluate and enforce applicable regulations if salmon recovery is to be successful.

Action #5: Establish a South Fork gene bank/supplementation program

- **Goal:** Preserve the unique genetic characteristics of the South Fork chinook population while stream habitat conditions critical to the recovery of the native chinook population improves.

- **Objectives:**
  - Develop and implement a native South Fork chinook brood stock program at the Skookum Creek Hatchery that increases the numbers of South Fork early-timed native chinook spawners in the South Fork (abundance) while minimizing to the extent possible, the effects of hatchery intervention on the genetic character of the stock.
  - Reduce North Fork early and late timed (fall) hatchery chinook strays into the South Fork to reduce risks to the South Fork chinook population which may arise from interbreeding between stocks, redd superimposition, and/or competition.

- **Background**: The South Fork native early-timed chinook population is genetically distinct from the North Fork Nooksack chinook population, and both are very distinct from all other Puget Sound chinook stocks. Adult spawning escapement for the South Fork population has averaged about 210 fish from 1997-2004. Additionally, the South Fork population appears to be at risk from interactions with hatchery strays from the Kendall Hatchery releases of North Fork early-timed chinook and from non-native late-timed (fall) chinook. Approximately half

the fall chinook found in the South Fork are believed to be naturally produced fish (unmarked) while the remaining half are marked and of hatchery origin. Recent DNA analysis of South Fork Nooksack River chinook juvenile outmigrants indicated over 80% of naturally produced sub-yearling outmigrants sampled at the South Fork smolt trap were late timed (fall) chinook, with the remainder a fairly even combination of North Fork and South Fork early-timed chinook. Yearlings were also predominately late-timed chinook.

Beginning in 1980, native early chinook brood stock hatchery programs were initiated at WDFW's Kendall Creek and Lummi Nation's Skookum Creek facilities. Both programs collected native early chinook in there respective river basins for brood stock. Resulting juvenile chinook were likewise released into the North Fork from Kendall Creek and to the South Fork from Skookum Creek. The South Fork program continued until the early 1990's and did not establish a brood stock which returned to Skookum Hatchery. The North Fork program at Kendall continues today and has established returns which consistently provide natural spawners as well as returns to the hatchery that meet or exceed egg take needs. The effort has increased the overall numbers of spawners returning to the North Fork although the numbers of natural-origin chinook (originating from chinook parents spawning in the wild) have not substantially increased as a result of the higher spawning escapements.

- **Anticipated benefits to chinook**: Preservation of unique South Fork chinook population genetic diversity by increasing abundances through selection and culturing of target population, while habitat conditions for spawning, incubation and rearing are restored and population productivity increases. Program will build on the successful techniques developed in the Kendall Creek North Fork chinook population gene bank and supplementation program.

- **Status/Timeline:**
  - 2005: Improve microsatellite DNA baselines and stock identification procedures.
  - 2005: Develop strategy to reduce early and late time chinook strays into the South Fork.
  - 2005: Develop appropriate broodstock collection and spawning protocols
  - 2006-2014: Implement brood collection, stock identification spawning, subsequent rearing and release annually.
  - 2006: Evaluate need for actions to improve adult returns to hatchery.
  - 2009 on: Evaluate contribution/ survival to return of hatchery production

- **Estimated costs**:
  - Baseline DNA analyses - $20,000-$30,000
  - Hatchery modifications and other preparations - $100,000
  - Annual hatchery program implementation - $120,000 (stock collection, DNA stock identification, hatchery operations)
  - Engineered log jams to increase attraction flows into side channel hatchery rack discharges - $250,000

- **Actions**:
  - Reduce North Fork early chinook and late timed (fall) chinook hatchery strays into the South Fork to reduce negative interactions between the stocks.

> Lead: WDFW, Lummi Nation, Nooksack Tribe
> Partners: NOAA Fisheries

— Improve the Nooksack chinook microsatellite DNA stock identification baselines to improve our ability to distinguish South Fork chinook in a mix of South Fork, North Fork and late-timed chinook and to minimize the number of ambiguous DNA stock of origin assignments
> Lead: WDFW
> Partners: Nooksack Tribe, Lummi Nation, Northwest Fisheries Science Center, Northwest Indian Fisheries Commission

— Work with geneticists to determine the genetic benefits and risks associated with culturing South Fork chinook considering the numbers taken into the hatchery and the numbers remaining in the population outside of the hatchery. Objective is to maximize likelihood of success while minimizing the potential for propagation related genetic impacts (such as having a majority of juveniles produced from a minority of the entire adult return).
> Lead: WDFW, Lummi Nation, Nooksack Tribe
> Partners: NOAA Fisheries, Northwest Fisheries Science Center, Northwest Indian Fisheries Commission

— Develop a Hatchery Genetic and Management Plan for a hatchery program at Skookum Creek Hatchery after reviewing the risks, and ways to minimize them, , and provides for adaptive management based on observed program results. Review the protocols, procedures, and lessons learned from the earlier South Fork chinook program at Skookum Hatchery and identify any factors (e.g., brood collection, fish husbandry, diseases, time and size release schedules, etc) that may need resolution before initiating a new supplementation effort.
> Lead: Lummi Nation, Nooksack Tribe, WDFW
> Partners: NOAA Fisheries, Northwest Fisheries Science Center, Northwest Indian Fisheries Commission

— Capture broodstock and transfer the appropriate number of adults to Skookum Hatchery and compare adult tissue samples to the improved microsatellite DNA stock baselines. Culture, rear and release those identified as South Fork early chinook origin.
> Lead: Lummi Nation, Nooksack Tribe, WDFW
> Partners: NOAA Fisheries, Northwest Fisheries Science Center, Northwest Indian Fisheries Commission

— Review river side-channel and adult return ladder configurations and, if needed, construct a small number of engineered log jams to increase river discharge into the side-channel that the ladder outlet delivers to, and/or improve ladder design to ensure adults will return to hatchery before returns are expected.
> Lead: Lummi Nation, Nooksack Tribe
> Partners: WDFW, DNR

Action #6: Establish new instream flows in WRIA 1

- **Goal**: Water quantity, particularly low stream flows, is a limiting factor for WRIA 1 chinook and other salmonid populations. The goal of this action is to ensure adequate instream flow levels for salmonid spawning, rearing, and migration.

- **Objective**: Propose new instream flow levels for WRIA 1 rivers and streams and begin implementation through the WRIA 1 Instream Flow Action Plan.

- **Limiting factor(s) addressed**: Water quantity

- **Status/Timeline**:
  - In 1986, the state Department of Ecology set instream flows (a minimum flow level for a given stream at a given time of the year) for WRIA 1. A key goal of the WRIA 1 Watershed Management Plan (scheduled for adoption in May/June 2005)) is to reach an agreement on new ecological flow regimes for the various streams within WRIA 1 using the best available science. The 1986 flows, which are still in effect today, are not being met in many instances. In some streams and at certain times of the year, the actual flow levels are often lower than the required levels even if no water were taken out of the stream. The state has closed many drainages in WRIA 1 to new water rights.

    In addition, since the flows were set in 1986, the science around instream flow has improved—more stream and flow data have been collected with more accurate methods, there is more knowledge about what fish need in terms of habitat, and so on. A new instream flow study was conducted throughout WRIA 1 over the 1999 to 2004 period as part of the WRIA 1 Watershed Management Project (http://wria1project.wsu.edu).

    The watershed management plan includes an Instream Flow Selection and Adoption Acton Plan (Instream Flow Action Plan) that describes a process for selecting and adopting new flow levels that are based on ecological needs and community input. The process is also intended to resolve tribal water rights claims to instream flows; it is anticipated that adopted flows will have a very senior priority date. These new flow regimes will affect how much water is available for current and future instream and out-of-stream uses, as well as the quality of water in the stream and the quantity of habitat available for fish.

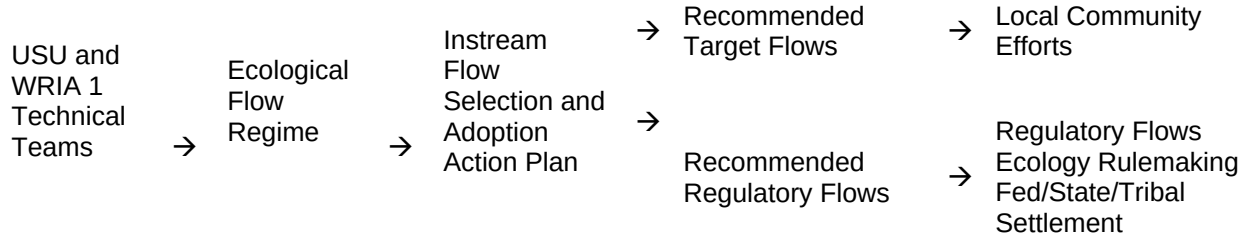
  - As described in the WRIA 1 Watershed Management Plan the next steps are the development of instream flow recommendations for two pilot drainages, the Middle Fork Nooksack River, with the City of Bellingham as the lead, and the Bertrand Creek watershed, led jointly by the PUD No. 1 of Whatcom County and the Bertrand Watershed Improvement District. These pilots are underway and will continue through 2005 and likely into 2006. As part of the Instream Flow Action Plan implementation, the results from the pilots and from the Watershed Management Plan technical studies will be used to develop instream flow recommendations for the remaining drainages in WRIA 1 starting as early as fall of 2005 and proceeding through 2010.

- **Actions**:
  - **Ecological flow regimes** for each stream will be developed using best available science. Ecological flow regimes are made up of five functional flow components: valley maintenance, riparian maintenance, channel maintenance, fisheries baseflow, and water quality maintenance flow. The ecological flow regime is the technical product of the

work currently being completed by the WRIA 1 technical teams and their consultant, Utah State University.

- **Target flows** are achievable and include consideration of instream and out-of-stream water needs. Target flows will be developed locally by the Intergovernmental Instream Flow Working Group for *each* of the ecological flow components. Target flows will be the recommended goals that will come out of local negotiations and are the flows the community agrees to try to achieve. It is noted that the target flow may be the same as the recommended regulatory flow regime.
- **Regulatory flows** will be developed locally by the Intergovernmental Instream Flow Working Group for *each* of the ecological flow components. WRIA 1 approved regulatory flows based on an agreed-to management strategy will be the recommended regulatory flow regime. The recommended regulatory flows will be submitted to: (a) Ecology for the use in the state rulemaking process to revise the current state regulatory instream flows for WRIA 1 (WAC 173-501), and (b) the Federal/Tribal/State settlement process and may be used by a judge and/or legislative body for consideration and adoption through a consent decree and/or Federal and State legislation. The result of these two adoption processes will establish the final regulatory flows.
- State and/or Federal regulatory instream flows may be different than locally recommended flows if the WRIA 1 Planning Unit and/or the Joint Board fail to reach agreement on recommended flows and do not pass on a recommendation to Ecology and the Federal/Tribal/State settlement process. Ecology or the settlement process may then undertake rule making or court or legislative action to change existing state regulatory flows. The following figure provides a summary of the overall selection and adoption process and how each of these flow terms are used.

Overall Selection and Adoption Process



- **Cost estimate**: To date, approximately $3 million has been spent developing the technical information needed for setting instream flows. It is anticipated that the development of instream flow recommendations for the Bertrand watershed will cost approximately $300,000. The development of instream flow recommendations for the remaining drainages in WRIA 1 will cost between $2 million to $3 million over the next four years.
- **Commitments/Conditions**: Implementation of the two pilot drainages was approved and is supported by the City of Bellingham, Lummi Nation, the Nooksack Tribe, Public Utility District No. 1 of Whatcom County, Whatcom County, and the WRIA 1 Planning Unit.

Action #7: Estuarine and nearshore areas

- **Goal:** Protect and restore quantity and quality of properly functioning habitat conditions in the estuarine and nearshore marine habitats that will lead to the recovery of the Nooksack stocks of chinook and other salmonids.

- **Objectives:** The near-term objectives for the next 5-10 years are to:
  - Protect ecosystem processes essential to the productivity and abundance of Nooksack chinook, bull trout, and other salmonids and the prey on which they depend. (See also Action #4.)
  - Provide incentives for the restoration of nearshore habitat structure and processes.
  - Develop and begin implementation of a prioritized list of actions for protection and restoration of habitats and ecosystem processes necessary to recover the productivity and abundance of Nooksack early chinook, bull trout, and other salmonids.
  - Minimize water quality impacts to the marine environment from watershed and shoreline activities.

- **Limiting factor(s) addressed**: Estuarine/nearshore conditions

- **Status/Timeline:** The Bellingham Bay Demonstration Pilot Project[1] and the Waterfront Futures Group[2] processes are underway and plans should be complete by 2005. Updates to local Critical Area Ordinances and Shoreline Management Programs should be complete by the end of 2005. Consultation with regional researchers and participation in the Near Shore Recovery Planning group are ongoing. WRIA 1's contribution to the larger Puget Sound-wide nearshore marine research effort is on-going. Lummi Natural Resources is currently completing a Nooksack Estuary Assessment Report that evaluates restoration needs and opportunities within the historic Nooksack estuary areas adjacent to Lummi and Bellingham bays. A joint study by the Whatcom Marines Resources Committee and Whatcom County Planning is underway to fill data gaps the inventory of marine shorelines features. Study results will provide information to guide priorities for protection and restoration within the restoration plan that is required to be developed under the Shorelines Management Program (see Action #4). Additional, nearshore and offshore studies should be completed by 2007 and a prioritized list of restoration projects should be taking shape by 2006.

- **Estimated costs**: Not available. Substantial process costs may be covered in existing budgets, but it may be anticipated that new funding on the order of $500,000 would be required to identify critical habitats and associated ecosystem processes. Given the value of waterfront property and remedial actions required to address toxic sediment issues, projects to address "migratory corridors," cover and forage fish productivity in the urbanized Bellingham Bay will likely run into the millions of dollars.

[1] The Bellingham Bay Demonstration Pilot Project is a multi-agency effort formed in 1996 to develop a cooperative approach to expediting sediment cleanup, pollution source control, and habitat restoration projects in Bellingham Bay.

[2] The Waterfront Futures Project was created in early 2003 as a visioning and master planning process for Bellingham's future waterfront redevelopment.

- **Anticipated benefits for chinook:** The EDT model was used to rate geographic areas for the benefit that restoration of those areas to historic conditions would provide to Nooksack early chinook populations. Ranks ranged from A (most benefit) to E (least benefit). Of 31 geographic areas for North Fork/Middle Fork Nooksack early chinook, the Nooksack Estuary and Marine Areas were both rated A. Of 12 geographic areas for South Fork Nooksack early chinook, the Nooksack estuary and Marine Areas were both rated B.[3] Given that less is known of specific timing and uses of estuarine and nearshore/marine systems, certainty around these ratings are lower than for freshwater habitats.

  Proposed assessment efforts will build on our existing knowledge base for Bellingham Bay and will contribute to our understanding of both the importance of WRIA 1 estuarine and nearshore marine habitats to Nooksack early chinook and bull trout and to the broader field of estuarine and nearshore marine science. Once the importance of such habitats to Nooksack early chinook productivity and abundance is further established, the prioritization and implementation of actions will contribute to recovery. In the meantime, protection efforts will be important to halt further degradation of estuarine and nearshore marine habitats and restoration opportunities identified through the Bellingham Bay Demonstration Pilot Project or other processes means will be pursued.

- **Actions**:
  - Conduct and synthesize assessments of current habitat conditions, ecosystem processes, and salmonid populations in WRIA 1 estuarine and nearshore areas (including Nooksack and Lummi River estuaries, Bellingham Bay, Lummi Bay, Chuckanut Bay, and southern Strait of Georgia). Emphasize investigation of role of estuarine and nearshore marine habitats in Nooksack early chinook productivity and abundance. Incorporate information from other applicable research throughout the Puget Sound and southern Strait of Georgia areas.
    - > Lead: Lummi Nation
    - > Partners: WDFW, NOAA Fisheries, Nooksack Tribe, investigators from other regions of Puget Sound and the Strait of Georgia
  - Use assessment results to describe desired future conditions, and plan and prioritize needed actions. Note that this correlates with the specific actions identified under Action #2 above.
    - > Leads: Nooksack Tribe, Lummi Nation, WDFW
    - > Partners: Whatcom County, Whatcom Marine Resources Committee, Bellingham Bay Pilot Project, Port of Bellingham, Puget Sound Action Team
    - > Estimated costs: $500,000, a two year program with biologists, technicians, gear, vessel time, and sample examinations (otolith and DNA)
  - Integrate specific chinook recovery needs into and facilitate implementation of Bellingham Bay Demonstration Pilot Project to clean up toxic sediments in the urbanized Bellingham Bay
    - > Leads: Port of Bellingham, Ecology

[3] Mobrand Biometrics. 2003. EDT Watershed Assessment: NF & MF Nooksack for Chinook. October 2, 2003. Vashon, WA. 78pp.
Mobrand Biometrics. 2003. EDT Watershed Assessment: SF Nooksack for Chinook. October 2, 2003. Vashon, WA. 38pp.

> Partners: Georgia Pacific, WDNR, City of Bellingham, ACOE, co-managers

— Incorporate chinook recovery needs into the Waterfront Plan for Bellingham and the Port of Bellingham redevelopment efforts at the Georgia Pacific site and other areas of inner Bellingham Bay.
> Leads: Port of Bellingham, City of Bellingham
> Partners: Waterfront Futures Group, co-managers

— Manage impacts to water quality from watershed and shoreline activities. The City of Bellingham has established a stormwater utility fee and is actively managing stormwater within the City limits to reduce impacts to both streams and the marine receiving waters. Whatcom County is in the process of implementing new stormwater programs consistent with Ecology guidelines.
> Leads: Bellingham, Whatcom County, Ecology, Port of Bellingham
> Partners: Nooksack Tribe, Lummi Nation, WDFW, US Fish & Wildlife Service, NOAA Fisheries, ACOE

— Integrate salmon recovery needs into SMP Restoration Plan, and general shoreline planning and development/redevelopment.
> Leads: Port of Bellingham, Whatcom County, City of Bellingham
> Partners: Nooksack Tribe, Lummi Nation, WDFW, US Fish & Wildlife Service, NOAA Fisheries, ACOE

— Implement projects necessary for recovery of Nooksack early chinook and monitor and evaluate impacts on salmon recovery. Potential short-term actions include habitat restoration in Nooksack River estuary and non-natal estuaries, forage fish spawning beach and eelgrass bed restoration, improvement of migratory corridors along marine shorelines, and restoration of marine riparian areas.
> Lead: WRIA 1 Salmon Recovery Board
> Partners: Whatcom County, Port of Bellingham, Whatcom Marine Resources Committee, ACOE, Nooksack Tribe, Lummi Nation, WDFW, NOAA Fisheries, US Fish & Wildlife Service, Salmon Recovery Funding Board, Bureau of Indian Affairs, Dept of Commerce

— Public Outreach. Engage the general community and affected cities in developing a nearshore restoration vision. Seek landowner and city agreements for nearshore reach restoration plans and projects.
> Anticipated results towards meeting recovery targets:
  o Community support of reach restoration objectives and specific projects and project benefits.
> Lead: Whatcom County, Bellingham, and Salmon Co-managers
> Partners: Cities, Shellfish Protection Districts, Marine Resource Committee, Whatcom Conservation District
> Timeline:
  o Develop and implement comprehensive approach by mid-2006
> Estimated cost: $25,000 to develop, $15,000/year to implement
> Commitments/Conditions:
  o Whatcom County, Bellingham, and Salmon Co-managers will work with partners to jointly develop outreach Plan.
  o Dependent on consistent funding

- Dependent on ability to adjust foundation outreach plan and effort to meet needs of specific communities along the river.

— ***Total Estimated costs $5,000,000 for chinook related project actions***.

Action #8: Restore functioning riparian and water quality conditions and reconnect isolated habitat in lowland tributaries (mainstem) and independent tributaries to the Fraser River and the Strait of Georgia

- **Goal**: Implement projects that address identified limiting factors such as impaired riparian functions and water quality, and that reconnect isolated habitats in Nooksack River tributaries and the independent tributaries to the Fraser River and Strait of Georgia. Support on-going efforts that prevent further habitat degradation, restore ecological processes where feasible, and implement cost-effective, community-based restoration to support the recovery of chinook, bull trout, and other WRIA 1 wild spawning salmonids. This action differs from Action #2 in that only indirect benefits to early chinook are expected but the methods and basic strategies employed are consistent.

- **Limiting factor(s) addressed**: Access, riparian conditions, water quality

- **Status/Timeline**: Comprehensive culvert inventory is expected May 2005; initial work plan to implement priorities will following in mid- 2005; riparian improvements are on-going and will continue pending funding and continued support by WRIA 1 SRB members.

- **Estimated cost**: See individual actions below.

- **Anticipated benefits for chinook and other salmonids**:
  — Unimpeded access to full range of historic habitats will support both long-term diversity and spatial structure parameters of VSP.
  — Restoration of biological and physical processes that support a range of ecological functions necessary to restore chinook and other wild salmonids in WRIA 1.

- **Actions**
  — Remove barriers to fish passage. Whatcom County is completing a comprehensive inventory of road culverts that fully or partially block fish passage focusing on County and private roads. Other jurisdications including WDNR, WDFW, USFS, WSDOT and large forestry landowners are also completing similar inventories, and available information has been included in the comprehensive inventory. The final report will be available in mid 2005. The next phase, currently in contract negotiations, is to bring the top 10 – 20 priority barriers to full design and permitting such that funding packages can be sought. Barriers are prioritized for correction based on benefit to priority species and miles of habitat opened up, and Whatcom County will work with the other jurisdictions to prioritize benefit to listed species over others to maximize benefits, instead of simply using the SSHEAR Priority Index rating, which by its nature may lead to prioritization of non-listed species over listed ones. This information will be used to identify, and prioritize funding to fix inventoried fish passage barriers.

- > Anticipated results towards meeting recovery objectives
  - o Restore access to full range of habitats occupied by salmonids native to WRIA 1
- > Leads: Whatcom County, Nooksack, Lummi, WDFW
- > Partners: Nooksack Salmon Enhancement Association WSDOT, local Public Works departments, private landowners
- > Partners' roles: Leadership in pursing design, permitting, and funding of priority passage problems.Technical assistance, provide supplemental inventories if needed, aid County and other jurisdictions in setting priorities and sequencing of passage improvements, assistance in evaluating project effectiveness and monitoring results,
- > Timeline: The comprehensive barrier inventory will be complete by May 2005. Phase 2 of the inventory, taking priority sites to design and permitting is in the proposal review and contract stage and will be completed by June 2006. The public works departments of Whatcom County and Bellingham are also actively restoring passage during regular maintenance work. Both public and private entities will have access to the comprehensive inventory and will be able to use this data to build passage restoration into annual maintenance and operations budgets and to develop specific funding requests for grants or requests for legislative or Congressional support.
  - o Estimated costs: Inventory - $705,000
  - o Supplemental inventory if needed - $10,000 for 5 years
  - o County fixes 5-10 priority barriers opening up 5 – 10 miles each year through Maintenance and Operations section - $300,000/year.
  - o County fixes specific priority passage problems beyond M & O scope using bridges or culverts through Special Projects section - $200,000/year
  - o Other detailed costs to be developed based on the outcome of the comprehensive inventory and WRIA 1 Salmon Recovery Board direction regarding priorities and preferred timelines to implement.
- > Commitments/Conditions:
  - o Completion of full inventory dependent on availability of RMAPS, USFS, and WSDOT data
  - o Current County rate of barrier correction is dependent on staffing and funding levels. Additional staffing and outside funding are necessary to increase rate at which culverts are replaced.

— Maintain Existing Fish Passage Structures. Regular maintenance by WSDOT of the Anderson Creek fishway under SR 542 is necessary to ensure passage and restore passage to upper reaches of the watershed.

- > Anticipated results towards meeting recovery objectives
  - o Restore access to full range of habitats occupied by salmonids native to WRIA 1
- > Leads: WSDOT
- > Partners: Nooksack Tribe, WDFW, Lummi Nation
- > Partners Roles: Technical assistance.
- > Timeline: Passage should be evaluated annually before upstream migration of salmon and following each significant storm event.
- > Commitments/Conditions:
  - o WSDOT affirmation they are aware of the issue and commit to regular inspection and maintenance.

- Funding to perform regular inspection and maintenance.

— Management of stormwater to prevent or minimize negative effects to salmonid habitat and water quality: On-going initiatives in WRIA 1 include the City of Bellingham and Whatcom County implementing the six key actions under the Phase II guidelines with the end goal being to obtain NPDES general permits by the end of 2005. The small cities in the county that are not subject to the Phase II Guidelines are addressing stormwater through implementation of standard BMP's and special conditions as necessary under existing permitting systems.
  > Anticipated results towards meeting recovery objectives
    - Maintain or improve water quality to meet the needs of all wild spawning WRIA 1 salmonids including ESA listed species (chinook and bull trout)
    - Control of stormwater at sources and prevention of habitat degradation or unnecessary delays in habitat recovery
  > Leads: Whatcom County, Bellingham, Whatcom Conservation District, Ecology
  > Partners: Other WRIA 1 Salmon Recovery Board members, NRCS
  > Partners' roles: Provide technical assistance, guidance on priorities, assistance in securing funding.
  > Timeline:
    - The timing of Bellingham and Whatcom County implementation of stormwater guidelines will depend on the schedule that will be issued by Ecology
    - Whatcom Conservation District farm plan development and implementation - on-going
  > Estimated cost: TBD during the development of the NPDES permits.
  > Commitments/Conditions
    - Commitments to NPDES permit process by County and Bellingham
    - Conditioned on financial resources to implement, maintain, and evaluate

— Implementation of farm plans: The Whatcom Conservation District has completed farm plans for all commercial dairy farms in the county and is now developing programs to address stormwater runoff via plans for the numerous "hobby" farms throughout the county. The intent is to continue the work of the Whatcom Conservation District and the NRCS, shellfish protection districts, and others to support community actions that promote implementation and maintenance of BMP's to address water quality related limiting factors. The partial reopening of Drayton Harbor shellfish beds in June 2004 is an example of a highly successful program driven by the community and supported by government that identified major factors degrading water quality and set in place specific corrective actions. These corrective actions produced rapid and measurable water quality improvements that the community desired. This serves as a successful local example of an approach for dealing with the fine sediment, temperature, toxics, and dissolved oxygen limitations identified as factors limiting WRIA 1 salmon. The monitoring needs of community efforts such as this will be coordinated to the extent possible with on-going monitoring such as is occurring under the WRIA 1 Watershed Management Project.
  > Anticipated results towards meeting recovery targets:
    - Measurable improvements in water quality in reaches for which treatments are devised (may or may not be salmon bearing, but affect salmon bearing waters)
    - Measurable improvements in water quality in downstream reaches that are salmon bearing.

- > Lead: Whatcom Conservation District, Department of Ecology
- > Partners: WRIA 1 Salmon Recovery Board members
- > Partners' roles: Technical and political support and coordination, partial financial support
- > Timeline:
  - o Develop hobby farm plans by the end of 2006
  - o Implement all plans by 2007
- > Estimated cost:
  - o Farm plan development – approximately $150,000/year
  - o Sub-basin water quality improvement coordination and BMP implementation - TBD
- > Commitments/Conditions:
  - o Commitment of the WCD Board approval to accept the task of developing farm plans
  - o Conditioned on sufficient funding for WCD to create farm plans
  - o Commitment of individual farms to implement the plans.
  - o Commitment of state or federal funds to provide incentives to implement.

— Implementation of a full range of voluntary restoration efforts such as restoring Tenmile Creek riparian function, channel/habitat structure, and wetland habitats.

- > Anticipated results toward meeting recovery targets:
  - o Reduce anthropogenic impacts on downstream early chinook habitats (e.g. instream flows, water quality)
  - o Improvement of riparian habitats and streamflow conditions for other salmonids.
- > Lead: Tenmile Creek Partnership, Bertrand Watershed Improvement District; Whatcom Conservation District (CREP), Nooksack Salmon Enhancement Association.
- > Partners: Lummi, Nooksack, WDFW, Whatcom County, Nooksack Recovery Team
- > Partners' roles: Provide technical expertise in establishing desired future conditions, salmonid habitat needs and priorities; assist in grantwriting, funding, and project implementation.
- > Timeline: 2005-2015
- > Estimated cost: To be funded by existing programs and funding mechanisms with a community focus , i.e. actions are lower priorities for WRIA 1 chinook recovery funding request..
- > Commitments/Conditions.
  - o Continued community support
  - o Adequate funding.

— Public Outreach. Engage the general community and affected cities in developing a restoration vision. Seek landowner and affected city agreements for reach restoration plans and projects.

- > Anticipated results towards meeting recovery targets:
  - o Community support of reach restoration objectives and specific projects and project benefits.
- > Leads: Tenmile Creek Partnership, Bertrand WID, Whatcom Conservation District, NSEA, WDFW
- > Partners: FCZD, Drainage and Diking Districts, Salmon Co-managers

- Timeline:
  - On-going for Tenmile, Bertrand, Terrell Creeks.
  - Will occur simultaneously as drainages proceed.
- Estimated cost: $15,000/watershed/year
- Commitments/Conditions:
  - Dependent on consistent funding
  - Dependent on ability to adjust basic outreach plan and efforts to meet needs of specific communities.