Skagit Watershed Council
Year 2022 Strategic Approach

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INTRODUCTION

The Skagit Watershed Council's 2022 Strategic Approach is updated from the 2005 2010 and 2015 Strategic Approaches. The Approach has evolved since its inception as a multispecies restoration Strategy in 1998, to a Chinook-focused Strategic Approach for habitat restoration in 2005. These revisions have been motivated by the need to incorporate new information about the relative importance of tributary and pocket estuary rearing habitat for juvenile salmon since the Skagit Chinook Recovery Plan (2005) was published. Our Strategic Approach is expected to be periodically revised as information improves, short-term objectives of the Council change, and long-term goals for salmon recovery in the Skagit and Samish evolve through Council discussion and regulatory mandates (e.g., 4(d) rules, ESA status, the Puget Sound Action Agenda, etc.).

Our Strategic Approach remains committed to restoring and protecting landscape processes that will produce the long-term, sustainable recovery of habitat conditions that benefit multiple species, but it also continues to evolve to better account for significant human constraints that prevent full restoration of processes in both the delta and floodplains and with the understanding that long-term watershed health is in part dependent on the community. The Skagit Watershed Council also recognizes that habitat restoration efforts will not fully restore all historical habitats in the Skagit River basin, and that Chinook salmon recovery is balanced against a variety of other ecosystem goods and services derived from the watershed. Hence, expected outcomes of restoration efforts should be tempered by a realistic view of human constraints that are unlikely to be removed or modified in the near future (e.g., certain dams or levees). This leads to more realistic expectations of what is possible, and a clear recognition that restoration actions in heavily constrained areas such as the lower Skagit will likely be dominated by habitat creation efforts that strive to mimic habitats that would naturally occur. An important challenge for habitat restoration in the Skagit basin is to assure that the suite of actions eventually taken is sufficient to support Chinook salmon populations that meet the recovery goals.

KEY CONCLUSIONS OF THE CHINOOK RECOVERY PLAN

The primary aim of this Approach is to be more strategic by targeting specific areas that are identified in the Chinook Recovery Plan as most important for Chinook habitat restoration and

protection. The Skagit Chinook Recovery Plan identifies six populations of Chinook salmon in the Skagit River basin (Table 1, Figure 1), and four different juvenile Chinook life history types (fry migrants, tidal delta rearing migrants, parr migrants, and yearlings). Chinook fry of all populations emerge from the gravel between late January and mid April. "Fry migrants" spend the least time in the Skagit River, migrating downstream to Skagit Bay within a few days to a few weeks following emergence. "Delta rearing migrants" migrate downstream through the Skagit River during the same time period as fry migrants, but reside in freshwater and estuary areas of the delta for several weeks to several months before moving to Skagit Bay. "Parr migrants" spend several weeks to several months rearing in the freshwater habitats. Parr migrants are dependent upon shallow riverine rearing habitats along the mainstem Skagit. "Yearlings" are juveniles that remain in freshwater habitats for over one year. After residing in stream and riverine habitats for a year, these juveniles migrate downstream to Skagit Bay from late March through June. The Cascade, Upper Sauk, and Suiattle River populations are largely comprised of yearling juveniles, whereas the other populations are primarily sub-yearlings.

The Skagit Chinook Recovery Plan (2005) identifies three major habitat types that currently limit population sizes of Chinook salmon in the Skagit River basin: (1) tidal freshwater and estuary habitats in the delta, (2) shallow nearshore habitats including pocket estuaries, and (3) freshwater rearing areas in mainstem and tributary floodplains. A fourth aspect of habitat loss is the alteration of watershed processes that control tributary habitat conditions, including changes in sediment supply, flow regime, and riparian functions. There has been a net loss of 73% of tidal delta and 98% of non-tidal delta areas, 86% of pocket estuaries, and 37% of the large river floodplain (upstream of the non-tidal delta) (Skagit Chinook Recovery Plan 2005). Each of these areas has the potential to provide significant rearing area for juvenile Chinook of all life history types, and all life-history types are present to colonize restored habitats. Therefore, the Chinook Recovery Plan recommends restoration and protection actions that address each of these four factors that limit recovery of Skagit Chinook.

GUIDING PRINCIPLES

The Skagit Watershed Council's 2004 Strategic Approach adopted three previously-developed principles to guide restoration efforts in the Skagit River basin: (1) target the most biologically important areas for restoration and protection, (2) protect the highest quality habitat first, and (3) do the most cost-effective projects first. However, these principles are challenging to implement strategically because existing land and water uses constrain restoration options. Perhaps most importantly, the notion of doing the best and most cost-effective projects first is rarely possible because of such constraints. In the 2010 Strategic Approach we recast these principles based in part on our past experience, and in part on recent scientific contributions to the philosophy and conceptual basis for river restoration. These principles strive to guide projects toward those that will lead to recovery of Chinook salmon in the Skagit River basin.

Principle #1: Restore processes that form and sustain salmon habitats

The Skagit Watershed Council's Habitat Protection and Restoration Strategy (1998) is founded upon an overarching restoration goal of encouraging the voluntary restoration and protection of natural landscape processes that formed and sustained the habitats to which salmon populations are adapted. This process-based approach aims to re-establish natural rates and magnitudes of physical, chemical, and biological processes that create and sustain river and floodplain ecosystems, thereby supporting recovery of Chinook salmon. Important process-based restoration actions in Skagit basin include restoring natural tidal, river, and erosion processes to delta habitats, restoring river-floodplain interactions and the formation of off-channel habitats, and plant growth and successional processes in riparian areas (Beamer et al. 2005). Additional processes include sediment erosion, deposition and transport; water storage and routing; input of nutrients and thermal energy; and nutrient cycling in the aquatic food web. Process-based restoration focuses on correcting anthropogenic disruptions to these processes, so that the river-floodplain ecosystem recovers with minimal future maintenance and has the capacity to respond to future climate change through natural physical and biological adjustments (Sear 1994, Beechie et al. 2010).

This approach contrasts with restoration efforts that focus on creating specific habitat characteristics to meet perceived "good" habitat conditions or uniform habitat standards (Wohl et al. 2005). These habitat creation efforts commonly attempt to control processes and dynamics rather than restore them, and often include channel stability as a criterion for success (Beechie et al. 2010). By contrast, efforts that re-establish habitat forming processes promote recovery of habitat and biological diversity, and include river dynamics as criteria for success. Because process restoration focuses on restoring critical drivers and functions, such actions will help avoid common pitfalls of engineered solutions such as creating habitats that are unsuited to the natural potential of a site or building habitats that are ultimately destroyed by untreated watershed or river processes (Beechie and Bolton 1999).

Restoration actions should (1) address the underlying cause of degradation, (2) be tailored to local physical and biological potential, and (3) match the scale of restoration with the scale of underlying problem (Beechie et al. 2010). Each reach in a river network has a relatively narrow range of channel and riparian conditions that match its physiographic and climatic setting, and restoration actions should be designed to correct disruptions to driving processes and redirect channel and habitat conditions into that range. Moreover, in order for restoration actions to succeed, the scale of the action must be at a scale that matches the scale of the underlying cause of degradation. That is, reach-scale problems such as riparian degradation or channel constraint by levees can be addressed at the reach scale, whereas sediment supply or hydrology issues must be addressed at larger scales.

The Role of Constraints in Choosing Restoration Actions and Designs

Restoration of Chinook salmon habitats in the Skagit River basin is constrained by competing land and water uses, particularly in the reaches downstream of Sedro Woolley. Therefore,

natural processes that shape river and delta habitats are not always fully restorable, and restoration actions must often concede to some level of human constraint. In some cases such actions may be less costly in the short-term, but future maintenance costs will be higher and benefits to listed Chinook populations will be lower. By contrast, restoration actions that fully restore natural processes may be more costly in the short term, but have little or no future maintenance cost and greater benefits to Chinook salmon. Considering these tradeoffs in selection of projects is not trivial, and deciding when concessions to constraints are necessary is difficult.

To assist in evaluating proposed projects, the Skagit Watershed Council recognizes that restoration projects fall into one of three general types: full process restoration, partial process restoration, and habitat creation (Table 2). Full restoration actions are most consistent with the underlying philosophy of process-based restoration, as their specific aims are to address underlying causes of habitat degradation, and to restore habitat conditions and dynamics that support salmon populations. Such actions are generally more effective and sustainable than the other two action types, but partial restoration and habitat creation are not excluded as options. Partial restoration actions are largely consistent with the Council's process-based approach, but they acknowledge some limitation on process restoration. Habitat creation actions are fundamentally least consistent with the process-based approach, but such actions can be designed in the context of recently developed process-based principles to assure maximum contributions to Chinook recovery. These principles guide habitat creation actions to be (1) consistent with historical habitat types at the site, (2) designed in accordance with current habitat-forming processes (which are altered by human constraints), and (3) designed at an appropriate scale for the site (Beechie et al. 2010). Actions designed in accordance with these three principles are more likely to provide significant habitat benefits for Chinook salmon, and to require minimal future maintenance.

Principle #2: Protect functioning processes and habitats from degradation

The Council's Strategy describes the importance of protecting habitats and natural processes that retain a substantial measure of their natural productivity for salmon. In the Council's Strategy, these areas are generally referred to as key habitat. Protecting these highly functioning habitats is: 1) essential for anchoring highly productive spawning and rearing areas for long-term recovery, and 2) more cost-effective than attempting to restore degraded processes and habitats (Beechie et al. 2008). However, habitat protection commonly does not increase habitat function or salmon populations, and by itself cannot achieve recovery of Chinook salmon.

One of the most important aspects of Chinook recovery in the Skagit River basin is protection of the remaining high quality habitats in the Tier 1 and Tier 2 target areas below. Only 27% of Skagit tidal-delta habitats, 2% of non-tidal habitats, 14% of pocket estuaries in the Whidbey basin, and 63% of side channel habitats in the Skagit basin remain intact, and preventing further losses of these habitats is a critical component of Chinook salmon recovery, estimated at 60%

of the overall Recovery Plan goals. Moreover, protecting currently non-functioning habitats may in some cases lead to improved habitat conditions as those habitats return to a more natural condition in the future. Nonetheless, it is important to note that habitat protection efforts alone will achieve relatively little increase in productive capacity of the basin, so restoration actions will also be required to achieve Chinook salmon recovery. Habitat protection actions are especially important in areas where legal protections are insufficient to prevent habitat degradation.

Principle #3: Focus protection and restoration on the most biologically important areas

The Puget Sound Chinook Recovery Plan identifies loss of delta and floodplain habitats in the lower Skagit River basin as the main constraints on Chinook salmon recovery. Therefore, this guiding principle encourages project proposals that focus habitat restoration and protection efforts in those target areas. While our long-term Strategy (Skagit Watershed Council 1998) is a multi-species approach to watershed and salmon habitat restoration and protection, projects addressing critical rearing habitats for multiple Chinook salmon populations in the Skagit delta and floodplains are the focus at this time. Lack of rearing habitat in the mainstem, floodplain, and lower major tributaries of the Skagit River continue to be confirmed as the major habitat limiting factor for increasing most Chinook salmon populations particularly for peak flood impacts during incubation (SRSC and WDFW 2005; Zimmerman et al. In press). The tiered target areas described below reflect this current focus.

TARGET AREAS

For this update of the Strategic Approach, the Skagit Watershed Council has refined the target areas based on the Skagit Chinook Recovery Plan (Figure 2, Table 3); a multiple regression analysis predicting tributary spawner densities; an intrinsic potential assessment for major Chinook tributaries; an assessment of the proportion of tributary spawners per Chinook population; and a GIS analysis of the intrinsic potential for tributary rearing habitat supervised by recently completed yearling studies (Beamer et al. 2010; Lowery et al. in development; Connor et al. 2015). These target areas are divided into three tiers based on their importance to Chinook salmon recovery, and on the number of populations that will benefit from habitat protection and restoration actions within each area. While projects in all tiers are consistent with the Chinook Recovery Plan, projects within the Tier 1 and 2 target areas are the primary focus as they are the habitats with the greatest potential to increase Chinook salmon populations. We recognize that the target areas do not encompass all important areas for all salmon. Targeting all species simultaneously would likely result in priority areas covering nearly the entire basin, and provide little basis for prioritizing restoration and protection actions for the Council.

Maps included as figures herein have planning-level information and are secondary to the target area narrative criteria. Identification of eligible floodplain areas and Chinook salmon distributions, for example, has not occurred comprehensively and/or thoroughly in all target

areas, so if additional information is required it is the responsibility of project sponsors to provide evidence in their applications for how each site's floodplain and/or fish distribution was determined.

The Baker River system upstream of the fish trapping facility is currently omitted from our target areas because it is partially isolated from the Skagit by Lower Baker and Upper Baker hydroelectric dams (the Baker River Hydroelectric Project) which completed the Federal Energy Regulatory Commission (FERC) relicensing process in 2008. The Baker basin (upstream of the Upper Baker Dam) contains high quality salmon habitat in either natural or moderately disturbed condition, and has relatively little anthropogenic sediment impairment. The vast majority of this upstream habitat is in protected, federal ownership. Moreover, the basin is not accessible by Chinook salmon at this time as they are no longer passed upstream of the lower dam by Puget Sound Energy.

Tier 1 Target Areas

The 1st Tier target areas are the Skagit estuary, riverine tidal delta, and river floodplains that provide rearing habitats for juveniles of multiple Chinook salmon populations. These areas currently constrain Chinook salmon recovery, and therefore have the highest potential benefit to Skagit wild Chinook salmon at this stage in implementation of the Skagit Chinook Recovery Plan.

Skagit estuary and riverine tidal delta target area

Target Area Description
The Skagit estuary and riverine tidal delta target area includes:

- Historic extent of the estuarine emergent wetland zone and estuarine scrub-shrub wetland zone adjacent to Skagit Bay and the North and South forks of the Skagit River, as well as the Swinomish Channel corridor and contiguous wetlands on Padilla Bay (Collins 2000).
- Historic extent of riverine tidal forested and riverine tidal scrub-shrub zones, particularly the North and South forks up to and including Cottonwood Island (Collins 2000).

Rationale for target:
The Chinook Recovery Plan identifies loss of rearing habitat in the delta as the primary habitat factor limiting recovery of Skagit River Chinook populations. In the past 150 years, 73% of tidal delta and 98% of non-tidal delta habitats have been lost, and the limited remaining habitats are insufficient to support juvenile Chinook salmon from the six populations (Skagit Chinook Recovery Plan 2005). Therefore, the Skagit delta is included in the highest priority Tier 1 target area.

Priority objectives:
The primary restoration objectives in this target area are to restore habitat capacity and connectivity in the Skagit delta. Specific recommended actions include:

- Restore distributary channels connecting the North Fork of the Skagit River to the Skagit bayfront.
- Restore connectivity between the North Fork and the Swinomish Channel/Padilla Bay area by addressing the barriers created by the McGlinn Island Causeway, jetties, levees, and Highway 20.
- Restore estuarine emergent and scrub-shrub wetlands that are directly connected to the North or South Fork Skagit River or a major distributary channel.
- Restore functioning riverine tidal forested and scrub shrub wetland habitat through actions such as dike removal and/or set back.
- Restore natural riparian structure and processes (including shade, large woody debris recruitment, and root reinforcement of banks and adjacent unstable slopes) by reforesting impaired riparian zones.
- Implement actions to improve water quality in areas identified as impaired.
- Protect existing high quality habitat and contribute to restoration actions through acquisition or permanent conservation easement.

Issues/challenges:
A major challenge in this target area will be achieving the community support necessary to realize significant habitat gains on or near privately owned lands (most of which has been heavily invested in agricultural production for many years). A second major challenge is incorporating potential effects of climate change on effectiveness of protection and restoration actions (e.g., sea-level rise will shift locations of delta habitat types). Predictions of such changes should be incorporated into project identification and design as they become available.

Floodplain target area (multiple population rearing)

Target Area Description:
The large river floodplain target area includes mainstem river, floodplain, tributaries within the floodplains, and floodplain-adjacent alluvial fans of the Skagit and Sauk Rivers that provide rearing habitat for multiple Chinook populations (Figure 2).

Rationale for target:
Chinook salmon utilize habitats in the mainstem and floodplain of the Skagit and Sauk Rivers extensively for migration, spawning, refuge and rearing. These floodplain habitats and contributing upland areas have been significantly altered over the past 100+ years due to road building, bank hardening, hydropower operations, timber harvest in riparian and upland zones, rural development, etc. Upstream of the delta, 61 miles of the mainstem channel edge has been hardened with riprap, and 31% of floodplains have been isolated from the river (Skagit Chinook Recovery Plan 2005). The Skagit basin has also lost approximately 37% of the historic side channel habitat that provided critical rearing and refuge functions in the floodplain (Skagit Chinook Recovery Plan 2005). An analysis of riparian vegetation conditions in these floodplain habitats throughout the Skagit basin found significant impairment in most of the reaches surveyed (Beamer et al., 2000). Recent research in the Skagit has found the junctions between tributaries and mainstem channels where alluvial fans are formed to be biological “hot spots”

for habitat diversity and salmon utilization (Kiffney et al. 2003). Many of these fans have been delineated and are included in this target area where they are adjacent to the mainstem floodplain.

Priority objectives:

- Reconnecting isolated floodplain areas and restoring mainstem edge habitat by removing, relocating, or improving hydromodifications and floodplain structures or roads that restrict natural floodplain and fan functions.
- Restore natural riparian structure and processes (including shade, large woody debris recruitment, and root reinforcement of banks and adjacent unstable slopes) by reforesting impaired riparian zones.
- Acquire lands or conservation easements to permanently protect high priority parcels or facilitate restoration actions.

Issues/challenges:
One objective for future Strategic Approach revisions will be to develop acceptable criteria for distinguishing among the targeted floodplain reaches, similar to that under development for the mainstem Skagit between Rockport and Sedro Woolley. Further work over the next year or two will provide much clearer objectives for this target area that will help identify specific actions and better guide project identification.

Tier 2 Target Areas

Additional habitat losses that significantly impede Chinook salmon recovery are pocket estuaries in the nearshore marine area and river floodplains that provide rearing for single Chinook salmon populations, including fourteen Skagit tributaries that provide significant spawning and rearing habitats. These are considered the Tier 2 target areas (Figure 2).

Nearshore pocket estuary target area

Target Area Description:
Pocket estuaries are small embayments within the nearshore that form behind spit or barrier beach landforms or at small creek deltas. This target area includes all pocket estuaries within Whidbey Basin (Beamer et al. 2006).

Rationale for target:
Pocket estuaries are used by wild juvenile fry migrant Chinook during late winter through early spring (Beamer et al. 2003; Beamer et al. 2006). These habitats provide extended rearing and growth opportunities for these Chinook, as well as refuge from predatory species. Eighty six percent of the total historic pocket estuary area in close proximity to the Skagit delta was blocked to non-natal salmon use and the habitat-forming forces of tidal hydrology. Restoration and protection of this habitat will benefit the fry migrant life history type and help alleviate the effects of overcrowding in the Skagit delta, though pocket estuary restoration is not a substitute for delta restoration. To maximize recovery benefits for Skagit Chinook salmon in pocket estuaries it is important to focus restoration effort on pocket estuaries with a high

degree of connectivity to the Skagit Delta (part of WRIA 3), or in areas of Whidbey Basin where connectivity between individual pocket estuaries is low (i.e. pocket estuaries are far apart) to increase connectivity. Supporting the efforts of other lead entities in WRIAs 5, 6. 7, and 8 in restoring the Whidbey Basin sites will also contribute to implementation of the Skagit Chinook Recovery Plan.

Priority objectives:
Protect and/or restore natural landscape and riparian processes, connectivity, and habitat functions that form and maintain the identified pocket estuaries in Whidbey Basin (SRSC and WDFW 2005, Beamer et al. 2006) (including acquisition of land necessary to achieve this objective).

Issues/challenges:

The nearshore marine areas of the Skagit and Samish basins encompass considerably more habitat than the pocket estuaries, including vegetated and unvegetated intertidal flats, subtidal flats, rocky reefs, the pelagic zone, beaches, backshore areas, and marine riparian zones. The value of these habitats for Chinook salmon is largely unknown. However, a recent NOAA study (Greene et al., 2005) has shown that environmental factors during the nearshore life stage significantly influence adult spawning recruitment, indicating the need to better understand the nearshore system and its role in recovery of Skagit Chinook salmon. The Salish Sea Marine Survival Project also found that prey availability in the nearshore may be adversely impacting marine survival. Continuing research to assess current habitat conditions and salmon habitat use throughout the nearshore to understand the processes and conditions that may be limiting salmon production will help us target the most effective salmon restoration and protection actions in the nearshore. In the interim, it is the Council's decision to focus nearshore habitat restoration and protection actions on pocket estuaries because potential benefits to Chinook salmon are well established. However, pocket estuaries are particularly susceptible to sea level rise impacts given their shoreline location (i.e. usually bordered by higher elevation uplands rather than a gradual river delta). Sea level rise modeling should eventually be incorporated into selection and design to ensure restoration goals are achieved and sustained through time.

Floodplain target area (single population rearing)

Target Area Description:
The single population floodplain target area includes mainstem or tributary floodplains and adjacent areas that provide or significantly influence spawning and rearing habitat for single Chinook populations. The upper extent of this target area is the end of documented Chinook presence in the mainstem of the identified tributary, which is shown in Figure 2. Eligible tributary floodplain areas are those identified as moderately confined or unconfined valleys wider than 2 channel widths using TFW protocols (Pleus and Schuett-Hames 1998). As noted above, it is the responsibility of the project sponsor to provide documentation of site eligibility, though SWC and other staff are available to support this endeavor by request.

Specific target areas include:

- Mainstem and large floodplains of the upper Skagit, upper Sauk and South Fork Sauk, upper Cascade, and Suiattle Rivers.
- Key tributary floodplains above the mainstem floodplains that contain significant rearing habitat for Chinook salmon, including Nookachamps Creek, Hansen Creek, Day Creek, Finney Creek, Illabot Creek, Diobsud Creek, Bacon Creek, Goodell Creek, Tenas Creek, Buck Creek, Downey Creek, Dan Creek, White Chuck River, and North Fork Sauk.
- Floodplain-adjacent unstable slopes, alluvial fans, and riparian areas (generally not more than 2 site-potential tree heights in width).

Rationale for target:
Chinook salmon utilize habitats in the mainstem and floodplain of the upper Skagit, upper Sauk, upper Cascade and Suiattle Rivers extensively for migration, spawning, and rearing. These floodplain habitats and contributing upland areas have been significantly altered over the past 100+ years due to road building, bank hardening, hydropower operations, timber harvest in riparian and upland zones, and rural development. These areas are separate from Tier 1 floodplains because protection and restoration actions in these mainstem floodplains benefit only one population of Chinook salmon.

Recent studies have confirmed that tributary spawning and rearing by Chinook salmon is an important life history for long-term viability as it provides additional capacity, refuge from mainstem disturbances (e.g. floods), and diverse spatial structure. Analyses completed for the 2015 Strategic Approach (Connor et al. 2015) yielded a list of tributary floodplains for inclusion in Tier 2 target areas. While these tributaries were explicitly incorporated into the Tier 2 target area category to reflect their value relative to Tier 1 target areas, it should be noted that most of these tributaries likely do support rearing by juveniles from multiple populations, though in lower abundances than the mainstem areas.

Priority objectives:

- Reconnecting isolated floodplain areas and restoring mainstem edge habitat by removing, relocating, or improving hydromodifications and floodplain structures or roads that restrict natural floodplain and fan functions.
- Acquire lands or conservation easements to permanently protect high priority parcels or facilitate restoration actions.
- Restore natural riparian structure and processes (including shade, large woody debris recruitment, and root reinforcement of banks and adjacent unstable slopes) by reforesting impaired riparian zones and LWD supplementation where necessary to recover pool-riffle habitat until trees mature.

Issues/challenges:
As with the Tier 1 floodplains, there are currently no clear criteria for distinguishing among the tier 2 floodplain reaches. Future assessments should focus on identifying clearer restoration objectives and specific actions necessary to support Chinook salmon recovery.

As described below for Tier 3 watersheds, considerable sediment reduction work has been done in many of these watersheds, and it is currently unclear which, if any, of these basins remain priorities for sediment reduction efforts. An updated sediment supply analysis is needed to better target upland protection and restoration actions within the Tier 2 floodplain target area.

Tier 3 Target Area

Sediment and hydrology impaired watersheds

Target Area Description:
The Tier 3 target area includes watersheds that have been identified as having impaired (elevated) sediment supply or peak flows (Skagit Chinook Recovery Plan 2005).

Rationale:
The scientific rationale for this Tier is that sediment contributions and increased peak flows to Chinook spawning areas contribute to reduced survival of eggs to emergence (Greene et al. 2005), while spawning area availability appears to be sufficient to support greater spawner populations (Beechie et al. 2006). This target area includes tributaries that deserve our most immediate attention in the near term (next 10 years), based primarily on their importance to Chinook salmon. Some of these areas were previously described as sediment impaired, and numerous tributaries in the lower Skagit have poor or degraded riparian, floodplain, peak flow, road density, and sediment supply conditions. These impaired processes fill pools and aggrade channels, increase the proportion of fine sediments in channel beds, increase the frequency of channel forming and bed mobilizing flow events, and decrease habitat complexity and resilience to

floods. Important biological effects of these changes include reduced rearing capacity and reduced egg to fry survival.

While restoring natural riparian structure and processes through riparian planting, as well as channel/floodplain processes with LWD supplementation as an interim measure, are important objectives, the sequence of implementation should assure that degraded watershed processes upstream have been remediated first to reduce the risk of failure of these types of actions.

Priority objectives:

- The priority objective For Tier 3 is to reduce land use impacts on sediment supply and peak flows.
- Repair, relocate, or remove roads, bridges, culverts and other man-made structures that contribute to (or are at high risk of contributing to) significantly increased erosion or peak flows.
- Acquire lands or conservation easements to permanently protect high priority parcels or facilitate restoration actions.

Issues/challenges:

Much road sediment reduction work has been accomplished on federally managed land since the assessments informing the Council's strategy application (Beamer et al. 2000) were conducted. Many sediment "impaired" watersheds have been rehabilitated and additional road surveys conducted. An update of the road sediment analysis from the 2000 assessment is needed to revise our priorities for sediment reduction work.

Existing land use regulations are assumed to be a sufficient regulatory baseline to support salmon across the watershed as a whole. However, the future implementation and success of these regulations is somewhat uncertain and it may be prudent to attain higher levels of protection in those places deemed most important for salmon recovery. Assessing the potential effects of changing land use regulations will help discern whether such expanded protection areas will significantly contribute to salmon recovery relative to other protection and restoration actions.

INTERRELATED STRATEGIES AND ACTIONS

To achieve our desired priority objectives, two interrelated strategies and actions must also be implemented. First, habitat stewardship of restoration and protection sites to ensure that they prosper and evolve to highly functional habitats is critical to meet assumptions of project effectiveness. This strategic approach envisions that project sponsors, their partners, and citizen volunteers will have the knowledge, guidance, resources, and collaborative opportunities that will be required to be successful.

Second, community engagement that seeks consultation, involvement, and support of the citizens of the Skagit and Samish Watersheds is important to project authorization, development, implementation, and stewardship. Further, community engagement and habitat stewardship together will be imperative to ensuring the long-term function of all of the landscape, floodplain, and riparian processes that are the basis of forming and maintaining healthy salmon and trout habitat, whether project-based or otherwise.

AREAS FOR FURTHER REFINMEMENT

Several critical uncertainties have been raised during the 2015 update that warrant further assessment and decision as we continue to improve our strategic approach to capital project investments. These include:

- While all six, native Chinook salmon populations in the Skagit River are important to recover by meeting delisting criteria, do any of the populations warrant increased focus and early sequencing given their current status and relevance to management?
    - Should we manage by population?
- While there is significant evidence supporting the conclusion that in sum Skagit Chinook salmon populations are rearing habitat limited (SRSC and WDFW 2005; Zimmerman et al. In press), there is uncertainty about whether the Suiattle spring Chinook salmon population is spawning habitat limited. An analysis of spawning limitations within this watershed and its tributaries may need to be completed.
    - An important question is whether the current Tier 2 priority provided to the Suiattle River floodplain is sufficient to protect and restore all potential spawning and rearing habitat in its major tributaries.

Table 1. Population origin, production type, and status of Skagit River Chinook salmon populations (WDFW 2002, Federal Register 2005).

Chinook Population	Timing	Origin	Production Type	Population Status
Samish	Fall	Non-native	Composite	Not-defined
Upper Skagit	Summer	Native	Wild	Threatened
Lower Skagit	Fall	Native	Wild	Threatened
Lower Sauk	Summer	Native	Wild	Threatened
Upper Sauk	Spring	Native	Wild	Threatened
Suiattle	Spring	Native	Wild	Threatened
Upper Cascade	Spring	Native	Wild	Threatened

Table 2. Classification of river restoration actions based on the degree to which each restores natural habitat-forming processes (Beechie et al. 2010).

Action class	Definition
Full restoration	Restore processes that create and maintain habitats and biota, thereby returning a river ecosystem to its normative state.
Partial restoration	Restore or improve selected ecosystem processes, thereby partially restoring a riverine ecosystem.
Habitat creation	Improve quality of habitat by treating specific symptoms through creation of locally appropriate habitat types; used where causes of degradation cannot be addressed.

Table 3: Summary of Target Areas for the Skagit Watershed Council's 2022 Strategic Approach

Tier	Target Area	Description	Geographic Locations within Watershed	Importance to Skagit Chinook Production
1	Skagit Estuary	Estuarine emergent marsh, estuarine scrub shrub.* Saltwater-freshwater mixing areas. Most productive aquatic ecosystem in watershed. Remaining brackish habitats areas are highly compressed due to dikes and levees. Key habitat features include delta distributaries and blind sloughs.	Skagit Bay including Fir Island bay front; lower end of North and South Fork Skagit River; Swinomish Channel; and associated wetlands on Padilla Bay	Critical physiological transition zone for juvenile Chinook (all life history types). Highest growth rates for juvenile Chinook in watershed (hence high ocean survival). Loss of habitat substantially reduces juvenile survival in Puget Sound and ocean.
	Riverine Tidal Delta	Riverine tidal marshes and wetlands* are the second most productive aquatic ecosystems in watershed.	North and South Fork Skagit River up to and including Cottonwood Island	Historically expansive habitat area for delta-rearing Chinook juvenile life history type. Rearing habitat areas limited due to dike and levee system.
	Floodplains (mixed population rearing)	Broad large-river floodplain areas with prominent alluvial features formed by channel migration, including secondary (islanded) channels, backwater habitats, freshwater sloughs, and oxbows. Highly productive aquatic habitats due to frequent floodplain inundation and extensive wetlands.	Floodplains of the Skagit River from Cottonwood Island to Marblemount, and the Sauk River up to Darrington.	Historically expansive rearing habitat area for distinct riverine juvenile Chinook life history type. Middle Skagit provides rearing habitat for all six independent Chinook populations in Skagit. Growth rates of juveniles equivalent to tidal freshwater habitats. Major spawning areas for fall and summer Chinook.
2	Nearshore Pocket Estuaries	Isolated and relatively small estuary habitats located along nearshore areas of Whidbey Basin.	Pocket estuaries that are in close proximity to the delta	Rearing habitats for fry migrant Chinook salmon emigrate from Skagit River in large numbers. Ocean survival rates extremely low (near zero) for emigrating fry that don't rear in these habitats.
	Floodplains (single population rearing)	River floodplain areas with prominent alluvial features formed by channel migration, including secondary (islanded) channels, backwater habitats, freshwater sloughs, and oxbows. Highly productive aquatic habitats due to frequent floodplain inundation and extensive wetlands. Large tributary floodplains that currently or historically provided extensive spawning and rearing habitat areas for Chinook salmon.	Floodplains of the upper Skagit (above Marblemount), upper Sauk (above Darrington), Suiattle, and Cascade Rivers, as well as Nookachamps Creek, Hansen Creek, Day Creek, Finney Creek, Illabot Creek, Diobsud Creek, Bacon Creek, Goodell Creek, Tenas Creek, Buck Creek, Downey Creek, Dan Creek, White Chuck River, and North Fork Sauk.	Major spawning areas for single Chinook populations. Historically expansive rearing habitat area for riverine juvenile Chinook. Important to spatial structure and life history diversity of Chinook populations according to NOAA Viable Salmonid Population (VSP) criteria.
3	Sediment and Hydrology Impaired (High Risk) Watersheds	Watersheds that have been identified as major sediment risk areas to important downstream Chinook spawning and rearing habitats. Watersheds located in unstable soils, sedimentary geology, and which possess high densities of forest roads.	Major tributaries to lower Cascade River, lower Suiattle River, and middle Skagit.	Increased risk of severe habitat degradation and reduced Chinook survival due to high risk of landslides, road failures, combined with peak flows caused by historic land management (i.e., logging) and forest road development.

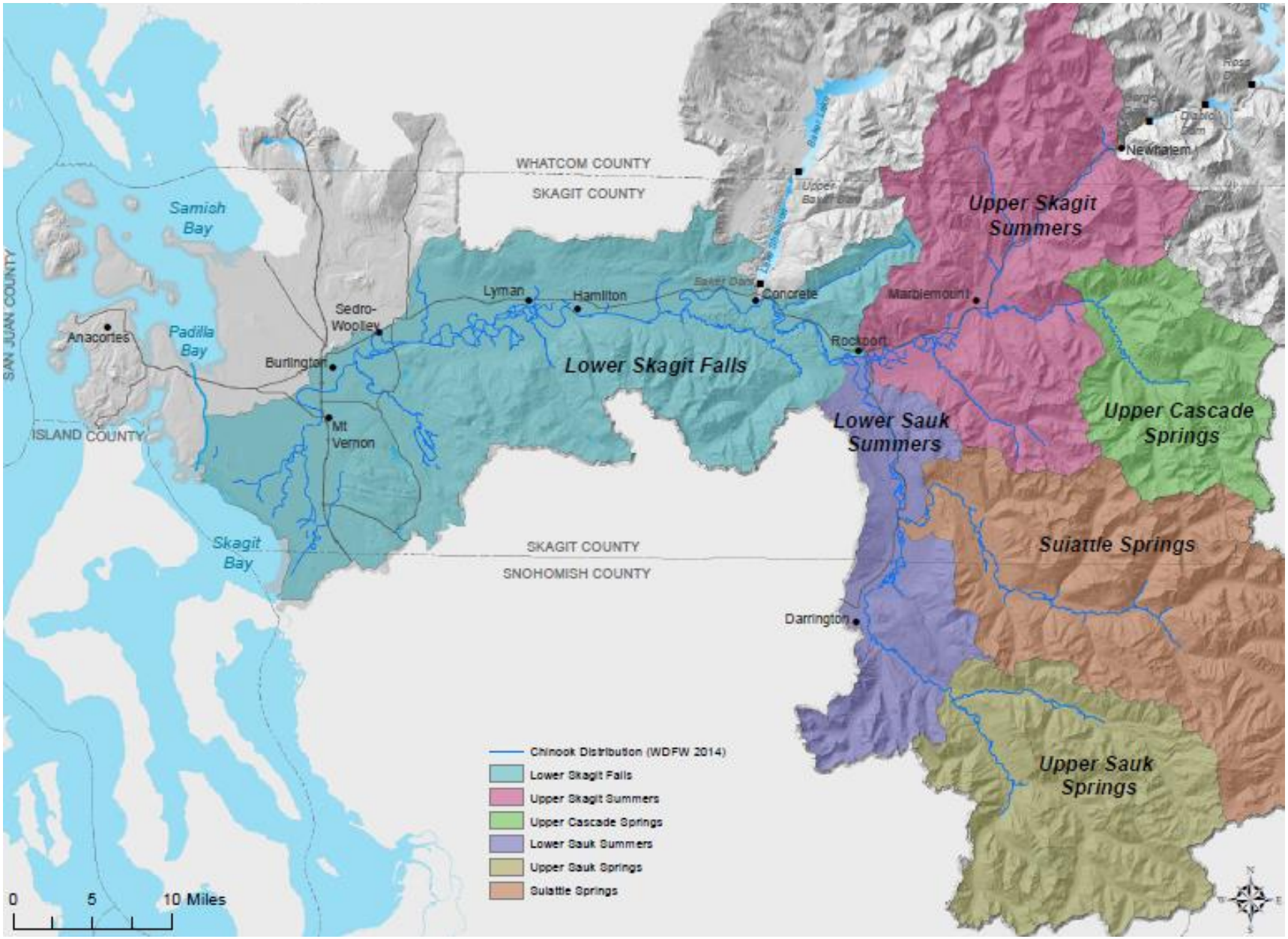

Figure 1. Locations of the six populations of Chinook salmon in the Skagit River basin.

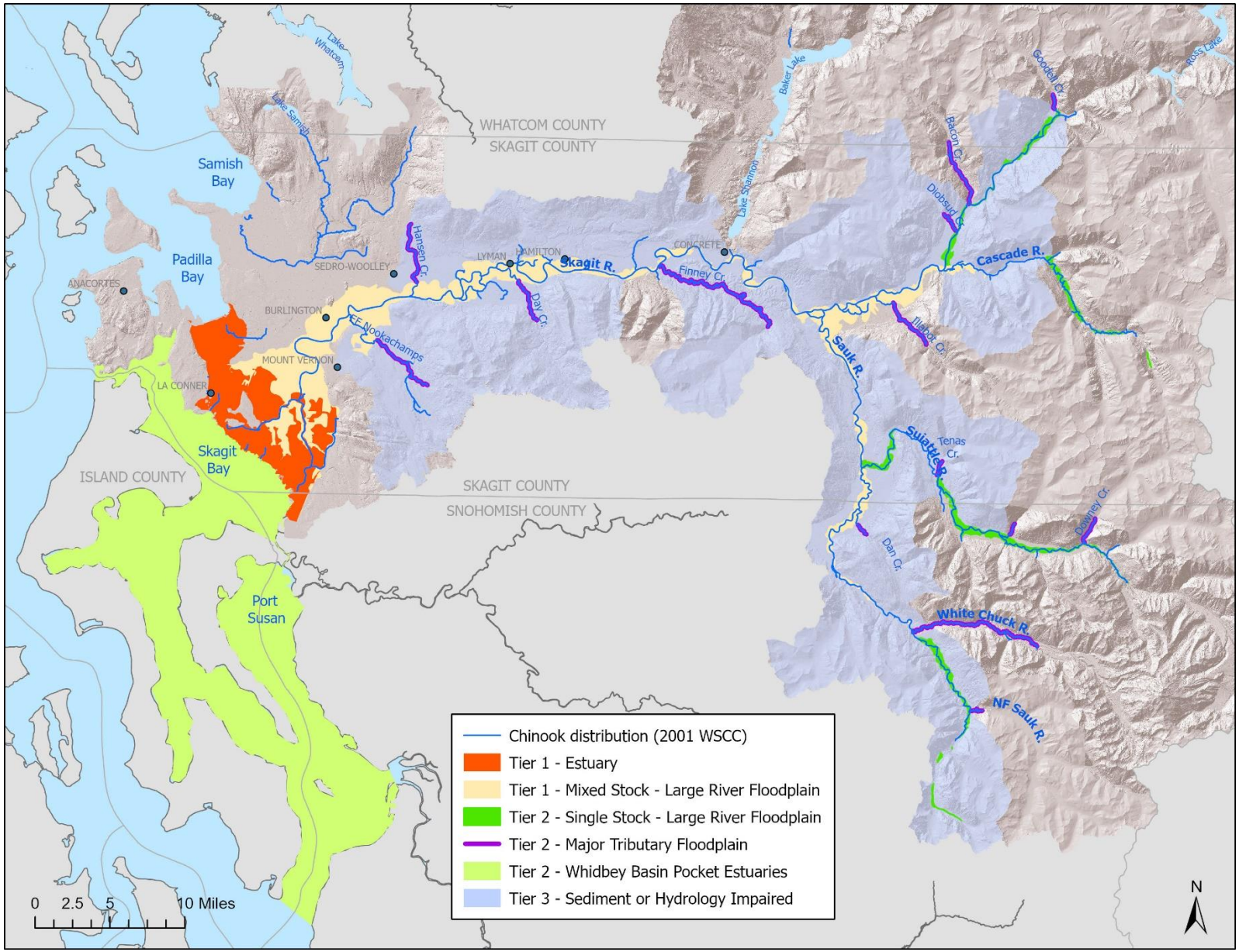

Figure 2. Tier 1, 2 and 3 target areas for habitat restoration and protection in the Skagit River basin. See Skagit Watershed Council website for higher resolution maps. Maps present planning-level information and are secondary to narrative criteria presented above for each target area.

REFERENCES

Beamer, E., T. Beechie, B. Perkowski and J. Klochak. 2000. Application of the Skagit Watershed Council's Strategy. River basin analysis of the Skagit and Samish River Basins: tools for salmon habitat restoration and protection. Skagit Watershed Council, Mt. Vernon, Washington. 79 pages.

Beamer, E., A. McBride, R. Henderson, K. Wolf. 2003. The importance of non-natal pocket estuaries in Skagit Bay to wild chinook salmon: An Emerging Priority for Restoration. Skagit River Tidings. Mt. Vernon, WA.

Beamer, E., A. McBride, C. Greene, G. Hood, K. Wolf, R. Henderson, and C. Rice. 2005. Delta and Nearshore Restoration for the Recovery of Wild Skagit River Chinook Salmon: Linking Estuary Restoration to Wild Chinook Salmon Populations. Skagit River System Cooperative. January 2005.

Beamer, EM, A McBride, R Henderson, J Griffith, K Fresh, T Zackey, R Barsh, T WyllieEcheverria and K Wolf. 2006. Habitat and fish use of pocket estuaries in the Whidbey Basin and north Skagit County bays, 2004 and 2005. Skagit River System Cooperative, LaConner, WA.

Beamer, E., J.P. Shannahan, K Wolf, E. Lowery, and D. Pflug. 2010. Freshwater habitat rearing preferences for stream type juvenile Chinook salmon and steelhead in the Skagit River Basin: Phase 1 Study Report.

Beechie, T. and S. Bolton. 1999. An approach to restoring salmonid habitat-forming processes in Pacific Northwest watersheds. Fisheries 24(4):6-15

Beechie, T.J., C.M. Greene, L. Holsinger, and E. Beamer. 2006. Incorporating parameter uncertainty into evaluations of spawning habitat limitations on Chinook salmon populations. Canadian Journal of Fisheries and Aquatic Sciences 63(6): 1242-1250.

Beechie, T., G. Pess, P. Roni, and G. Giannico. 2008. Setting river restoration priorities: a review of approaches and a general protocol for identifying and prioritizing actions. N. Am. J. Fish. Mgmt. 28:891-905.

Beechie, T.J., D. Sear, J. Olden, G.R. Pess, J. Buffington, H. Moir, P. Roni, and M..M Pollock. 2010. Process-based principles for restoring river ecosystems. BioScience. 60(3):209-222.

Collins, B. 2000. Mid-19th century stream channels and wetlands interpreted from archival sources for three north Puget Sound estuaries. Prepared for: Skagit System Cooperative, Bullitt Foundation, Skagit Watershed Council. Prepared by: Brian Collins, University of Washington, Seattle, WA. Aug. 1, 2000.

Connor, E., E. Lowery, K. Ramsden, B. Barkdull, B. Warinner, R. Hartson, R. Brocksmith and D. Smith. 2015. Tributary Assessment for Potential Chinook Salmon Rearing Habitat and Recommendations for Prioritizing Habitat Protection and Restoration.

Federal Register. 2005. Endangered and threatened species: Final listing determinations for 16 ESUs of West Coast Salmon, and final 4(d) protective regulations for threatened salmonid ESUs. Federal Register 70(123): 37160-37204.

Greene, C., D. Jensen, G. Pess, and E.A. Steele,. 2005. Effects of environmental conditions during stream, estuary, and ocean residency on Chinook salmon return

rates in the Skagit River, Washington. Transactions of the North American Fisheries Society 134:1562-1581.

Kiffney, P.M., C.M. Greene, J.E. Hall, and J.R. Davies. 2006. Tributary streams create spatial discontinuities in habitat, biological productivity, and diversity in mainstem rivers. Can. J. Fish. Aquat. Sci. 63:2518-2530.

Lowery, E., J. Thompson, J.P. Shannahan, E. Connor, D. Pflug, B. Donahue, C. Torgersen, and D.A. Beauchamp. In development. Seasonal Distribution and Habitat Associations of Salmonids with Extended Juvenile Freshwater Rearing in Different Precipitation Zones of the Skagit River, WA.

Pleus, A.E. and D. Schuett-Hames. 1998. TFW Monitoring Program methods manual for stream segment identification. Prepared for the Washington State Dept. of Natural Resources under the Timber, Fish, and Wildlife Agreement. TFW-AM9-98-001. DNR #103. May.

Sear DA. 1994. River restoration and geomorphology. Aquatic Conservation 4: 169-177.

Shared Strategy for Puget Sound. 2007. Puget Sound Salmon Recovery Plan.

Skagit River System Cooperative and Washington Department of Fish and Wildlife. 2005. Skagit Chinook Recovery Plan. Skagit River System Cooperative, La Conner, WA.

Skagit Watershed Council. 1998. Habitat Protection and Restoration Strategy. Skagit Watershed Council, PO Box 2856, Mount Vernon, WA 98273. 56 pages.

WDFW. 2002. Salmonid Stock Inventory. Washington Department of Fish and Wildlife, Olympia, Washington.

Wohl E, Angermeier PL, Bledsoe B, Kondolf GM, MacDonnell L, Merritt DM, Palmer MA, Poff NL, Tarboton D. 2005. River restoration. Water Resources Research 41: W10301

Zimmerman, M. S., C. Kinsel, E. Beamer, E. J. Connor and D. E. Pflug. In press. Abundance, survival and life history strategies of juvenile migrant Chinook salmon in the Skagit River, Washington. Transactions of the American Fisheries Society.