UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
Northwest Region
7600 Sand Point Way N.E., Bldg. 1
Seattle, Washington 98115

Refer to NMFS
Tracking No.: 2008/03803

September 25, 2009

Michelle Walker
Corps of Engineers, Seattle District
Regulatory Branch CENWS-OD-RG
Post Office Box 3755
Seattle, Washington 98124-3755

Re: Endangered Species Act Section 7 Formal Consultation and Magnuson-Stevens Fishery Conservation and Management Act Essential Fish Habitat Consultation for the Skagit Delta Tidegates and Fish Implementation Agreement. (HUC Code 171100070202 – South Fork Skagit River)

Dear Ms. Walker:

The enclosed document contains a Biological Opinion prepared by the National Marine Fisheries Service pursuant to section 7(a)(2) of the Endangered Species Act (ESA) on the effects of providing programmatic coverage for the repair and replacement of tidegates in the Skagit delta as described in the Tidegates and Fish Agreement in the Skagit delta (May 2008). In this Opinion, the National Marine Fisheries Service concludes that the action, as proposed, is not likely to jeopardize the continued existence of Puget Sound Chinook salmon and Puget Sound steelhead or result in the destruction or adverse modification of designated critical habitat for Puget Sound Chinook salmon.

As required by section 7 of the ESA, the National Marine Fisheries Service provided an incidental take statement with the Opinion. The incidental take statement describes reasonable and prudent measures the National Marine Fisheries Service considers necessary or appropriate to minimize incidental take associated with this action. The take statement sets forth nondiscretionary terms and conditions, including reporting requirements, that the U.S. Army Corps of Engineers and any person who performs the action must comply with to carry out the reasonable and prudent measures. Incidental take from actions that meet these terms and conditions will be exempt from the Endangered Species Act take prohibition.

This document also includes the results of our analysis of the action's likely effects on Essential Fish Habitat pursuant to section 305(b) of the Magnuson-Stevens Fishery Conservation and Management Act (MSA). Section 305(b)(4)(B) of the MSA requires Federal agencies to provide a detailed written response to National Marine Fisheries Service within 30 days after receiving these recommendations.

If the response is inconsistent with the Essential Fish Habitat conservation recommendations, the Army Corps of Engineers must explain why the recommendations will not be followed, including the justification for any disagreements over the effects of the action and the recommendations. In response to increased oversight of overall Essential Fish Habitat program effectiveness by the Office of Management and Budget, the National Marine Fisheries Service established a quarterly reporting requirement to determine how many conservation recommendations are provided as part of each Essential Fish Habitat consultation and how many are adopted by the action agency.

The National Martine Fisheries Service believes that the proposed action already features conservation measures that are necessary to avoid mitigate of offset the impact of the proposed action on Essential Fish Habitat. Since the National Marine Fisheries Service is not providing conservation recommendations, no 30-day response is required from the U.S. Army Corps of Engineers [MSA section 305(b)(4)(B)].

If you have questions regarding this consultation, please contact Tom Sibley at (206) 526-4446 or via e-mail at thomas.sibley@noaa.gov.

Sincerely,

for Michael Tehan

Barry A. Thom
Acting Regional Administrator

Enclosure

cc: Randle Perry, COE
Michael Shelby, WWAA
Martha Jensen, USFWS

Endangered Species Act - Section 7 Consultation
Biological Opinion

And

Magnuson-Stevens Fishery Conservation and Management Act
Essential Fish Habitat Consultation

Skagit Delta Tidegates and Fish Programmatic Consultation
South Fork Skagit River, HUC Code 171100070202
Skagit County, Washington

Lead Action Agency: U.S. Army Corps of Engineers

Consultation Conducted By: National Marine Fisheries Service
Northwest Region

Date Issued: September 25, 2009

Issued by: ____________________
Barry A. Thom
Acting Regional Administrator

NMFS Tracking Number: **2008/03803**

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LIST OF ACRONYMS

CFR	Code of Federal Regulations
CH	Critical Habitat
COE	U.S. Army Corps of Engineers
CWA	Clean Water Act
cy	Cubic Yards
DPS	Distinct Population Segment
DQA	Data Quality Act
EEM	Estuarine Emergent Marsh
EFH	Essential Fish Habitat
EPA	U.S. Environmental Protection Agency
ERT	Emergent Forested Transition
ESA	Endangered Species Act
ESU	Evolutionarily Significant Unit
FR	Federal Register
FRT	Forested Riverine Tidal
HUC	Hydrologic Unit Code
IA	Implementation Agreement
ITS	Incidental Take Statement
lambda	Median Population Growth Rate
LWD	Large Woody Debris
MHW	Mean High Water
mm	millimeters
MSA	Magnuson-Stevens Fishery Conservation and Management Act
NMFS	National Marine Fisheries Service
NOAA	National Oceanic and Atmospheric Administration
OHW	Ordinary High Water
Opinion	Biological Opinion
PCE	Primary Constituent Element
PFMC	Pacific Fishery Management Council
PL	Public Law
PS	Puget Sound
PSTRT	Puget Sound Technical Recovery Team
RPM	Reasonable and Prudent Measure
SRSC	Skagit River Systems Cooperative
TFI	Tidegates and Fish Initiative
U.S.C.	United States Code
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey
VSP	Viable Salmonid Population
WDFW	Washington Department of Fish and Wildlife

INTRODUCTION

This document contains a Biological Opinion (Opinion) and Incidental Take Statement (ITS) prepared in accordance with section 7(b) of the Endangered Species Act (ESA) of 1973, as amended (16 U.S.C. 1531, et seq.), and implementing regulations at 50 CFR 402. The National Marine Fisheries Service (NMFS) also completed an Essential Fish Habitat (EFH) consultation, prepared in accordance with section 305(b)(2) of the Magnuson-Stevens Fishery Conservation and Management Act (MSA) (16 U.S.C. 1801, et seq.) and implementing regulations at 50 CFR 600. The docket for this consultation is on file at the Washington State Habitat Conservation Office in Lacey, Washington.

Background and Consultation History

This document transmits NMFS' Opinion and EFH consultation based on our review of the Skagit Tidegates and Fish Initiative (TFI) Implementation Agreement (IA) dated May 2008 and developed by Western Washington Agricultural Association, the National Oceanic and Atmospheric Administration's (NOAA) National Marine Fisheries Service, and the Washington State Department of Fish and Wildlife (WDFW). The U.S. Army Corps of Engineers (COE) is proposing a programmatic consultation for repair and replacement of tidegates and floodgates within the Skagit River and Samish River deltas, specifically the geographic scope covered in the IA, in order to develop a landscape approach to the issuance of permits under Section 10 of the Rivers and Harbors Act of 1898 and Section 404 of the Clean Water Act (CWA). The Skagit River and Samish River are in the geographic range of the Puget Sound (PS) Chinook salmon Evolutionarily Significant Unit (ESU) and the PS steelhead (*O. mykiss*) Distinct Population Segment (DPS) and include designated critical habitat (CH) for PS Chinook salmon. The Skagit River and Samish River are also Essential Fish Habitat (EFH) for Chinook salmon, coho salmon (*O. kisutch*), and PS pink salmon (*O. gorbuscha*).

The COE sent a letter requesting consultation that was received by NMFS on June 19, 2008. The COE determined that if a proposed repair or replacement of a tidegate or floodgate was conducted in accordance with the conditions set forth in the IA, the proposed action was not likely to adversely affect PS Chinook salmon, CH of PS Chinook salmon and PS steelhead and would not adversely affect EFH of Pacific salmon, groundfish and coastal pelagic species. The NMFS concurs with the COE determination that the proposed action is "not likely to adversely affect" PS steelhead because this species is not expected to occur in close proximity to the tidegates where construction may occur. However, NMFS believes that it is reasonably likely that a small number of the projects conducted during the proposed 25 year duration of the project may adversely affect PS Chinook salmon or adversely affect CH of PS Chinook salmon. Because the specific actions to be covered by the programmatic have not been identified at this time, it is difficult to quantify specific effects that may occur. However, it is reasonable to expect that some adverse effects may occur as a result of actions covered by this consultation during the proposed 25 year duration of the action. Therefore, NMFS has prepared this Opinion to evaluate potential effects of the action and provide terms and conditions that will minimize the consequences of those effects to PS Chinook salmon and their CH.

After the conclusion of consultation, NMFS prepared this document in draft and shared it with the COE and the Skagit Systems Cooperative in May 2009. The COE and Skagit Systems Cooperative reviews concluded in September 2009 and the results of those reviews are reflected in the final description of the proposed action, which follows below.

Description of the Proposed Action

The COE proposes a landscape approach to programmatic consultation in order to develop a more efficient consultation process for permit applications under Section 10 of the Rivers and Harbors Act and Section 404 of the Clean Water Act for permits covering the repair and replacement of tidegates and floodgates in the Skagit River and Samish River deltas. This consultation includes specific types of actions (minor repairs, major repairs, and replacements) related to tidegate repairs and replacements described in Part 4 of the Draft Final Agreement (May 2008).

The purpose of the TFI is to insure that federal permits for tidegate maintenance activities can be efficiently obtained by tidegate owners and maintainers. To participate in the TFI, drainage districts agree to support habitat restoration projects, identified in the Puget Sound Chinook Recovery Plan, which will contribute to recovery of Skagit River populations of PS Chinook salmon. To mitigate potential adverse effects of tidegate maintenance activities, a fundamental requirement of the TFI agreement is that sufficient credit for habitat restoration projects must be available prior to submitting the permit application for individual tidegate permits. If sufficient restoration activities have not occurred, the application cannot be processed under the programmatic consultation and will instead require an individual consultation. Linking tidegate repairs and replacements to implementation of restoration activities ensures that the Skagit River populations will trend toward recovery while existing infrastructure is maintained.

Minor Repairs

"Minor repairs" are the replacement of damaged or worn hinge pins, nuts, and bolts necessary to keep the tidegate or floodgate in good operating condition, and also include removal of logs and debris to ensure gates are able to open and close properly. Maintenance for tidegates is conducted during a low tide cycle, once the drainage water has passed through the gate. Floodgate maintenance is conducted once the drainage water has passed through the gate. Debris removal is performed as needed to ensure that the downstream flow of water is not impeded and that blockages do not develop. Debris that collects in the gates and trash racks is typically composed of trash, leaves and branches, and is generally small and easily removed with hand tools. Occasionally, larger debris (such as logs) is removed using mechanical equipment, such as an excavator, which is positioned on the bank. Materials are deposited on the adjacent bank or disposed of as necessary. All debris removal with equipment staged on the bank is considered minor repair.

Most maintenance actions are categorized as minor repair and are completed manually. For tidegates and floodgates, these minor repair actions are addressed through District

Drainage Maintenance Agreements and Plans developed through the Skagit Drainage and Fish Initiative. These actions either have no effect on listed species, or have effects that are so small or are so unlikely to be experienced by listed species that they are not likely to adversely affect listed species. Effects to species are expected to be discountable because these minor repairs will occur during low tide cycles when no fish are present at the site. And habitat disturbance that occurs will be so small that it will not be detectable after the first tidal cycle. Therefore, the conservation value of CH will not be reduced and effects to species from habitat modification will be undetectable. Consequently, this opinion does not provide additional analysis of the effects of minor repairs.

Major Repairs

Major repair includes all maintenance activities, except replacement and installation of liners, required to keep the tidegates and floodgates operational. These actions include, but are not limited to the replacement of doors and collars, repair of discharge pipes and tubes, and repair of rock armoring or thresholds. In rare instances, major repairs include debris removal requiring the access of heavy equipment within the watercourse. Major repairs do not require excavation of the dike or levee to accomplish the repair.

Replacement of doors may require the use of heavy equipment, such as a boom truck or excavator. Any heavy equipment used is staged and operated from the dike or bridge. The door is suspended over the dike, near the tube opening and manually connected to the collar. Work is conducted during a low tide cycle without a cofferdam. If replacing of collars is necessary, work is performed manually during a low tide cycle.

Discharge pipe or tube repair consists of patching holes or cracks in the protruding ends on either side of the dike. The damaged area is patched with cement or fiberglass, depending on the composition of the pipe or tube. Patches are typically used to repair small holes or cracks. If the damaged area is large enough that a patch will not work the protruding end of the pipe will be encased in cement. These are typically temporary repairs to prolong the life of the pipe or tube until it can be replaced. These repairs are completed manually during a low tide cycle and no cofferdam is required. If equipment is needed, such as a cement truck, it will be staged and operated from the supporting/associated dike or bridge.

Repair of rock armoring or thresholds is required when existing rock has shifted, or a storm event has caused erosion at the structure. Repair work typically involves the repositioning of existing rock that has shifted. In some circumstances, new rock may need to be imported to the repair site, typically 10 cubic yards (cy) or less, to restore the original footprint of the rock armoring. Equipment is staged from the associated dike or bridge.

Debris is typically removed manually or with equipment staged on the bank. Operation of equipment within the watercourse for the removal of debris shall only occur to prevent the loss of a tidegate or floodgate structure, including the dike or bridge supporting that structure. This action will be completed during one low tide cycle. If the equipment enters the channel, the site where the equipment enters the channel will be isolated from the rest of the channel.

Replacement

Replacement of tidegates to extend the life of the gate facility or to restore impaired function usually includes the replacement of tubes. Tubes typically collapse due to corrosion and are replaced during the late summer or early fall months when extreme low tides occur during daylight hours.

The replacement of a tidegate tube requires the excavation of the dike to provide access to the tube. This action is completed during one low tide cycle, and must be completed quickly to prevent intrusion of saltwater into the work area. A cofferdam will be constructed upstream of the work area to prevent drainage water from entering and provide a dry work environment.
A downstream cofferdam will also be installed to isolate the work area from the watercourse. The tube requiring replacement will be excavated with equipment staged on the dike or shoreline, above the Ordinary High Water (OHW) or Mean High Water (MHW) elevation. Excavated material will be stockpiled upland, to prevent it from entering any waterway. Stockpiled material will be replaced in the dike after the new tube is installed. Once the new tube is placed, the excavated material is then replaced in kind, within the existing footprint. Less than 50 cy of new material may be required to replace some of the excavated material because 100 percent of the material cannot be collected and replaced. If the number of tubes has been modified (e.g. four tubes replaced with three), the soil quantities excavated and replaced will vary, but the overall footprint and function of the tidegate or floodgate structure will remain the same. Any spoils are disposed of at an upland location. No construction debris or deleterious materials will be disposed of or abandoned on-site.

The installation of liners requires that the dike be partially excavated, which requires that this activity be included within replacement actions. Lining a tube consists of installing a liner to the inside section of the tube where corrosion typically occurs. To line an existing tube with new material, the work must be conducted during a low tide cycle when the tube can be accessed easily. Any debris in the existing tube is removed so that the liner will fit properly. The new lining material is installed within the existing tube by utilizing a boom truck or other equipment that can lift and suspend the new liner over the watercourse near that tube opening. The equipment is staged from the dike (or bridge) and does not enter below the OHW or MHW elevation. Once the liner is in position it is manually placed in alignment with the tube and then secured to the existing tube. The new liner is grouted into place to provide a seal between the tube and the liner. The dike is partially excavated to create access to the tube so that the liner can be grouted. The tube is then opened to provide access to the void between the tube and the liner. A grout material, such as concrete slurry, is then pumped into the void between the tube and the liner. This grout material seals the liner to the tube. Liner installation is completed during one low tide cycle, all equipment is staged from the dike and a cofferdam is not required.

Required Linkage of Programmatic Activities to Estuarine Habitat Restoration

The program includes a landscape approach to permitting repairs and replacements of tidegates, coupling such work with estuarine habitat restoration projects to increase and enhance rearing habitat for juvenile salmonids. Before any covered activities can occur under the proposed program, restoration of certain, predefined acreages of estuarine habitat must be restored. That is, permits for tidegate repairs and replacement will not be issued under this program unless estuarine restoration actions are proceeding at a rate that will provide 2,700 acres of new estuarine habitat identified in the Puget Sound Chinook recovery plan for the Skagit Basin, during the 25 year duration of the program. Specific restoration actions that can contribute to the restoration goal are identified in Section 4.4.2 of the IA. Eligible restoration activities are currently limited to actions that were identified in the Skagit Chinook Recovery Plan (Skagit River Systems Cooperative (SRSC) and WDFW, 2005), or the House Bill 1418 Tidegate Taskforce Report.

The Skagit Chinook recovery plan identified eight specific near-term projects and seven long-term projects that would lead to restoration of the identified extent of estuarine habitat. These projects include levee setbacks, dike removals, tidegate removal or replacements, conversion of agricultural land to channel and marsh habitats and reconnection of distributary channels. Four additional projects that were identified as part of the House Bill 1418 Taskforce Report could also contribute acreage for this consultation. New projects that have not yet been identified could be included as part of the Estuarine Habitat Restoration if they are consistent with the objectives of the Skagit Chinook Recovery Plan and within the action area described below. However, those actions must be reviewed by a technical committee that is primarily concerned with salmon recovery. It is anticipated that habitat credits for any new projects will be consistent with models utilized by the Skagit River System Co-operative during the preparation of the Skagit Watershed Recovery Plan (SRSC and WDFW, 2005).

Habitat Credits and Accounting

Tidegate repair and replacement is linked to estuarine restoration in the proposed action through the requirement that certain amounts of “credit” based on restoration is available for tidegate repair or replacement projects to apply for permits under this programmatic consultation. The restoration activities are not covered by this Opinion and will require separate consultations if they may affect ESA listed species or EFH. One option for guiding completion of those actions is compliance with Washington State Fish Passage and Habitat Enhancement Restoration Programmatic Consultation (NMFS No. 2008-03598).

Detailed description of the Credit Determination and Use system included in the proposed action is provided in Section 4.5 of the IA. At the time the Skagit Chinook Recovery Plan was prepared, a total of 2,700 additional acres of estuarine habitat was considered necessary to produce recovery of PS Chinook salmon in the Skagit River watershed (SRSC and WDFW, 2005). To stimulate restoration of the necessary acreage, the Western Washington Agricultural Association proposed coupling tidegate maintenance activities with restoration projects identified in the Skagit Chinook

Recovery Plan. Therefore, the restoration goal was set at 2,700 acres of estuarine habitat. To ensure that restoration projects and tidegate maintenance would proceed simultaneously, the proposed action would enable permit issuance under the provisions of this programmatic opinion (i.e. without project-specific ESA consultation) so long as the necessary habitat restoration "credits" are in hand to justify permit issuance. If credits are not available, the applicant will be required to complete a project-specific ESA consultation on any proposed action. Credits required for individual tidegate actions are based upon the total area behind the tidegate (Table 4-2 of IA). Half of the designated credits are necessary for a major repair and all of the credits are required for a replacement. If all the credits have been designated for an individual tidegate, additional work can be conducted as necessary. While the restoration projects themselves are not part of the proposed action and will either be covered under a separate programmatic consultation or individual consultations, NMFS and the other parties to the TFI expect that the credit linkage between tidegate maintenance and replacement and habitat restoration will significantly increase the likelihood that the 2,700 acre goal will be reached within the 25 year life of the proposed action.

Restoration projects that are completed prior to the implementation of TFI will not provide credits for permitting. However, they will count toward the required 2,700 acres. Therefore, as projects are completed, values in Table 4-2 of the IA agreement may need to be recalculated. This will be the responsibility of the Oversight Committee when the Implementation Agreement is adopted.

<u>Program Administration and Management</u>

The IA designates the Western Washington Agricultural Association to be the Credit Administrator under the direction of an Oversight Committee composed of representatives from the agricultural communities (3) and fisheries agencies (2). Local tribes will be invited to provide an additional member. If the tribes do not participate in the Oversight Committee, another representative will be selected from the fisheries agencies or environmental community. The Oversight Committee is responsible for determining appropriate credits as restoration projects are developed and the Credit Administrator is responsible for distributing available credits as drainage districts apply for federal permits.

Action Area

"Action area" means all areas to be affected directly or indirectly by the Federal action and not merely the immediate area involved in the action (50 CFR 402.02). For the purpose of this consultation the action area is comprised of approximately 53,322 acres of farmland in the Skagit and Samish River deltas located in the western portion of Skagit County and a limited area in northwest Snohomish County, including the tidal delta areas of Skagit Bay, Padilla Bay, Samish Bay, and the Swinomish Channel (Figure 1). This area is inclusive of the jurisdictional boundaries and jurisdictional responsibilities of Drainage and Irrigation Districts 5, 14, 15, 16, 17, 18, 19, 22, 25; Consolidated Diking District 22; and Diking, Drainage and Irrigation District 12, all of which control lands historically subject to tidal influence within the Skagit and Samish River deltas, as well as Diking District 3, which has drainage interests within tidally influenced zones that lay within the same geographic area. This area is bounded by the towns of Sedro-Woolley, Burlington, and Mount Vernon on the east and Samish and Padilla Bays and the Swinomish Chanel on the west.

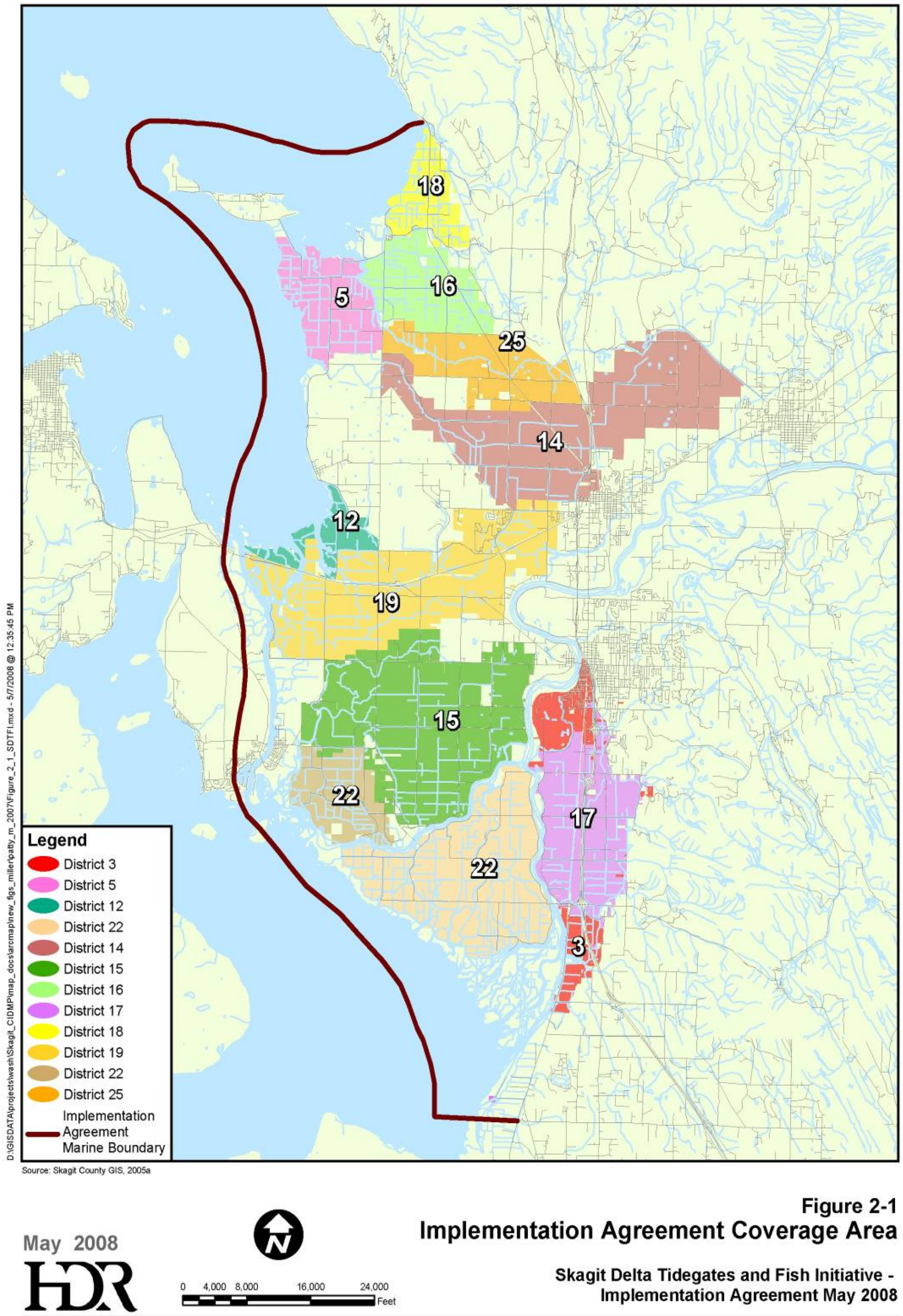

FIGURE 1. Location of action area within Skagit and Snohomish Counties. (Figure taken from Implementation Agreement Figure 2-1)

Section 7(a)(2) of the ESA requires Federal agencies to consult with NMFS to ensure that their actions are not likely to jeopardize the continued existence of endangered or threatened species, or adversely modify or destroy their designated CH. The Opinion records the results of the interagency consultation for this proposed action. An ITS is provided that specifies the impact of any taking of threatened or endangered species that will be incidental to the proposed action and reasonable and prudent measures (RPM) that NMFS considers necessary and appropriate to minimize such impact. The Opinion also provides non-discretionary terms and conditions that must be complied with by the Federal agency, applicant (if any), or both, to carry out the RPMs.

Biological Opinion

To complete the jeopardy analysis presented in this Opinion, NMFS reviewed the status of each listed species of Pacific salmon and steelhead[1] considered in this consultation, the environmental baseline in the action area, the effects of the action, and cumulative effects (50 CFR 402.14(g)). From this analysis, NMFS determined whether effects of the action were likely, in view of existing risks, to appreciably reduce the likelihood of both the survival and recovery of the affected listed species.

For the CH adverse modification analysis, NMFS considered the status of the entire designated CH, the environmental baseline in the action area, the likely effects of the action on the function and conservation role of the affected CH, and cumulative effects. The NMFS used this assessment to determine whether, with implementation of the proposed action, CH would remain functional, or retain the current ability for the Primary Constituent Elements (PCEs) to become functionally established, to serve the intended conservation role for the species (Hogarth 2005).

Status of the Species

This section describes the range-wide level of risk faced by PS Chinook salmon. Listed species facing a high risk of extinction are more vulnerable to the aggregation of effects considered under the environmental baseline, the effects of the proposed action, and cumulative effects.
The Services describe the status of the listed species using criteria that describe a ‘viable salmonid population’ (VSP) (McElhany et al. 2000). Attributes associated with a VSP include abundance, productivity, spatial structure, and genetic diversity at levels that maintain its capacity to adapt to various environmental conditions and allow it to sustain itself in the natural environment. These attributes are influenced by survival, behavior, and experiences throughout the entire life cycle, characteristics that are influenced, in turn, by habitat and other environmental conditions.

[1] An “evolutionarily significant unit” (ESU) of Pacific salmon (Waples 1991) and a “distinct population segment” (DPS) of steelhead (71 FR 834; January 5, 2006) are both “species” as defined in Section 3 of the ESA.

Puget Sound Chinook Salmon

The NMFS listed PS Chinook salmon as threatened March 1999 (64 FR 14308), and the ESU has been defined to include all PS Chinook populations residing below impassable natural barriers (e.g., long-standing natural water falls) in the Puget Sound region from the Nooksack River to the Elwha River on the Olympic Peninsula, inclusive (Myers et al. 1998).

There are 22 extant geographically distinct populations in the ESU (PSTRT 2004) and an estimated 15 spawning aggregations are extinct. Overall abundance of this ESU has declined substantially from historical levels (63 FR 11494, March 9, 1998). Historical abundance has been estimated to be approximately 609,000 adult returns (Myers et al 1998), while average abundance between 1998 and 2002 of natural origin spawners is 30,182 fish, and average hatchery abundance between 1997 and 2001 is 52,504 fish (NMFS unpublished data).

Status reviews have identified a number of factors for decline including habitat conditions, artificial propagation, and harvest of the species. Degradation and loss of estuarine, riparian, and freshwater habitats through past and present urbanization, agricultural activities, man-made impassible barriers, and the ecological legacies of past forest practices remain the significant limiting factors to recovery (69 FR 33102, June 14, 2004), threatening ESU abundance, diversity, spatial structure and productivity.

Like all other salmonid species, PS Chinook salmon are anadromous and semelparous (i.e., dies after spawning once). Chinook salmon display two general life-history types, one designated as “stream-type” (Groot and Margolis 1991; Myers et al. 1998), which spends one or more years as a fry or parr in fresh water before migrating to sea. The second form, designated “ocean-type” (Groot and Margolis 1991; Myers et al. 1998) migrates to sea during the first year of life, normally within three months after emergence from spawning gravel (Groot and Margolis 1991; Myers et al. 1998).

Skagit River Populations of Puget Sound Chinook Salmon. The Skagit River watershed is the largest in Puget Sound and supports six independent PS Chinook salmon populations (PSTRT 2002) representing 27 percent of the total populations in the ESU. Three of the six populations are spring migrants, representing 50 percent of the total spring runs in the ESU. Individually and collectively, the Skagit PS Chinook salmon populations are essential to the survival and recovery of the ESU because they provide vital contributions to its abundance, productivity, diversity and spatial structure.

Abundance. Overall abundance of this ESU has declined substantially from historical levels, and many populations are small enough that genetic and demographic risks are likely to be relatively high (63 FR 11494, March 9, 1998). Estimates of historic abundance in the Skagit range from 71,530 (PSTRT 2002), to several hundred thousand adults (Hayman 2005) while contemporary abundance has been approximately 14,000 fish, each Skagit population is a fraction of its historic abundance estimates. Of the six

PS Chinook salmon populations within the Skagit basin, the stock status of five is listed as "depressed" (Shared Strategy 2007). The number of natural spawners is far below historic levels for each of the Skagit basin populations (Table 1).

Table 1. Existing geometric mean of natural spawners, historical abundance, and stock status of Skagit Basin Chinook salmon populations (from Good et al. 2005 and Shared Strategy 2007).

Chinook Populations	Geometric Mean of Natural Spawners 1998-2002	Historical Abundance	Stock Status
Lower Skagit	9,489	35,000	Depressed
Upper Skagit	2,527	22,000	Depressed
Lower Sauk	601	7,800	Depressed
Upper Sauk	324	4,200	Depressed
Suiattle	274	1,700	Depressed
Upper Cascade	365	830	Healthy

Productivity. Productivity is the measurement of a population's growth rate through all or a portion of its life-cycle. Productivity values indicate the relative ability of a salmonid population to respond to natural or anthropogenic changes that alter habitat quality or quantity. Although NMFS overall focus is on population growth rate over the entire life cycle, estimates of stage-specific productivity, particularly productivity during freshwater life-history stages, are also important to the comprehensive evaluation of population viability.

Median population growth rate (lambda), calculated from long- and short-term trends in abundance, is used to estimate productivity. Long- and short-term trends are calculated from returning spawners, and the short-term lambda is calculated assuming the reproductive success of naturally spawning hatchery fish is equivalent to that of natural-origin fish (Good et al. 2005). A lambda value greater than 1 represents a population that is replacing itself. The Skagit basin Chinook salmon each display lambdas between 0.96 and 1.06, indicating that the current populations are just replacing themselves (Good et al. 2005). Each population is well below the target lambda for recovery, therefore there will be no sustainable population growth without an increase in productivity.

Genetic Diversity. Examples of diversity among salmonids include morphology, fecundity, run timing, spawn timing, juvenile behavior, age at smolting, age at maturity, egg size, and development rate, among others (McElhany et al., 2000). Of these traits, some are genetically determined, while others are influenced by a combination of genetic and environmental factors. Diversity is important to population viability because: 1) it allows a species to use a wider array of environments than they could without it; 2) it protects against short term spatial and temporal changes in the environment, increasing the likelihood that some individuals would survive and reproduce when faced with environmental variation; and 3) genetic diversity provides the raw material for surviving long-term environmental changes. Salmonids have adapted to environments that feature regular and cyclic changes due to natural dynamics, such as ocean conditions or precipitation and runoff patterns. Genetic diversity allows fish to adapt to these changes.

Differentiation between the populations is based on spawning timing and location as well as genetic analysis. Chinook salmon in the Skagit basin display moderate genetic diversity (Shared Strategy 2005).

Spatial Structure. The spatial structure of habitat must support the population at the desired productivity, abundance, and diversity levels through short-term environmental perturbations, longer term environmental oscillation, and through natural patterns of disturbance regimes.
A population's spatial structure is evaluated in term of habitat quantity (habitat should be large enough to support growth and abundance and diversity criteria), habitat quality (habitat patches should be within specified habitat quality limits for the life history activities occurring in the patches), habitat connectivity (habitat patches should have permanent or appropriate seasonal connectivity to allow adequate migration between spawning, rearing, and migration patches), habitat dynamics (spatial structure should not deteriorate in its ability to support the population; habitat loss should not exceed the rate of creation over time) and catastrophic risk (spatial structure should be geographically distributed in such a way as to minimize the probability of a significant portion of the structure being lost due to a single catastrophic event, either anthropogenic or natural).

The spatial distribution of Chinook salmon populations with a strong component of natural-origin spawners in the Puget Sound ESU has not changed since the last status assessment. The Skagit River basin contains significant numbers of natural-origin spawners whose status can be reliably estimated. General spawning among the Skagit Chinook salmon populations takes place between August and October. The Suiattle Chinook salmon begin and complete their spawning slightly earlier, between July and September. The lower Skagit Chinook salmon are late spawners, beginning in September and spawning until mid-November. This later spawning season is likely due to the shorter migration to spawning grounds. Based on the spawning locations, very little overlap between stock spawning grounds is anticipated. There may be a slight overlap between the upper Skagit and the upper Cascade Chinook salmon populations as well as between the upper and lower Sauk populations. The spatial distribution of different Chinook salmon populations within the Skagit River basin contributes to the long term survival and recovery of the ESU.

Chinook Salmon Use of Estuaries. Residency in the estuary provides an opportunity for juvenile salmonids to grow and adapt to physiological and behavioral modifications associated with smoltification, and reduce predation. The latter is more significant in open marine waters. Among all salmonid species, a transition in estuary habitats is most essential for juvenile Chinook salmon. Chinook salmon, particularly ocean-type fish, take longer to adjust to increasing saline gradients, and rear and grow in estuaries longer than any other salmonid species (Thorpe 1994). Estuarine rearing is important to each of the six Skagit Chinook salmon populations.

Timing of Arrival and Growth. Juvenile Chinook salmon utilize estuarine habitats for foraging and physiological transition zones from fresh to saltwater environments. Within estuarine habitats distribution of juvenile Chinook salmon is tidally dependant. Residence time varies widely and differs among ocean and stream-type juveniles. Ocean-type fish reside in estuarine habitats for longer periods of time, some fish typically arriving as early as February and others residing through July. Stream-type Chinook salmon generally leave fresh water habitat the second spring post-emergence, and utilize estuarine habitats for days to weeks as they emigrate to the ocean. Residence time and feeding within estuaries for stream-type Chinook salmon is less obligate relative to ocean-type fish because they arrive at the estuary at larger sizes than ocean-type fish (Groot and Margolis 1991) and are able to exploit larger prey that are present in Puget Sound and the ocean. Conversely, ocean-type Chinook salmon arrive within the estuary at smaller sizes, and rely on smaller food sources available within estuarine habitat prior to emigration to Puget Sound and the ocean. Within the Skagit, most juvenile Chinook salmon arrive between February and July (Beamer et al. 2000). Within the Nanaimo River estuary, recovery of marked fry suggested a maximum residence of approximately 60 days (Groot and Margolis 1991). Juvenile Chinook salmon in the Skagit have been documented to reside in the estuary from an average of 28 to 51 days (Beamer and Larsen 2004). However, fry migrants emigrate directly to Skagit Bay and do not reside in the estuary (Beamer and Larsen 2004).

Juvenile Chinook salmon utilize a wide variety of food sources depending on the size of the fish. Documented food sources include zooplankton, terrestrial and aquatic insects, and other fish (Groot and Margolis 1991). Chinook salmon fry less than 50 millimeters (mm) long have diets dominated by benthic detritivores, herbivorous zooplankton and terrestrial insects (Northcote et al. 1979). Juvenile Chinook salmon diets consisting of 40 percent insects, 40 percent benthic organisms, and 20 percent plankton, and larger fish were observed to exploit more diverse diets that also included juvenile fish (Healey 1982). Larger smolts (typically yearlings) are able to feed upon larger prey, such as chum or pink salmon fry, or other juvenile fish typically found in estuaries such as herring and sticklebacks.

Estuarine habitats provide rich feeding areas for smaller fry, and observed growth is relatively rapid. Groot and Margolis (1991) reported daily growth rates ranging from 0.48 mm in the Sacramento River estuary to 0.33 mm in the Cowichan River estuary. Seasonal variation of growth has also been reported. Within the Sixes River (Oregon), Reimers (1973) reported that daily estuarine growth ranged from 0.9 mm from late April to early June to 0.07 mm from June to August. The daily growth rate for juvenile Chinook salmon in the Nanaimo River (Canada) estuary averaged 1.32 mm while the growth rate for the population rearing in the river was only 0.5 mm (Healey 1980).

Habitat within the Skagit River estuary, and other Puget Sound estuaries, is differentiated by salinity and vegetation characteristics (Hayman et al. 1996; Haas and Collins 2001). Daily growth rates for juvenile Chinook salmon in the tidal marshes of the Skagit estuary were four to seven mm higher than for their river cohorts, except during periods of high immigration (Congleton et al. 1981). Within the Skagit River estuary, growth within the

Estuarine Emergent Marsh (EEM) habitat was over 3 times higher than growth in emergent forested transition (ERT) zones, and Forested Riverine Tidal (FRT) zones, which are upstream from EEM habitat (SSC and the U.S. Geological Survey [USGS] 1999).

When high numbers of juvenile Chinook salmon occupy estuaries, growth within these populations can be reduced (Reimers 1973; Beamer et al. 2005a). Within the Nanaimo River, food intake and growth were reduced during periods of peak abundance of juveniles in the estuary (Groot and Margolis 1991). Stomach contents of fry averaged two to five percent of body weight, except during the period of peak fry abundance, when it was reduced to 0.5 percent of body weight (Groot and Margolis 1991). Similarly, average length of juveniles decreases with greater abundance of Chinook salmon juveniles in the Skagit estuary (Beamer et. al. 2003).

Predation Avoidance. Residence of juvenile Chinook salmon in estuaries is thought to reduce predation by birds, fish, otters and seals (Simenstad et al. 1982; Macdonald et al. 1988; Thorpe 1994), although there are few comprehensive studies that analyze this. McCabe (1983) documented very little predation on salmonids from other fish that reside in the Columbia River estuary. Non-salmonids that reside in estuaries are generally smaller than those in the intertidal region of the adjacent marine habitat (McCabe et al. 1983). Estuarine turbidity could be a mechanism that protects juvenile Chinook salmon from predation (Quinn 2005). The Skagit River is fed by several large glaciers that seasonally cause turbid river and estuarine conditions. Tides and wave action can also suspend sediment, all of which may make juvenile Chinook salmon more difficult to locate by predators. Perhaps most importantly, estuaries enable growth of juveniles, which are then less vulnerable to predation when they enter the sea.

Smoltification. Smoltification is an energetically demanding and complex change of morphology, physiology, and behavior designed to prepare juvenile salmonids for the vastly different environmental conditions in seawater (Quinn 2005). During this process, fish appearance changes as vertical parr marks fade to blue-green and silver sides, and their bellies turn white. These colors reduce vulnerability to predation in open water because fish are less apparent to predators from the side, above and below (Quinn 2005). The body also becomes more streamlined, and teeth further mature on the gums and tongue that allow fish to catch larger, faster, and a more diverse array of prey (Quinn 2005). Physiological changes include altered osmoregulation (salt balance) system, energy storage and kidney function and ion regulation though the gills. Behavioral changes include altered schooling, predator avoidance and feeding. When estuarine habitat is limiting, salmonids do not have adequate time to complete the smoltification process and are more vulnerable top physiological stresses and predation when they enter marine habitats.

Tidal Distribution. Growth, predator avoidance and smoltification are enhanced by tidal dispersion. Levy and Northcote (1981) investigated the relationship between occurrence and abundance of Chinook salmon in estuarine habitats based on the physical characteristics of the habitat. They determined that juvenile Chinook salmon prefer tidal channels with low banks and subtidal refugia, such as aquatic vegetation and complex woody materials. Juvenile Chinook salmon in estuaries often distribute with high tides, occupying temporarily inundated mudflats and marshes, and as tides recede, retreat into defined tidal channels that retain water at low tides (Groot and Margolis 1991). Juvenile Chinook salmon are among the last fish to vacate tidal channels in the marsh when the channels dry up at low tide (Levy and Northcote 1981, 1982). Fish often concentrate in tidal channels at low tide, and move to the landward margin of the intertidal area on incoming and high tides (Healey 1980). During high tides, juvenile Chinook salmon vacate deeper intertidal habitat and occupy temporarily inundated habitat (Healey 1980). This distribution with the tidal cycle is likely a combination of passive movement with the current, and active selection of preferred habitat. Distribution with the tides facilitates dispersion into habitats that, by definition, are only available for portions of the day.

Tidal dispersion is vital for juvenile Chinook salmon because it provides:

1) access to small channels with structural complexity in the form of emergent vegetation and general benthic structure that provides protection from predators (Miller and Simenstad 1997; McMahon and Holtby 1992); 2) access to a greater volume of habitat for feeding opportunities, and simultaneously reduces juvenile Chinook salmon density, and thus reduces competition for food. (Miller and Simenstad 1997; Neilson et al., 1985), and; 3) access to habitats with slower current velocities than larger channels. Slower current velocities reduce energy expenditure necessary to maintain a preferred position in the water column, thus facilitating greater ability to pursue food. Juvenile salmonid feeding peaks during the upper portion of the tidal cycle. Stomach contents of salmon fry within the Skagit estuary peaked 3 to 4 hours after high tide, and minimum weights occurred late in the slack (ebb) water period (Congleton 1978). Juvenile salmon have higher feeding rates at lower water velocities (Bailey et al. 1975).

Skagit Estuarine Habitat Related to Viable Salmonid Populations Parameters. Estuarine and Skagit Bay habitat provide vital functions that support Skagit Chinook salmon abundance (by increasing habitat capacity for juvenile rearing and survival to adult returns), productivity, diversity (expressed here in terms of timing of arrival and duration of habitat use), and spatial structure.

Within the past decade, outmigrant Chinook salmon abundance (juveniles that emerge from redds and travel downstream) has ranged from approximately 0.5 million to 6.5 million fish (Seiler et al. 2004). Estuarine abundance of juvenile Chinook salmon in the Skagit is minimally influenced by hatchery Chinook salmon releases[2]. Habitat loss within the Skagit estuary constrains the number of juvenile Chinook salmon that can successfully reside and grow there. Average juvenile Chinook salmon density ranges from 808 to 5,668 fish per acre of estuarine habitat (Beamer et al. 2005a) depending upon the outmigrant class size. Although the average outmigrant class is 5.1 million juvenile Chinook salmon, there is only enough rearing habitat in the estuary for approximately

[2] As an example, the 2003 Skagit River Chinook outmigrant class was 5.5 million fish, and 197,000 were also estimated to be hatchery releases, roughly equating to 3.6 percent of the outmigrant class size.

2.25 million fish (44 percent) (Beamer et al. 2005a). When population size exceeds 2.25 million juveniles the growth rate of individual fish declines. Juvenile Chinook salmon that rear in estuarine habitat are more likely to successfully returnas adult fish (Reimers 1973; Levings 1989). Fish that rear in the estuary are larger (Beamer et al. 2005), and have a higher survival rate than fish that emigrate directly to Skagit Bay.

Productivity, measured as juvenile growth rate within the Skagit estuary, is reduced in most years as a result of habitat loss and degradation. Habitat in the Skagit estuary is delineated, from upstream to the Skagit Bay, into FRT, estuarine forested transition, and EEM based upon differing vegetation communities and saline gradients. Average growth rate for juvenile Chinook salmon is higher in EEM than in FRT and estuarine forested transition habitat. Estuarine productivity depends upon the amount of time juveniles spend within the estuary, the type of habitat they occupy within the estuary, and the density of individuals that occupy the existing habitat.

Habitat loss and degradation within the Skagit estuary may constrain the life-history diversity of the six Skagit Chinook salmon populations. Within the Skagit River, several different life history types have been identified (Beamer and Larson 2004) to describe the variability of rearing by young of the year juvenile Chinook salmon in riverine and estuarine habitats. These rearing types, termed yearlings, tidal delta migrants, parr migrants, and fry migrants have been determined from the analysis of otoliths[3] from Skagit River Chinook salmon
(Beamer et al., 2005a):

- Yearling fish rear within freshwater for at least one year, and migrate to Skagit Bay from late March through May at an average size of 120 mm. Yearling fish do not reside in the Skagit estuary for extended periods; rather they move to deeper water habitats in Skagit Bay and are rarely found in nearshore habitat.

- Parr migrants grow in freshwater habitat for approximately two months and migrate to Skagit Bay at an average size of 75 mm. They do not reside in tidal delta habitats for measurable periods.

- Tidal delta migrants emerge and emigrate downstream concurrently with fry migrants and reside in the estuary from several weeks to several months (average of 34.2 days in 1995 and 1996). They move into Skagit Bay in May and June at an average length of 74 mm.

- Fry migrants rapidly emigrate down the river after emergence. These fish do not rear for measurable periods within the estuary, and are typically the first juveniles to enter Skagit Bay (from February through March), with an average fork length of 39 mm. Chinook salmon fry migrants are less fit to survive in saltwater than other life-history types. Because of their rapid entry to higher saline environments, it is likely that fry migrants are unable to properly initiate or

[3] Otoliths are calcareous particles found in the inner ear of vertebrates. Chinook movement and growth can be generally tracked, on a daily basis, upon removal and investigation of the otolith.

complete the important process of smoltification. It is very likely that most fry migrants would rear in the delta and be tidal delta migrants if the Skagit estuary habitat was large enough to accommodate all juveniles.

All six Skagit Chinook salmon populations have yearlings, parr migrants, tidal delta migrants, and fry migrant life history (Beamer et al. 2005a). All populations appear to have relatively similar proportions of fry migrant juveniles, which are less fit (mostly because of their small size) to survive in Skagit Bay, Puget Sound, and the Ocean. Life history diversity enables stocks to be more resilient to naturally changing habitat conditions. For example, yearlings would not be subjected to poor ocean conditions during their year of freshwater residency. Conversely, tidal delta users minimize their risk from poor freshwater conditions because they rely much more on estuarine habitat prior to emigration to the ocean. They are also able to capitalize upon favorable ocean conditions sooner than Yearling fish.

Within the Skagit estuary and Bay, juvenile Chinook salmon habitat usage is largely dependent upon landscape and local (or site level) habitat connectivity. For instance, juvenile Chinook salmon densities in the Swinomish Channel and Padilla Bay (located to the North of the Skagit estuary) are generally much lower than other portions of the estuary and bay because the Swinomish Channel Jetty directs river flow, and juvenile Chinook salmon, away from the channel and reduces northward migration opportunity (Yates 2001). Conversely, juvenile Chinook salmon densities is the highest within the high connectivity habitat of the Skagit estuary, averaging 4,534 fish per hectare of blind channels[4] over the outmigrant season (Beamer et al. 2005a). Chinook salmon densities in the Skagit estuary are also dependent upon local habitat characteristics; estuarine habitat use is influenced by current velocities, depths, and amount of edge habitat (Beamer et al. 2005a). Juvenile Chinook salmon densities are the greatest in deep low velocity blind channels compared to other estuarine habitat.

Status of Critical Habitat

The ESA defines CH as "the specific areas within the geographic area occupied by the species, at the time it is listed, on which are found those physical or biological features that are:
essential to the conservation of the species, and (2) areas outside the geographical area occupied by the species at the time it is listed that are determined by the Secretary to be essential for the conservation of the species and may require special management considerations or protections (50 CFR 424.02(d)). The NMFS published a final rule designating CH for PS Chinook salmon on September 2, 2005, (70 FR 52630). Critical habitat includes the stream channels within the proposed stream reaches, and includes a lateral extent as defined by the ordinary high-water line (33 CFR 319.11). In estuarine and nearshore marine areas CH includes areas contiguous with the shoreline from the line of extreme high water out to a depth no greater than 30 meters relative to mean lower low water (69 FR 74572).

[4] 'Blind Channels' are waterways that are formed by, and drain, tidally introduced water rather than runoff from associated wetlands and upland sources (Simenstad 1983).

The NMFS reviews the status of CH affected by the proposed action by examining the condition and trends of primary constituent elements throughout the designated area, a region that corresponds approximately to the geographic range of the species. The action area contains CH designated for PS Chinook salmon.

Primary Constituent Elements consist of the physical and biological elements identified as essential to the conservation of the species in listing and recovery documents. Critical habitat PCEs include sites essential to support one or more life stages of the ESU (sites for spawning, rearing, migration and foraging) and contain physical or biological features essential to the conservation of the ESU, for example, spawning gravels, water quality and quantity, side channels, and forage species.

The CH PCEs affected by the proposed action are estuarine and nearshore marine areas. Estuarine PCE function requires areas free of obstruction and excessive predation with: (i) Water quality, water quantity, and salinity conditions supporting juvenile and adult physiological transitions between fresh- and saltwater; (ii) Natural cover such as submerged and overhanging large wood, aquatic vegetation, large rocks and boulders, side channels; and (iii) Juvenile and adult forage, including aquatic invertebrates and fishes, supporting growth and maturation. Nearshore PCE function requires marine areas free of obstruction and excessive predation with: (i) Water quality and quantity conditions and forage, including aquatic invertebrates and fishes, supporting growth and maturation; and (ii) Natural cover such as submerged and overhanging large wood, aquatic vegetation, large rocks and boulders, and side channels.

Presently, PCE function in the range of designated CH is generally degraded. Freshwater spawning, rearing, and migration corridors offer a fraction of the historic habitat quality and quantity. Factors responsible for degraded spawning habitat include loss of Large Woody Debris (LWD); dike and levee construction and other bank stabilization measures that result in loss of side channel development; elevated velocities that contribute to scour; and elevated sedimentation that inhibits redd excavation and emergence (NMFS 2005). Factors responsible for degraded rearing conditions include the loss of riparian areas and loss of floodplain connectivity from dike and levee and bank stabilization measures and the reduction of natural cover such as shade, submerged and overhanging large wood, logjams, side channels, and undercut banks (NMFS 2005). Factors responsible for degraded migration corridors include elevated summer temperatures and loss of habitat complexity through a decrease in LWD. Temperatures are generally elevated due to the loss of shade from degraded and lost riparian cover. Natural logjams and large wood accumulations enable the development of deep pools with complex natural hiding and escape cover that support adult and juvenile holding habitat (NMFS 2005).

As part of the process to designate CH within the PS Chinook salmon ESU, NMFS assessed the conservation value of habitat within freshwater, estuarine and nearshore areas at the fifth field Hydrologic Unit Code (HUC) scale. That scale corresponds generally to the watershed scale. The ratings were generally devised as “low”, "medium", or "high" conservation value. The NMFS rated the fifth field HUC within which the action area lies as having a "high" conservation value. Surrounding Upper Skagit and Sauk Rivers also have a "high" conservation value. Activities identified as degrading habitat quality within this area included agriculture, channel and bank modifications such as riprap and diking, wetland loss and removal, and urbanization (Good et al. 2005).

As described in more detail within the Environmental Baseline section below, CH within the Skagit River Watershed and nearshore Puget Sound is generally degraded from a variety of human-induced habitat process and structural changes.

The estuarine and nearshore areas of CH within the action area are generally degraded from a combination of channel in-filling from the loss of distributary channel and connected blind sloughs on Fir Island, extensive shoreline armoring and levee/dike construction and maintenance along the Skagit estuary and Bay, loss of large wood input from upstream and marine riparian sources, and reduced accessibility and quality of pocket estuaries.

Environmental Baseline

The environmental baseline includes the past and present impacts of all Federal, state, or private actions and other human activities in the action area, the anticipated impacts of all proposed Federal projects in the action area that have already undergone formal or early Section 7 consultation, and the impact of state or private actions which are contemporaneous with the consultation in process (50 CFR 402.02).

The NMFS describes the environmental baseline in terms of the habitat features and processes necessary to support life stages of the subject ESU within the action area. The habitat requirements of salmon in the action area vary depending on the life history stage present and the natural range of variation present within that system (Groot and Margolis 1991; Natural Resource Council 1996; Spence et al. 1996). Habitat requirements for juvenile rearing include seasonally suitable microhabitats for holding, feeding, and resting. Migration and feeding corridors for juveniles to reach rearing areas requires unobstructed access to these habitats. Physical, chemical, and thermal conditions may all impede migrations of adult or juvenile fish. The PS Chinook salmon ESU considered in this Opinion resides in or migrates through the action area. Thus, for this action area, the habitat requirements for Chinook salmon are those that support successful juvenile rearing.

The Skagit River Watershed is the largest (1,433,205 acres) within the ESU, and contributes roughly one-third of freshwater inflow to Puget Sound. Habitat loss and degradation, most prominently within the mainstem and estuary, are significant factors in the declines in Skagit Chinook salmon abundance within the last century. Impaired upland sediment budgets in some sub-basins, the loss of floodplain, off channel and wetland areas, impaired riparian areas, simplified mainstem edge habitat[5], inaccessible and altered estuarine habitat, and isolation, degradation and loss of nearshore habitat continue to be fundamental habitat limitations that cumulatively impede the viability of each population. Despite these impacts, portions of the watershed are among the best remaining habitat within the Puget Sound ESU.

The loss and simplification of floodplain, off channel, and edge habitat in the mainstem (above the estuary delta) contributes to a reduction of freshwater rearing capacity for each population (Beamer et al. 2005b). Of the historic mainstem floodplain, 31 percent is lost or inhibited from river access and processes, there has been a 98 percent loss of habitat area (wetland and floodplain forest) in the non-tidal delta, and 85 percent of the non-tidal delta edge habitat has been hydro-modified. The most prominent example of this hydromodification is the placement of rock riprap, often from the bottom of the stream channel margin to the upper extent of the bank. Upstream of the town of Sedro-Wooley, which is located at river mile 23, 15 percent of mainstem edge habitat has been hydro-modified. Juvenile salmonid abundance is consistently lower at riprap banks than at natural banks. Therefore, hydromodification reduces the quality of juvenile rearing habitat in the mainstem river. Bank stabilization precludes the formation of under-cut banks, the recruitment of large wood, and often the growth of riparian vegetation. It also inhibits access to (and the formation of) lower velocity off channel habitat that can provide enhanced feeding opportunities and refuge from high flows. Consequently, juvenile salmonids may be prematurely displaced to downstream areas, including the estuary and ocean.

Skagit Estuary and Nearshore. Estuaries are the meeting of freshwater flow and tidal influence from the sea. The upper extent of estuaries feature tidally influenced freshwater, through areas of intermediate salinity, and increasing tidal influence and salinity at their gradual terminus with the sea. Sediment and nutrients are delivered from freshwater and deposited within estuaries, and changing volumes of freshwater outflow and tidal fluctuations foster dynamic temperature, salinity, velocity and turbidity levels. While the net flow within estuaries is toward the sea, currents and velocities are in a constant state of flux, and flow can actually be upstream on incoming tides. Habitat types within estuaries include mud and sand flats, distributary channels and blind sloughs. In the Skagit River estuary these dynamic processes and habitat types contribute to juvenile Chinook salmon rearing but the quality and quantity of habitat has been reduced from loss and degradation of habitat. Much of the Skagit River estuary and delta has been converted from aquatic habitat to farmland and other uses through the development of extensive dike and levee systems (Figure 2 and Table 2). Tidegates have been installed on many channels.

In summarizing estuarine habitat conditions in the Skagit, the Washington State Conservation Commission (2003) found that distributary channels (channels that branch from the mainstem and drain into the estuary) were historically numerous, and wetland

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[5] "Edge habitat" refers to stream channel margins that are preferred habitat for juvenile salmon. Functioning edge habitat features reduced velocities, refuge from predation, and enhanced feeding opportunities relative to other portions of the channel.

complexes covered more than half of the Skagit River delta resulting in a large amount of land in contact with saltwater (Bortleson et al. 1980; Collins and Montgomery 2001). Prior to human impacts, blind tidal habitat comprised an estimated (20,386 acres) while riverine tidal wetlands covered about (10,378 acres) in the Skagit and Samish deltas for a total of (30,765 acres) (Collins and Montgomery 2001). By the end of the 19th century, dikes had isolated most of the Skagit wetlands and by the mid 20th century, numerous distributary channels had been closed off (Collins and Montgomery 2001). Many channels were converted to ditches that drain farmlands and are no longer accessible to salmonids at their upper ends, and more than 100 miles of drainage ditches exist in the Skagit delta (Phinney and Williams 1975). In addition, much of the land isolated by dikes has been ditched, dredged, or filled, resulting in a considerable loss and conversion of wetland habitat.

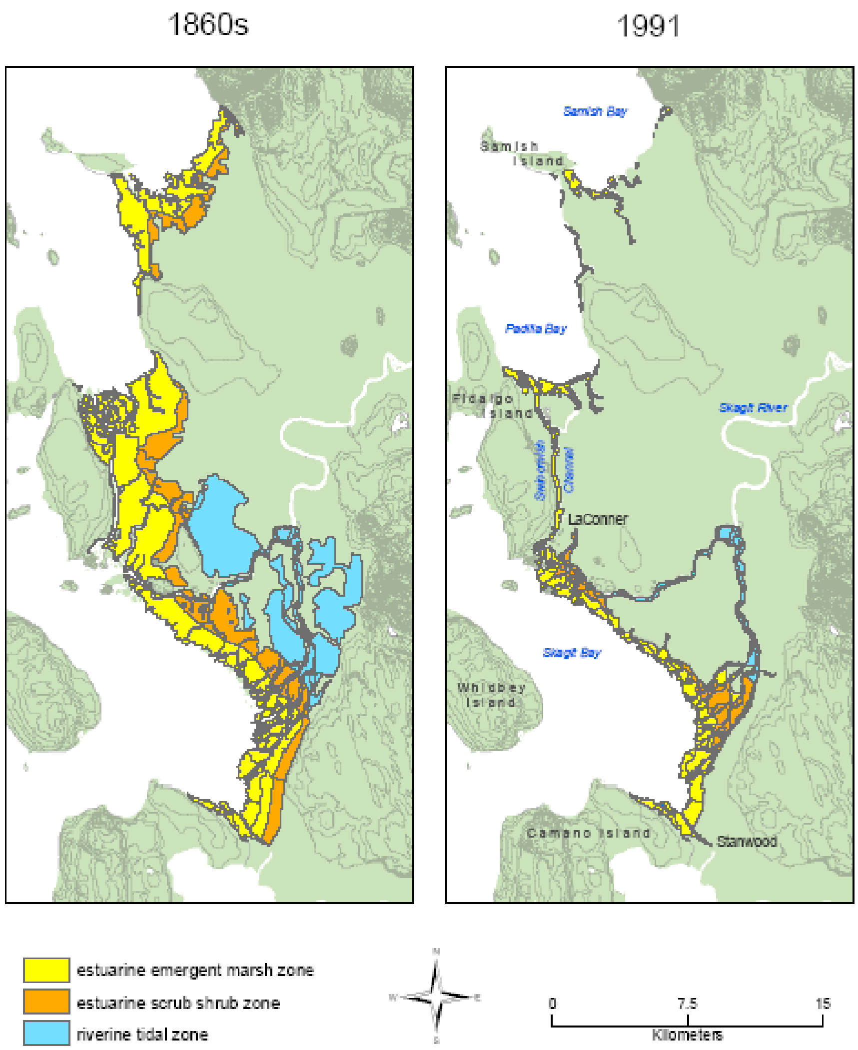

Figure 2. Historic and Contemporary Habitat Types in the Skagit Delta.

(Beamer et al. 2005a)

Table 2. Loss of Skagit Delta for each Habitat Type (Beamer et al. 2005a).

	Current Acres	Historic Acres	Loss
Riverine Tidal	3,578	21,797	84 percent
Estuarine Forested Transition	5,916	17,213	66 percent
Estuarine Emergent Marsh	12,219	34,315	68 percent
Total	20,601	73,333	72 percent

In addition to the widespread loss of estuarine/delta habitat, Beamer et al. (2005a) estimate that blind channels, which are preferred habitat for juvenile Chinook salmon, have been reduced by 94.6 percent (2,765.3 acres). The net loss of edge and blind channel habitat preferred by rearing Chinook salmon is an estimated 87.9 percent.

While a substantial amount of estuarine habitat has been lost or rendered inaccessible, remaining accessible habitats within the estuary have also been degraded from a lack of LWD, lost riparian vegetation, and hydromodification, all of which degrade rearing habitat for juvenile Chinook salmon (Skagit Watershed Council 1999). Habitat volume within some remaining tidal channels of the Skagit estuary has also been reduced. Historic diking of upper reaches of tidal channels reduced the tidal prism for channel reaches downstream, and this loss of tidal energy continues to cause a decrease of channel size and depth through sediment redistribution (Hood 2004b). As sediment redistributes, channels get shallower, leaving less habitat for Chinook salmon to occupy and more areas dewatered during low tides. For example, as a result of dike construction, accessible tidal channel habitat within Wiley Slough, a former distributary slough of Fir Island, has been reduced by 23.2 acres between 1956 and 2000 (Hood 2004b). This loss was derived from reduced channel sinuosity and sediment redistribution. Confining water to a channel, that otherwise would have dissipated in the floodplain, caused channel widening and decreased sinuosity in Freshwater Slough.

With the extensive hydromodification of the historic Skagit Estuary, it has been suggested that sediment which historically would have been deposited on the now inaccessible floodplain deposits (also termed progradation) would now deposit within Skagit Bay creating shallow areas outside of existing dikes, increasing estuarine habitat and compensating for habitat loss behind the dikes. Recent analysis of progradation in the Skagit estuary (Hood 2004, 2005) suggests that effect may have been overestimated. Hood (2004) estimated that net loss of estuarine habitat was 174 acres near Wiley Slough and 102 acres near the North Fork channel. Since 1956, Hood (2005) estimated that the Skagit delta is prograding at approximately 4.1 acres per year near the North Fork of the delta, and losing an average of 0.74 acres per year in the South Fork. In total, a net increase of 168 acres has occurred. During the last 15 years, Hood (2005) estimated that the North Fork region is prograding at roughly the same rate (average of 3.5 acres per year), and the South Fork area showing an average loss of 6.5 acres per year which is a net loss of 46 acres since 1991. Marine currents move sediment from the Skagit Delta, slowing down or halting extensive progradation (Bortelson et al. 1980).

Connectivity within estuarine and nearshore habitats has been lost and compromised. Over 124 tidegates, pumphouses and floodgates currently regulate drainage within the estuary (Smith et al. 2004). Few of these structures (i.e. Edison Slough, Browns Slough) allow fish passage, while the rest are drainage-only gates. Connectivity within the estuary and nearshore has also been altered by the Swinomish Channel (which is waterway connecting Skagit bay and Padilla Bay). Yates (2001) documented a northward decline of juvenile Chinook salmon abundance along the Channel and estimated that only 5.5 percent of the juvenile Chinook salmon outmigrant class migrate through the channel from Skagit Bay to Padilla and Samish Bay.

Smith et al. (2004) summarized water quality in the estuary, as degraded. In addition to the loss of connectivity caused by dikes, water quality conditions were rated as poor for many of these sloughs (Smith 2003). Warm water temperatures and low dissolved oxygen levels have been recorded in Hall, Browns, Dry, and Wylie Sloughs, particularly in the summer months (Entranco 1993). Phosphorus and nitrogen levels were also high in each of these sloughs (Entranco 1993). The causes for the water quality problems are thought to be low flows, non-point pollution, loss of riparian vegetation, loss of wetland habitat, and absence of flushing and circulation due to hydromodifications. Restoration activities that increase tidal flushing should also help address some of the water quality and vegetation impacts.

The Skagit River Recovery Plan, prepared by The Skagit River System Co-operative and WDFW (2005) and incorporated into the Puget Sound Chinook Salmon Recovery Plan (Shared Strategy 2007), identified specific estuarine restoration projects in the Skagit River delta that would mitigate for the loss of estuarine habitat in the delta that has adversely affected PS Chinook salmon. The Recovery Plan states that the restoration of the specified areas is sufficient to recover Chinook salmon in the Skagit River. It is completion of those projects that provides credits to implement this proposed action for continuing repair and maintenance of tidegates.

Effects of the Action

Effects of the action means the direct and indirect effects of an action on the listed species or CH, together with the effects of other activities that are interrelated or interdependent with that action, that will be added to the environmental baseline (50 CFR 402.02). Direct effects are the immediate effects caused by the proposed action. Indirect effects occur later in time but are still reasonably certain to occur.

Elements of the proposed action that are likely to adversely affect PS Chinook salmon are analyzed in terms of how the proposed repairs affect habitat and individual fish in the action area. The analysis then evaluates whether these effects result in appreciable consequences to populations of PS Chinook salmon in the Skagit watershed, and finally how these population-level effects influence the viability of the PS Chinook salmon ESU. The consequences to the Skagit populations and the PS Chinook salmon ESU are generally framed within the VSP assessment parameters (McElhany et al. 2000).

The goal of the proposed action is to streamline the permitting process for tidegate repairs and replacements that would otherwise require individual consultations on permit applications as long as sufficient estuarine habitat restoration has occurred to provide the required amount of mitigation credit. The NMFS anticipates that utilization of this programmatic approach by the COE will stimulate estuarine restoration projects proposed in the Skagit Chinook River Recovery Plan because the program requires restoration credits in hand to permit tidegate repairs and replacements under this programmatic consultation. The Skagit Chinook Recovery Plan based recovery estimates on the restoration of the specified estuarine habitat within 50 years. The proposed COE program anticipates that as a result of the linkage between tidegate repair and replacement and the completion of restoration projects, those projects will be completed during the 25 year duration of the proposed action, half the time stated in the Skagit Chinook Recovery Plan. This would result in estuarine habitat for juvenile PS Chinook salmon rearing becoming available sooner than anticipated in the Recovery Plan. Therefore, the NMFS expects that implementation of the IA will further recovery of the six Skagit River populations of PS Chinook salmon.

It is reasonably certain that the tidegate repairs and replacements covered by this programmatic consultation will have minor adverse effects on PS Chinook salmon populations as a result of temporary changes in water quality, temporarily reduced riparian functions, continued blockage of fish passage to the area upstream of the tidegates, and the operation of equipment. However, as described above, applicants for COE permits who have in hand credits for habitat restoration may expedite the process and obtain ESA coverage under this programmatic consultation. In addition, it will significantly increase the likelihood that the restoration projects described in the recovery plan will be implemented, and that as a result, significant amounts of estuarine habitat will be made available to juvenile Chinook salmon during the term of this action. Therefore, while there might be minor adverse effects from the tidegate repairs and replacements, the established linkage within the IA between such actions and the restoration of important estuarine habitat is expected to have a positive effect on PS Chinook salmon populations.

The following discussion of the effects of the proposed action assumes that regardless of the proposed action, the existing tidegate infrastructure will remain in place. The bases for this assumption are: 1) the fact that if the tidegates are not repaired or replaced under this programmatic consultation, they will not likely fail, and 2) if not repaired or replaced and they do threaten to fail, they will likely be replaced with an alternative mechanism. On this basis, this analysis does not consider the prevention of full restoration of the area behind the tidegates to the condition that existed prior to construction of the diking and drainage system to be an effect of the proposed action. Further, while the proposed action is not the sole stimulus of the restoration projects, which could proceed without the proposed action, the following effects analysis considers the effects of the restoration projects because the proposed action the tidegate repairs and replacements cannot occur without them. In addition. the proposed action will stimulate and speed the completion of the restoration projects.

Typically, when a new tidegate is placed and maintained on the landscape, there are several effects that would be addressed in formal consultation, where a Federal nexus exists for that new tidegate. Those effects include changes in water quality stemming from impoundment behind the tidegates when they are closed, such as increased temperatures, reduced concentrations of dissolved oxygen and sharp gradients in temperature, oxygen or salinity when the gates are opened. Furthermore, the placement and operation of a tidegate reduces access to habitat above the tidegates for rearing or spawning depending upon the species, the specific environmental conditions, and whether the tidegate partially or completely prevents fish passage. Activities conducted under the proposed programmatic consultation cannot occur until the requisite extent of habitat restoration is completed such that recovery of PS Chinook salmon in the Skagit Basin is fully supported. The effects of any projects that cannot comply with the programmatic will be addressed in a separate formal consultation.

Effects on Habitat

Water Quality. During implementation of tidegate repair and replacement projects, excavating the watercourse and disturbing the shoreline will temporarily generate increased concentrations of suspended sediments in the watercourses because of equipment and people in the water, and soil released from upland areas as a project levee is removed and restored. In addition, accidental discharge of concrete leachate or petrochemicals from the equipment may occur and degrade water quality. These effects will be localized and temporary. As part of the programmatic consultations, the COE will require measures that confine turbidity to the immediate area of construction and as a result effects should be limited to the first incoming tide following construction.

Riparian Functions. Replacement of tubes, repair of tubes that requires levee removal and placement of rock armoring around the tidegates will involve removal of riparian vegetation in the vicinity of the tidegates, to the extent there is any such vegetation before the project begins. Devegetated area will be typically less than 50 feet on either side of the tidegate. Since tidegates are typically installed in levees or dikes, and most of these dikes are managed to conform to COE regulations for vegetation under the PL 84-99 program, affected areas typically have little or no functional riparian vegetation as a threshold matter. They have no large woody vegetation, and may be mowed to grass. At best, they have small shrubs and woody vegetation of less than 4 inch diameter. Removal of vegetation at this functional stage should restore naturally within five years of construction of de-vegetation activities.

Functioning riparian vegetation provides shade to the watercourse and input of detrital material and terrestrial insects. Removal of this vegetation can elevate water temperatures, and will reduce the detrital input into the watercourse that supports the aquatic food web and production of invertebrates. Further, removal of riparian vegetation will reduce the volume of terrestrial insects that reach the water. Finally, riparian vegetation provides additional functions such as complex edge habitat and wood for recruitment of LWD.

Prey Availability. Excavation of the watercourse can result in the temporary removal of aquatic vegetation. Removing the aquatic vegetation may reduce production of epibenthic and benthic invertebrates that are important fish prey. Excavating the watercourse can also remove or bury epibenthic and benthic prey items. These excavation activities will be limited spatially and temporally under the proposed action.

Effects on Puget Sound Chinook Salmon

In general, effects to Chinook salmon from tidegate repairs and replacement permitted under the proposed action are expected to be minimal because of seasonal limitations on work and the limited geographic scale of the individual repairs and replacements. Best management practices required by the TFI Agreement include a general prohibition on excavation or equipment operation below the ordinary high water line except from August 1 to October 15. Thus, construction will generally occur in the dry during the summer when juvenile PS Chinook salmon are not expected to be present in the action area because they have moved to more marine habitats. Construction may also occur during emergency flood events which typically occur in the winter after adults have migrated to spawning grounds and before juveniles have migrated to the estuary. Nevertheless, some actions may occur when fish are present and a few fish may be injured or killed.

Puget Sound Chinook salmon could be exposed to the effects of the action if fish are present at the time of construction. Effects may include death or injury caused by contact with motorized equipment or stranding during dewatering. In addition, injury or death to individual fish could result from high concentrations of suspended sediments or accidental discharge of concrete leachate or petrochemicals from the equipment. Such events are unlikely because as discussed above, fish are unlikely to be present during these actions, and because of minimization measures the COE has agreed to require in permits issued under this consultation.

As discussed above, removal of riparian vegetation can elevate the water temperature with subsequent stress, displacement or death to resident fish. However, in the Skagit delta the seasonal presence of juvenile salmonids occurs when water temperatures are lower and do not generate physiological stress. Temperature increases resulting from loss of vegetation during this time are not expected to harm juvenile Chinook salmon.

Removal of riparian vegetation will also reduce the detrital input into the watercourse that supports the aquatic food web and production of invertebrate fish prey. The availability of terrestrial insects that are important prey for juvenile PS Chinook salmon will also be reduced by removal of riparian vegetation. The loss of riparian vegetation, reduction of riparian function, and excavation in watercourses can reduce prey availability, potentially resulting in reduced growth of individual fish. Such effect is expected to be minor if it occurs at all, because fish are not expected to be in the area at the time of construction and any loss in prey availability will be undetectable by the time listed species return the impacted area.

The coupling of repairs to blocking structures with estuarine habitat restoration is important to meet the ecological needs of Chinook salmon in the estuary. Estuarine habitat restoration should create and enhance utility of habitat seaward of permitted tidegate maintenance and repair actions over the longer term. The effect of increased support of transition and rearing juvenile life histories will leave individual fish more fit for subsequent ocean life histories, increasing individual performance and survival.

Relevance to Viability of Skagit River Populations of Puget Sound Chinook Salmon. The VSP assessment parameters to evaluate the effects to individual populations of PS Chinook salmon include abundance, productivity, spatial structure and diversity. Because individual tidegate repairs and replacements are expected to have only minor effects on individual fish, NMFS does not anticipate that there will be adverse effects to population level VSP parameters from these actions. That analysis assumes that existing infrastructure will remain in place whether the proposed action occurs or not.

As discussed above, NMFS anticipates that the linkage between tidegate repair and replacement and restoration of estuarine habitat will increase the likelihood and pace at which additional habitat becomes available and progress toward PS Chinook salmon recovery objectives is made. Thus, the effects of the linked restoration projects on VSP parameters are discussed below.

Abundance: Because rearing habitat in the Skagit River estuary is limiting and the restoration activities linked with this action are expected to increase the available habitat, NMFS expects the action to increase the abundance of the six populations of PS Chinook salmon in the Skagit watershed. The rate at which the increase occurs cannot be predicted accurately because it will depend upon the rate of estuarine restoration, marine survival of PS Chinook salmon, and fishing pressure. Nevertheless it is expected to be positive. Similarly, it is difficult to predict which of the six PS Chinook salmon populations in the Skagit watershed will experience the largest increases in abundance. It is reasonable to predict that the summer/fall runs (Lower Skagit, Upper Skagit and Lower Sauk) will benefit the most because a larger percentage of juveniles currently rear as delta fry. However, the spring runs (Upper Cascade, Upper Sauk and Suiattle) currently have much lower overall abundance. Consequently, increased production of delta fry could have a disproportionate impact on the total population.

Productivity: Increased availability of estuarine rearing habitat is expected to increase productivity of delta-fry for all populations. A larger number of delta fry will be able to rear in the estuary and they may be larger before migrating to sea which reduces their susceptibility to predation. That increased productivity of juveniles is expected to slightly increase marine survival, spawner recruit ratios and lambda values for all six populations. As with abundance, it is uncertain which populations will exhibit the greatest increases in production.

Diversity: The NMFS cannot predict how the project may alter the genetic diversity within a population or the relative abundance of different populations within the Skagit watershed, but any effects are likely to be minor because all six populations are expected to benefit from the increased availability of estuarine habitat and the populations within the Skagit watershed are genetically similar. It is expected that an increased percentage of returning spawners will have had a delta-fry life history.

Spatial Structure: The NMFS does not anticipate that this project will impact the spatial structure of the Skagit Watershed populations as it relates to spawning aggregations. The tidegate replacements are also not expected to alter spatial structure in the estuary. However, the restoration actions increase connectivity between different habitats such that rearing habitats are more accessible to migrating juveniles

Relevance of Population Viability to the Evolutionarily Significant Unit. Because the tidegate repairs and replacements are not expected to affect the VSP parameters at the population level, they are likewise not expected to adversely affect the survival or recovery of the PS Chinook salmon ESU. The principal effects of the linked restoration actions will be increased productivity and abundance of the six populations in the Skagit River watershed. Based on current run size and a stray rate of five percent, approximately 700 Skagit River Chinook salmon currently return to non-natal spawning ground annually. If abundance in the Skagit River increases, the number of strays should also increase and potentially enhance abundance in adjacent watersheds.

Effects on Critical Habitat

Effects on CH are presented in terms of how the proposed action alters the value and function of PCEs in the action area. Although the replacement of tidegates limits tidal influence to blind channels upstream of the tidegates, NMFS only designated CH below tidegates. Therefore, NMFS analyzed effects from the project on CH outside (on the marine side) of replaced tidegates.

The proposed action would affect only one PCE. That PCE consists of estuarine areas free of obstruction with water quality, water quantity, and salinity conditions supporting juvenile and adult physiological transitions between fresh and saltwater; natural cover such as submerged and overhanging large wood, aquatic vegetation, large rocks and boulders, and side channels; and juvenile and adult forage, including aquatic invertebrates and fishes, supporting growth and maturation.

Repairing and maintaining tidegates will affect estuarine habitat as it relates to juvenile rearing but not adult use because adults primarily use deeper water for migration. There will be temporary and localized reductions in habitat quality caused by increased concentrations of suspended sediments but those are not expected to decrease the conservation value of the PCE because of their very limited temporal and geographical scope. Because excavation activities are limited spatially and temporally and will occur when listed species are not present, the effects are not anticipated to affect the conservation value of critical habitat. Removal of riparian vegetation from the face of the levee will have effects that persist longer but will be limited to the immediate area of tidegates and tubes that are being replaced. Riparian functions such as shading and input of detritus and terrestrial insects will be incrementally reduced. Because the existing habitat on the levees is currently degraded and the disturbance is infrequent, less than once in 25 years, and small, less than 100 feet per tidegate repair, the loss of riparian function is not anticipated to reduce the conservation value of critical habitat. Large Woody Debris that is greater than 6-inch diameter will be placed outside the tidegate to provide complex habitat features in the estuary. Although there may be minor short-term and localized alterations to habitat, the effects of tidegate repairs and maintenance will not rise to the level of adverse modification of CH.

Because the linked restoration actions will generate additional acreage of high quality habitat for juvenile rearing, the NMFS anticipates that the likelihood of and pace at which habitat quality and quantity will be enhanced and conservation value of estuarine PCE will be increased as a result of the proposed action.

To conduct this analysis, NMFS analyzed the effects of the action within the action area, the magnitude (or severity) of the action area effects on the overall watershed (or habitat unit), and the importance of the watershed (or habitat unit) to the entire area of designated CH. Because the conservation value of estuarine areas in the Skagit River watershed will be enhanced, NMFS does not anticipate adverse effects to estuarine areas in designated CH of the PS Chinook salmon ESU.

Cumulative Effects

'Cumulative effects' are those effects of future state or private activities, not involving Federal activities, that are reasonably certain to occur within the action area of the Federal action subject to consultation (50 CFR 402.02). The Skagit Chinook Recovery Plan (SRSC and WDFW 2005) is based on analysis of limiting factors within the basin and its nearshore waters. One essential key of the Plan is the recovery of habitat forming processes including the growth to maturity of riparian areas that provide the host of functions discussed above. Habitat conditions experienced in the lower Skagit River are particularly important because rearing juveniles from all populations must be able to reside and grow at optimum rates in preparation for their oceanic migration. However, most of the lower mainstem river banks are actively maintained for flood control, and any colonizing shrubs and trees are regularly cut down in part because of COE maintenance regulations that only allows trees up to four-inches in diameter. The cutting of most trees in riparian areas will prevent natural recovery of functions essential to incremental, yet vital, habitat improvements for rearing juvenile PS Chinook salmon.

By the year 2025, the projected human population growth for Skagit County is 61,818 people, which is a 60 percent increase (Redman et al., 2005). With these projections, NMFS assumes that future private and state actions will continue within the action area, increasing as population density rises. It is anticipated that stream bank vegetation management that only allows grasses and incidental willows to persist will continue as a result of COE guidance and policy, as well the perception that trees can increase flood risks and reduce bank integrity. As a result, restoration, natural colonization and recovery of riparian vegetation and enhanced edge condition will be retarded and remain at present-day conditions. However, Skagit County is proposing to set aside riparian conservation areas. Thus, some local municipalities may contribute to recovery in the future. If this occurs some riparian functions may be restored despite the COE levee policies. In addition, Skagit County has recently proposed levee repairs that incorporate wood into the structure to provide higher quality edge habitat.

As the human population in the action area continues to grow, demand for agricultural, commercial, or residential development is also likely to grow. New development is likely to further reduce the conservation value of habitat within the watershed through water withdrawals, stormwater quality degradation and increased volumes, loss of riparian functions, and encroachment to floodplains. The NMFS expects the existing Skagit County regulatory mechanisms to minimize and avoid impacts to watershed function from future commercial, industrial, and residential development are generally not adequate, and/or not implemented sufficiently. Thus, while these existing regulations could decrease adverse effects to watershed function, they still allow incremental degradation to occur, which accumulates over time, and when added to the degraded environmental baseline, results in degraded habitat conditions and reduces habitat quality and suitability for salmonid species.

Implementation of the Skagit Chinook Recovery Plan is ongoing but uncertain beyond present funding and local effort. Thus, the element of the proposed action requiring restoration to occur prior to maintenance actions should help ensure that restoration occurs during the 25-year terms of the proposed program.

<u>Conclusion</u>

After reviewing the status of PS Chinook salmon, the environmental baseline for the action area, the effects of the proposed action and cumulative effects, NMFS concludes that the action is not likely to jeopardize the continued existence of the PS Chinook salmon ESU. This conclusion is based on the determination that none of the VSP parameters will be appreciably reduced by this action. This determination is based on NMFS finding that: (1) adverse effects from individual tidegate repairs and replacements are limited temporally and spatially and will generally occur when no fish are present and with Best Management Practices implemented as part of the individual actions to further reduce potential adverse effects; (2) the action is expected to stimulate restoration of estuarine habitats, which in turn is expected to increase productivity and abundance for all six populations of PS Chinook salmon in the Skagit watershed; and (3) no adverse effects are expected to be measurable to any population of PS Chinook salmon in the Skagit River basin.

In addition, the proposed action will not reduce the conservation value or alter the conservation role of designated CH in the action area and therefore is not likely to adversely modify or destroy CH for PS Chinook salmon. This determination is based on NMFS' finding that: (1) there is no CH behind existing tidegates that are the subject of this consultation; (2) the action will at least maintain existing habitat seaward of the tidegates; and (3) linked restoration activities will enhance the quality and quantity of estuarine habitat available for juvenile rearing of PS Chinook salmon. Therefore, the action is not expected to diminish the conservation value of CH for recovery of PS Chinook salmon.

Reinitiation of Consultation

Reinitiation of formal consultation is required and shall be requested by the Federal agency or by NMFS where discretionary Federal involvement or control over the action has been retained or is authorized by law and: (a) If the amount or extent of taking specified in the ITS is exceeded; (b) if new information reveals effects of the action that may affect listed species or designated CH in a manner or to an extent not previously considered; (c) if the identified action is subsequently modified in a manner that has an effect to the listed species or designated CH that was not considered in the Opinion; or (d) if a new species is listed or CH is designated that may be affected by the identified action (50 CFR 402.16). In particular, consultation might need to be reinitiated if restoration goals associated with Recovery Plan are changed.

To reinitiate consultation, contact the Washington State Habitat Office of NMFS and refer to the NMFS number (2008/03803) assigned to this consultation.

Incidental Take Statement

Section 9(a)(1) of the ESA prohibits the taking of endangered species without a specific permit or exemption. Protective regulations adopted pursuant to section 4(d) extend the prohibition to threatened species. Among other things, an action that harasses, wounds, or kills an individual of a listed species or harms a species by altering habitat in a way that significantly impairs its essential behavioral patterns is a taking (50 CFR 222.102). Incidental take refers to takings that result from, but are not the purpose of, carrying out an otherwise lawful activity conducted by the Federal agency or Whatcom County (50 CFR 402.02). Section 7(o)(2) exempts any taking that meets the terms and conditions of a written ITS from the taking prohibition.

Amount or Extent of Take

The following section assesses the amount or extent of take of PS Chinook salmon caused by the action. The effects of the proposed action on habitat in the action area are likely to co-occur with the presence of individual PS Chinook salmon such that incidental take in the form of harm is reasonably certain to occur. The NMFS' ability to quantify the amount of take in numbers of fish depends on whether NMFS has sufficient information to determine the number of fish that will be exposed, the manner in which each exposed fish will respond to exposure, and whether those responses will fall into one of the categories of take, listed above.

For take in the form of harm, quantifying take as a number of fish can be difficult if not impossible to accomplish because of the range of individual fish responses to habitat change. Some will encounter changed habitat and merely react by seeking out a different place in which to express their present life history. Others might change their behavior, causing them to express more energy, suffer stress, or otherwise respond in ways that impair their present or subsequent life histories. Yet others will experience changed habitat in way that kills them. While this uncertainty makes it impossible to quantify take in the form of harm in terms of numbers of animals injured or killed, the extent of habitat change to which present and future generations of fish will be exposed is readily discernable and presents a reliable measure of the extent of take that can be monitored and tracked. Therefore, when the specific number of individuals "harmed" cannot be predicted, NMFS quantifies the extent of take based on the extent of habitat modified (51 FR 19926 at 19954; June 3, 1986).

Operation of heavy equipment during repair and replacement of tidegates in the Skagit delta may occasionally kill or injure PS Chinook salmon during construction. Because construction will nearly always occur when fish are not present, the NMFS anticipates that such a loss will be rare. Consequently capture/salvage of fish, fish crushed by equipment or exposed to harmful concentrations of suspended sediments or contaminated water will affect no more than five juveniles annually.

Repairs and replacement of tidegates in the Skagit delta are estimated to remove up to 100 feet of riparian vegetation per site. Because it is anticipated that the number of repairs will not exceed five sites annually, the total loss of vegetation will be less than 500 feet of riparian vegetation annually. Harm of PS Chinook salmon would occur from the incremental loss of prey.

The estimated amount of take (up to five juvenile PS Chinook salmon annually) and extent of habitat affected (up to 500 linear feet of riparian vegetation annually) by construction activities represents the extent of take exempted in this ITS. This extent is readily observable and therefore suffices to trigger reinitiation of consultation, if exceeded and necessary (see H.R. Rep. No 97-567, 97th Cong., 2d Sess. 27 (1982).

<u>Reasonable and Prudent Measures</u>

The measures described below are non-discretionary, and must be required by the COE and must become binding conditions of any permit or grant issued under the proposed action, for the exemption in section 7(o)(2) to apply. The COE has a continuing duty to regulate the activity covered by this ITS. If the COE (1) fails to assume and implement the terms and conditions or (2) fails to require applicants to adhere to the terms and conditions of the ITS through enforceable terms that are added to the permit or grant document, the protective coverage of section 7(o)(2) may lapse. To monitor the impact of incidental take, the COE must report the progress of the action and its impact on the species to the Service as specified in the ITS.

The following measures are necessary and appropriate to minimize the impact of incidental take of listed species from the proposed action:

The U.S. Army Corps of Engineers shall:

1. Require measures that minimize exposure to suspended sediments as conditions of any permit issued under the proposed action.
2. Require measures that minimize effects of reduced riparian functions as conditions of any permit issued under the proposed action.
3. Require measures that minimize effects from capture of fish as a condition of any permit issued under the proposed action.
4. Ensure that the permits issued under this programmatic consultation are consistent with the restoration objectives set forth in the TFI program.
5. Ensure permits issued under this consultation include a monitoring, adaptive management and reporting program to confirm that the take exemption for the proposed action is not exceeded, and that the terms and conditions in this ITS are effective in minimizing incidental take, per (50 CFR 402.14(i)(1)(iv) and (I)(3)).

Terms and Conditions

To be exempt from the prohibitions of section 9 of the ESA, the COE and its cooperators, including the applicants, must fully comply with conservation measures described as part of the proposed action and the following terms and conditions that implement the RPMs described above. Partial compliance with these terms and conditions may invalidate this take exemption, result in more take than anticipated, and lead the Services to a different conclusion regarding whether the proposed action will result in jeopardy or the destruction or adverse modification of designated CHs.

1) To implement RPM Number 1 the COE shall, when issuing a permit under this programmatic consultation require the applicant to minimize PS Chinook salmon exposure to suspended sediments and contaminants by:

Limiting the operation of equipment in the water. Any excavation activity below OHW line shall be conducted to the maximum extent possible during low tide cycles or low flow cycles in the downstream watercourse. Motorized equipment used to repair or replace a damaged tidegate or floodgate shall only be operated above OHW line.

Constructing coffer dams. Whenever water is present in the upstream watercourse, a temporary cofferdam shall be installed upstream of the damaged tidegate/floodgate prior to initiating any excavation activity below OHW line in order to isolate the project site from the upstream watercourse. Whenever water is present in the downstream watercourse, a temporary cofferdam shall be installed immediately downstream of the damaged tidegate/floodgate prior to initiating any excavation activity below OHW line in order to isolate the project site from the downstream watercourse. The cofferdams may be constructed from substrate materials imported to the site or from substrate materials excavated from the existing dike above OHW line. Under no circumstances shall substrate materials be excavated below OHW line from the watercourses for the purpose of constructing the cofferdams. Waste water removed from within the cofferdam work area shall be discharged to a location landward of OHW line in a manner that allows removal of fine sediments prior to the discharged water returning to the watercourses. Upon completion of the tidegate/floodgate repairs and/or replacement, all material used to construct the cofferdams shall be removed from the watercourses and the project site returned to pre-project or improved conditions.

2) To implement RPM Number 2 the COE shall, when issuing a permit under this consultation, require that the applicant disturb no more than the absolute minimal amounts of soil necessary to repair or replace the damaged tidegate or floodgate. Following installation disturbed soils at the project site shall be protected from erosion using vegetation and/or other means. Disturbed surfaces shall be covered with topsoil and planted with native grasses and woody vegetation.

3) To implement RPM Number 3 the COE shall require as a condition of any permit issued under this proposed action that the applicant safely removes fish from work area. Immediately prior to initiating any excavation activity below OHW line, fish removal protocols shall be implemented by a qualified biologist, experienced and trained in the handling of fish who shall supervise the capture and relocation of the fish. Whenever water is present in the upstream watercourse, a block net shall be installed immediately upstream of the proposed project area to prevent fish from migrating back into the project area during fish salvage and project activities. Whenever water is present in the downstream watercourse, a block net shall be installed immediately downstream of the proposed project area to prevent fish from migrating back into the project area during fish salvage and project activities. Fish shall be captured and safely moved from the project area using the best available methods and practices, including but not limited to dip netting, and seining. The preferred sequence of fish removal is to first install the upstream block net followed by a seine and/or dip netting efforts proceeding in the downstream direction. The downstream block net shall be moved, closely behind the seining crew. After establishing the downstream block net, additional sweeps of the project area with a seine is recommended. Fish handling techniques shall be implemented that result in the least amount of stress or damage to the captured fish. Captured fish shall be immediately and safely transferred to the watercourse downstream of the project reach.

4) To implement RPM Number 4 the COE shall ensure that:

Progress toward the restoration goals is achieved as projected in the TFI program. If an annual report, as required by the TFI program, is submitted that does not document new credits, the oversight committee, within three months, shall provide to the COE and NMFS a detailed plan for accomplishing the restoration objectives. If two consecutive annual reports do not have new credits, the COE shall reinitiate consultation with NMFS. The COE shall not issue any new permits under the programmatic until a new Biological Opinion is issued in response to the re-initiation. At the time of each 5-year renewal for the WDFW Hydraulic Project Approval permit, the Oversight Committee shall assess and report on the progress of restoration projects and how the Recovery Plan goals will be accomplished within 25 years.

Available credits are not disproportionately allocated for purchase and permitting rather than completed restoration projects. Although NMFS anticipates that 2700 acres of estuarine habitat will have been restored at the completion of this programmatic, initially most credits will be provided for projects that are in planning stages. To insure that projects are completed, the COE shall require that an increasing proportion of credits are assigned to completed projects for the duration of the programmatic. Therefore:

- at year 5 at least 15 percent of the credits shall be for completed projects
- at year 10 at least 30 percent of the credits shall be for completed projects
- at year 15 at least 45 percent of the credits shall be for completed projects
- at year 20 at least 60 percent of the credits shall be for completed projects

Determination of available credits shall be made by an independent technical committee whose members have technical expertise designing and implementing estuarine restoration projects. The technical committee will be responsible for designating credits for individual projects consistent with the Skagit Chinook Recovery Plan. The technical committee will evaluate project designs submitted for permitting and actual acreage restored. NOAA's Northwest Restoration Center will chair the technical committee and select members to represent resource agencies, tribes and the agricultural community.

Because design and implementation of restoration projects is a multi-year process, credits for individual projects will be released at different times.

- When (1) landowner permission and agreement is secured, (2) easement and purchase of associated lands is secured, (3) projects feasibility and conceptual design are complete, and evaluated by the technical committee, 30% of the acreage proposed for restoration in the conceptual design shall be available for use.

- When (1) all local permits necessary to complete the projects have been obtain and (2) funding is obtained to fully implement the project an additional 30% of the acreage proposed in the most current design shall be available for use.

- When the project is implemented and construction activities are completed, the remaining 40% of credits shall be released based upon acreage in final as built plans.

- All credits for a specific project will be withdrawn if a project is not implemented within 10 years of the initial release of credits for that project.

- Credits available for Operational Improvements shall be determined by the Technical Committee based upon scientific documentation of increased accessibility to and use of habitat.

- If 2,700 acres of currently functioning agricultural land is released for estuarine restoration projects but the necessary credits have not been designated by the technical committee, no additional acreage will be required to obtain COE permits for tidegate repair and replacement.

- No credits shall be available for work completed prior to the signing of the Biological Opinion. However, for projects that are partially completed acreage will be proportioned toward the 2,700 acre total and the necessary credits for individual tidegate repairs and replacements will be re-calculated.

- Projects that are completed in response to legal obligations or required mitigation for other actions will not provide credits for TFI projects.

- During the first 4 years of the project, the applicant will be allowed to generate a credit deficit not to exceed 100 credits in the first year. The maximum number of deficit credits will be reduced to 75 in the second year, 50 in the third year and 25 credits in the fourth year and 0 in subsequent years. If a Diking District withdraws from the TFI Agreement during the first 5 years, the COE shall reinitiate consultation for any action that was completed with deficit credits and require appropriate, alternative habitat restoration.

- The COE shall notify all tribes in the Skagit River watershed prior to releasing verification notices under this programmatic consultation.

5) To implement RPM Number 5 (monitoring, adaptive management and reporting), the COE shall ensure that Western Washington Agricultural Association provides annual reports that detail the specific actions permitted by the programmatic, any take of habitat components as identified in the ITS and progress toward the restoration goals. The COE shall require that the applicants record the number and species of alive and dead fish associated with tidegate repairs and replacements and report this information to the COE as part of the annual report. If the number of PS Chinook salmon injured or killed as a result of these actions is five or more fish within any one year, consultation shall be immediately reinitiated. Submit a copy of the report by December 31 of each year to the Washington State Habitat Office of NMFS.

The COE will condition each permit issued under this programmatic consultation with the following notice that shall be provided in writing to each party that will supervise completion of a proposed action:

NOTICE: If a sick, injured or dead specimen of a threatened or endangered species is found in the action area, the finder must notify NMFS Law Enforcement at (206) 526-6133 or (800) 853-1964, through the contact person identified in the transmittal letter for this Opinion, or through the NMFS Washington State Habitat Office. The finder must take care in handling sick or injured specimens to ensure effective treatment, and in handling dead specimens to preserve biological material in the best possible condition for later analysis of cause of death. The finder also has the responsibility to carry out instructions provided by Law Enforcement to ensure evidence intrinsic to the specimen is not disturbed unnecessarily.

MAGNUSON-STEVENS FISHERY CONSERVATION AND MANAGEMENT ACT

The consultation requirement of section 305(b) of the MSA directs Federal agencies to consult with NMFS on all actions, or proposed actions that may adversely affect EFH. Adverse effects include the direct or indirect physical, chemical, or biological alterations of the waters or substrate and loss of, or injury to, benthic organisms, prey species and their habitat, and other ecosystem components, if such modifications reduce the quality or quantity of EFH. Adverse effects to EFH may result from actions occurring within EFH or outside EFH, and may include site-specific or EFH-wide impacts, including individual, cumulative, or synergistic consequences of actions (50 CFR 600.810). Section 305(b) also requires NMFS to recommend measures that may be taken by the action agency to conserve EFH.

The Pacific Fishery Management Council (PFMC) designated EFH for groundfish (PFMC 1998a), coastal pelagic species (PFMC 1998b), and Chinook salmon, coho salmon, and PS pink salmon (PFMC 1999). The proposed action and action area for this consultation are described in the Introduction to this document. The action area includes areas designated as EFH for various life-history stages of Chinook salmon, coho salmon (*O. kisutch*) and PS pink salmon (*O. gorbuscha*) salmon

Over the long term, NMFS believes that the net effects of the project on EFH will be beneficial. However, there may be some short-term adverse effects to EFH manifested during construction and shortly thereafter.

The NMFS believes that the proposed action may temporarily adversely affect EFH because the project will remove and exclude fish from rearing habitat, cause turbidity, and disrupt riparian functions. This will temporarily reduce EFH connectivity, reducing its suitability for feeding and growth to maturity.

Essential Fish Habitat Conservation Recommendations

The NMFS believes that the proposed action already features conservation measures that are necessary to avoid, mitigate, or offset the impact of the proposed action on EFH. Therefore, NMFS has no additional conservation recommendations for the proposed action.

Statutory Response Requirement

Because the conservation measures that the COE included as part of the proposed action to address ESA/EFH concerns are adequate to avoid, minimize, or otherwise offset potential adverse effects to the EFH of the species, conservation recommendations pursuant to MSA (section 305(b) (4) (A)) are not necessary. Since NMFS is not providing conservation recommendations at this time, no 30-day response from the COE is required (MSA section 305(b) (4) (B)).

Supplemental Consultation

The COE must reinitiate EFH consultation with NMFS if the proposed action is substantially revised in a way that may adversely affect EFH, or if new information becomes available that affects the basis for NMFS EFH conservation recommendations [50 CFR 600.920(k)].

DATA QUALITY ACT DOCUMENTATION AND PRE-DISSEMINATION REVIEW

Section 515 of the Treasury and General Government Appropriations Act of 2001 (PL 106-554) (Data Quality Act [DQA]) specifies three components contributing to the quality of a document. They are utility, integrity, and objectivity. This section of the Opinion addresses these DQA components, documents compliance with the Data Quality Act, and certifies that this Opinion has undergone pre-dissemination review.

Utility: This document records the results of one interagency consultation, completed under two separate legal authorities. The information presented in this document is useful to two agencies of the Federal government (NMFS and the COE), Skagit County Diking Districts, the residents of Skagit County, Washington, and the general public. These consultations help fulfill multiple legal obligations of the named agencies. The information is also useful and of interest to the other identified people and organizations because it describes the manner in which public trust resources are being managed and conserved. The information presented in this document and used in the underlying consultation represents the best available scientific and commercial information and has been improved through interaction with the consulting agency.

Integrity: This consultation was completed on a computer system managed by NOAA Fisheries in accordance with relevant information technology security policies and standards set out in Appendix III, Security of Automated Information Resources, Office of Management and Budget Circular A-130; the Computer Security Act; and the Government Information Security Reform Act.

Objectivity:

Information Product Category: Natural Resource Plan.

Standards: This consultation and supporting documents are clear, concise, complete, and unbiased; and were developed using commonly accepted scientific research methods. They adhere to published standards including the NOAA Fisheries ESA Consultation Handbook, ESA Regulations, 50 CFR 402.01 et seq., and the Magnuson-Stevens Fishery Conservation and Management Act (MSA) implementing regulations regarding EFH, 50 CFR 600.920(j).

Best Available Information: This consultation and supporting documents use the best available information, as referenced in the literature cited section. The analyses in this Opinion/EFH consultation contain more background on information sources and quality.

Referencing: All supporting materials, information, data and analyses are properly referenced, consistent with standard scientific referencing style.

Review Process: This consultation was drafted by NMFS staff with training in ESA and MSA implementation, and reviewed in accordance with Northwest Region ESA quality control and assurance processes.

LITERATURE CITED

Bailey, J.F., B.L. Wing, and C.R. Mattson. 1975. Zooplankton abundance and feeding habits of
fry of pink salmon (*Oncorynchus gorbuscha*) and chum salmon (*Oncorynchus keta*), in traitors Cove Alaska, with speculations on the carrying capacity of the area. National Marine Fisheries Service, Fishery Bulletin 73:846-861.

Beamer, E., and K. Larson. 2004. The Importance of Skagit delta habitat on the growth of wild ocean-type Chinook in Skagit Bay: Implications for delta restoration. http://www.skagitcoop.org/documents.html

Beamer, E., R.R. McClure, and B.A. Hayman. 2000. Fiscal Year 1999 Skagit River Chinook Restoration Research. Skagit System Cooperative report for the Northwest Indian Fisheries Commission Contract #3902 for FY 1999. http://www.skagitcoop.org/documents.html

Beamer E., A. McBride, R. Henderson, and K. Wolf. 2003. The importance of non-natal pocket estuaries in Skagit Bay to wild Chinook salmon: An emerging priority for restoration. Skagit System Cooperative. http://www.skagitcoop.org/documents.html

Beamer, E., McBride, A, Green, C., Henderson, R., Hood, G., Wolf, K., Rice., and K. Fresh. 2005a. Delta and nearshore restoration for the recovery of wild Skagit River Chinook salmon: linking estuary restoration to wild Chinook salmon populations. Supplement to the Skagit Chinook Recovery Plan. http://www.skagitcoop.org/Appendices.html

Beamer, E, Hayman, B., and D. Smith. 2005b (draft). Linking freshwater rearing habitat to Skagit Chinook recovery. An appendix to the Skagit River System Cooperative Chinook Recovery Plan. http://www.skagitcoop.org/documents.html

Bortleson, G.C., M.J. Chrzastowski, and A.K. Helgerson. 1980. Historical changes of shoreline and wetland at eleven major deltas in the Puget Sound Region, Washington. U.S. Dept. of the Interior, Geological Survey.

Collins, B.D. and D.R. Montgomery. 2001. Importance of archival and process studies to characterizing pre-settlement riverine geomorphic processes and habitat in the Puget lowland. *In*: Geomorphic Processes and Riverine Habitat (Dorava, J.M., D.R. Montgomery, B.B. Palcsak, and F.A. Fitzpatrick, eds.). Water Science and Application Volume 4, pp. 227-243.

Congleton, J.L. 1978. Feeding patterns of juvenile chum in the Skagit River salt Marsh. Pages 141-150 in Lipovsky, S.J. and J.A. Simenstad, ed. Gutshop ’78 Fish food habits studies, Proceedings of the second Pacific Northwest Technical Workshop. Washington Sea Grant, University of Washington, Seattle, Washington. 222p.

Congleton, J.L., S.K. Davis, and S.R. Foley. 1981. Distribution, abundance, and outmigration timing of chum and Chinook salmon fry in the Skagit salt marsh, p. 153-163. in E. L. Brannon and E. O. Salo (eds). Proceedings of the Salmon and Trout Migratory Behaviour Symposium. School of Fisheries, University of Washington, Seattle, WA.

Entranco. 1993. Lower Skagit River Basin water quality study. Final report November 1993. For: Skagit County Dept. of Planning and Community Development and Washington Dept. of Ecology. Bellevue, Washington. 75 pp

EPA (U.S. Environmental Protection Agency). 2003. EPA Region 10 guidance for Pacific Northwest state and tribal temperature water quality standards. EPA 910-B-03_002. Region 10 office of water, Seattle, WA.

Good, T.P., Waples, R.S., Adams, P., 2005. Updated Status of Federally Listed ESUs of West Coast Salmon and Steelhead. Technical Memorandum NMFS-NWFSC-66. US Department of Commerce, NOAA, Seattle, Washington.

Groot, C. and L. Margolis. 1991. Pacific Salmon Life Histories. UBC Press, Vancouver, Canada. 564 p.

Haas, A., and B. Collins. 2001. A historical analysis of habitat alterations in the Snohomish River Valley, Washington, Since the Mid-19th century: Implications for Chinook and coho salmon. Snohomish County Public Works, Surface Water Management and the Tulalip Tribes.

Hayman, R., E. Beamer, R. McClure. 1996. FY (Fiscal Year) 1995 Skagit River Chinook research. Skagit System Cooperative Chinook restoration research progress report #1,
NWIFC Contract #3311 for FY 1995. Skagit System Cooperative, La Conner, Washington. http://www.skagitcoop.org/documents.html

Hayman, R. E. 2005. Appendix H, Recovery Goals. Draft Skagit Chinook Recovery Plan. http://www.skagitcoop.org/Appendices.html

Healey, M.C. 1980. Utilization of the Nanimo River estuary by juvenile Chinook salmon, (*Oncoryhynchus tshawytscha*) Fishery Bulletin 77.653-668.

Healey, M.C. 1982. Juvenile Pacific salmon in estuaries: the life support system, p. 315-341. In: V.S. Kennedy (ed.). Estuarine comparisons. Academic Press, New York, NY.

Hogarth, W.T. 2005. Application of the "Destructive or Adverse Modification" Standard under Section 7(a)(2) of the Endangered Species Act. Memorandum for Regional Administrators.

Hood, G.W. 2004b. Indirect environmental effects of dikes on estuarine tidal channels: Thinking outside of the dike for habitat restoration and monitoring. Estuaries. Vol 27(2): 273-282. http://www.skagitcoop.org/documents.html.

Hood, W.G. 2005. Sea Level Rise in the Skagit Delta. Pages 14-15 *in* S. Solomon, editor. Skagit
River Tidings. Skagit Watershed Council, Mount Vernon, Washington.

Levings, C.D, McAllister, C.D., Macdonald, J.S., Brown, T.J., Kotyk, M.S. and Kask, B.A. 1989. Chinook salmon (*Oncorynchus tshawytscha*) and estuarine habitat: a transfer experiment can help evaluate estuary dependency. Canadian Special Publications. Fisheries and Aquatic Sciences. No. 105. pp. 116-122.

Levy, D.A. and T.G. Northcote. 1981. The distribution and abundance of juvenile salmon in the marsh habitats of the Fraser River estuary. Westwater Res. Cent. Univ. Br. Col. Tech. Rep. 25:117p.

Levy, D.A. and T.G. Northcote. 1982. Juvenile salmon residency is a marsh area of the Fraser River estuary. Canadian Journal of Fisheries and Aquatic Sciences. 39:270-276.

Macdonald, J. S. and C.D. Levings. 1988. A field experiment to test the importance of estuaries for Chinook salmon (Oncohynchus tshawytscha) survival: short term results.

McCabe, G. T., R. L. Emmett, W. D. J. Muir and T. H. Blahm. 1986. Utilization of the Columbia River estuary by subyearling Chinook salmon. Northwest Science. 60:113-124.

McElhany, P., M. Ruckleshaus, M. J. Ford, T. Wainwright, and E. Bjorkstedt. 2000. Viable Salmon Populations and the Recovery of Evolutionarily Significant Units. U. S. Department of Commerce, National Marine Fisheries Service, Northwest Fisheries Science Center, NOAA Technical Memorandum NMFS-NWFSC-42. 156 p. http://www.nwfsc.noaa.gov/publications/techmemos/tm42/tm42.pdf

McMahon, T. E. and L. Blair Holtby. 1992. Behaviour, habitat use, and movements of coho salmon (*Oncorynchus kisutch*) smolts during seaward migration. Canadian Journal of Fisheries and Aquatic Sciences. 49: 1478-1458.

Miller, J.A. and C.A. Simenstad. 1997. A comparative assessment of a natural and created estuarine slough as rearing habitat for juvenile Chinook and coho salmon. Estuaries 20:792-806.

Myers, J.M., R.G. Kope, G.J. Bryant, D. Teel, L.J. Lierheimer, T.C. Wainwright, W.S. Grant, F.W. Waknitz, K. Neeley, S.T. Lindley, and R.S. Waples. 1998. Status review of Chinook salmon from Washington, Idaho, Oregon, and California. U.S. Dept. Commerce, NOAA Tech. Memo. NMFS-NWFSC-35, 443p.

NMFS (National Marine Fisheries Service). 2005. Final Assessment of NOAA Fisheries' Critical Habitat Analytical Review Teams for 12 Evolutionarily Significant Units of West Coast Salmon and Steelhead. NOAA Protected Resources Division, 1201 NE Lloyd Blvd Suite 1100, Portland, OR 97232-1274. 27 pages + appendices.

Neilson, J.D., G.H. Geen, and D. Bottom. 1985. Estuarine growth of juvenile Chinook salmon (*Oncoryhynchus tshawytsa*) as inferred from otolith microstructure. Can. J. Fish. Aquat. Sci. 42:899-908.

Northcote, T.G., N.T. Johnston, and K. Tsumura. 1979. Feeding relationships and food web structure of lower Fraser River fishes. Westwater Res. Cent. Univ. Br. Col. Tech. Rep. 16:73p.

NRC (National Research Council). 1996. Upstream-Salmon and Society in the Pacific Northwest. National Academy Press, Washington, D.C. 452 p.

PFMC (Pacific Fishery Management Council). 1998a. Final Environmental Assessment/ Regulatory Review for Amendment 11 to the Pacific Coast Groundfish Fishery Management Plan. Pacific Fishery Management Council, Portland, Oregon (October 1998). http://www.pcouncil.org/groundfish/gffmp/gfa11.html

PFMC. 1998b. The Coastal Pelagic Species Fishery Management Plan: Amendment 8. Pacific Fishery Management Council, Portland, Oregon (December 1998). http://www.pcouncil.org/cps/cpsfmp.html

PFMC. 1999. Amendment 14 to the Pacific Coast Salmon Plan. Appendix A: Description and Identification of Essential Fish Habitat, Adverse Impacts and Recommended Conservation Measures for Salmon. Pacific Fishery Management Council, Portland, Oregon (March 1999). http://www.pcouncil.org/salmon/salfmp/a14.html

PSTRT (Puget Sound Techincal Recovery Team). 2002. Planning ranges and preliminary guidelines for the delisting and recovery of the Puget Sound Chinook salmon evolutionary significant unit. http://nwfsc.noaa.gov/trt/trt_puget.htm.

Phinney, D. and Williams. 1975. A catalog of Washington streams and salmon utilization. Vol. 1 Puget Sound. Washington Department of Fisheries. Olympia, Washington.

Poole, G.C., and C. Berman. 2001. An ecological perspective on in-stream temperature: Natural heat dynamics and mechanisms of human-caused thermal degradation. Environmental Management 27(6):787-802.

Quinn, T. P. 2005. The behavior and ecology of Pacific salmon and trout. American Fisheries Society and University of Washington Press. www.fisheries.org, www.washington.edu

Redman, S., D. Myers and D. Averill. 2005. Regional Nearshore and Marine Aspects of Salmon Recovery in Puget Sound (draft, June 28, 2005). http://www.sharedsalmonstrategy.org/plan/index.htm

Reimers, P.E. 1973. The length of residence of juvenile Chinook salmon in the Sixes River, Oregon. Fish Commission of Oregon Research Reports 4(2) 1-43.

Seiler, D., S. Neuhauser and L. Kishimoto. 2004. Annual Report – 2003 Skagit River wild 0+ Chinook production evaluation. Washington State Department of Fish and Wildlife.

Shared Strategy for Puget Sound. 2005. Puget Sound Salmon Recovery Plan. Chapter 5: Watershed Profile—Snohomish. http://www.sharedsalmonstrategy.org/index.htm

Shared Strategy Development Committee. 2007. Puget Sound Recovery Plan. Plan adopted by the National Marine Fisheries Service January 19, 2007.

Simenstad, S. A., K. L. Fresh, and E. O. Salo. 1982. The role of Puget Sound estuaries in the life history of Pacific salmon: An underappreciated function. Pages 343-364 in V. S. Kennedy, ed., Estuarine comparisions. Academic Press, New York.

Skagit River System Cooperative and the United States Geological Survey. 1999. Skagit Chinook history study progress report number 2. http://www.skagitcoop.org/documents.html

Skagit River Cooperative System and WDFW. 2005. Skagit Chinook Recovery plan. http://www.skagitwatershed.org/pdf/SkagitChinookPlan13.pdf

Skagit System Cooperative, Research Department. 2003. Estuarine Fish Sampling Methods. http://www.skagitcoop.org/documents.html

Skagit Watershed Council - E. Beamer, T. Beechie, B. Perkowski, and J. Klochak. 1999. Application of the Skagit Watershed Council's Strategy. River basin analysis of the Skagit and Samish Basins: Tools for salmon habitat restoration and protection.

Smith, C. J. and E. Manary. 2004. House Bill 1418 Report: Tidegates and Intertidal Salmon Habitat in the Skagit Basin. Prepared by the Washington State Conservation Commission, with contributing chapters by the Western Washington Agricultural Association and Skagit River System Cooperative.

Smith, C. 2003. Salmonid habitat limiting factors in WRIAs 3 and 4 the Skagit Basin. Washington State Conservation Commission, Lacey, Washington.

Spence, B.C, G.A. Lomnicky, R.M. Hughes and R.P. Novitzki. 1996. An Ecosystem Approach to Salmonid Conservation. TR-4501-96-6057. ManTech Environmental Research Services Corp., Corvallis, Oregon. (December 1996). http://www.nwr.noaa.gov/1habcon/habweb/habguide/ManTech/front.htm

Thorpe, J.E. 1994. Salmonid fishes and the estuarine environment. SOAFD Freshwater Fisheries Laboratory, Pitlochry, PH16 5LB. Scotland, United Kingdom. Estuarine Research Federation. Estuaries, Vol. 17, No. 1a, p. 76-93.

Waples, R.S. 1991. Definition of 'Species' Under the Endangered Species Act: Application to Pacific Salmon. U.S. Department of Commerce, National Marine Fisheries Service, Northwest Fisheries Science Center, NOAA Technical Memorandum NMFS- F/NWC-194. http://www.nwfsc.noaa.gov/publications/techmemos/tm194/waples.htm

Washington State Conservation Commission. 2003. Salmon and steelhead habitat limiting factors, water resource inventory, area 3 and 4 – Skagit River Watershed. Washington State Conservation Commission, PO Box 47721, Olympia WA 98504-7721.

Yates, S. 2001. Effects of Swinomish Channel jetty and causeway on outmigration Chinook salmon *Oncorhynchus tshawytscha* from the Skagit River, Washington. Master's thesis. Western Washington University, Bellingham, Washington.