United States Department of the Interior

FISH AND WILDLIFE SERVICE

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In Reply Refer To:
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Hannah Hadley
U.S. Army Corps of Engineers
CENWS-EN-ER
P.O. Box 3755
Seattle, Washington 98124-3755

Dear Ms. Hadley:

In June of this year, the United States Army Corps of Engineers – Seattle District (Corps) solicited public comments on the draft Feasibility Report and Environmental Impact Statement (FR/EIS) for the Skagit River Flood Risk Management General Investigation (GI). This letter provides comments on behalf of the United States Fish and Wildlife Service (Service) and reflects similar concerns raised by the Swinomish Indian Tribe, Upper Skagit Tribe, National Marine Fisheries Service, Environmental Protection Agency, Washington Department of Fish and Wildlife, Washington State Department of Ecology, and other stakeholders during meetings and other communications.

We appreciate the opportunity to provide comments on the draft FR/EIS and on the project proposal. As you know, flood risk reduction is a top concern among many communities across the United States, including the communities living in the lower Skagit River basin. The root cause of flood risk in the lower Skagit is clear. Over 20 miles of this large river have been tightly confined by levees with little to no setback from the river. Such configurations usually decrease flooding from smaller, more frequent flood events. However, they often increase flood risk and damages from larger, less common events that pose a risk of overtopping the levees. The communities that have grown behind the levee walls understandably want better protection from such large events.

The Skagit GI seeks to reduce flood risks in the lower Skagit River watershed, particularly for the cities of Mount Vernon (2010 census population 31,743) and Burlington (2010 census population 8,388). Outside of these developed areas, the lower Skagit River watershed is used almost exclusively for agriculture, a vital sector of the local economy. This area is a broad, flat floodplain and river delta that was predominantly estuary, saltmarsh, freshwater wetlands, and floodplain forest prior to Euro-American settlement. Extensive diking and levee building since the early twentieth century have provided flood control and allowed conversion of these lands to their present-day uses. Additional flood control has been provided by several reservoirs in the upper watershed, including but not limited to Lake Shannon and Baker Lake.

The Skagit River supports a wide variety of fish and wildlife species that is unparalleled in the region. The importance of the Skagit River to the regions fish and wildlife resources cannot be overstated. It is the only river in the region that supports relatively abundant, self-sustaining populations of all five Pacific salmon species. The river supports three fish species currently listed as threatened under the federal Endangered Species Act of 1973, as amended (16 U.S.C. 1531 *et seq*.) (ESA), including: the most abundant run of Puget Sound Chinook salmon (*Oncorhynchus tshawytscha*); the largest population of bull trout (*Salvelinus confluentus*) in western Washington; and, Puget Sound steelhead (*Oncorhynchus mykiss*). Historically, the Skagit River delta was the largest in Puget Sound and provided important habitat for native fish, shorebirds and waterfowl. The agricultural areas are still an important wintering area and stopover on the Pacific Flyway for migrating birds.

However, human impacts in the floodplain and delta have had substantial deleterious consequences to species, their habitat, and habitat-forming processes. The existing levee and dike systems have drastically reduced floodplain connectivity, diminished side channel and off-channel fish habitat, decreased distributary and tidal channels in the estuary, decreased riparian forest vegetation, increased water velocities, altered sediment transport, and limited the ability of the river to retain large woody debris. Main channel pool habitat and spawning habitat are almost non-existent. These impacts are important contributors to suppressing species abundance, and threaten long-term recovery and rebuilding efforts. The Skagit is thus at a critical juncture. This area and the habitat it provides cannot endure continued and additional permanent degradation if threatened and other native fish species are to be conserved in any reasonable numbers.

The scope of the GI and the draft FR/EIS is large in scale. The Skagit GI proposes to make a significant investment in reducing flood risk in the lower Skagit, upwards of $225 million initially, plus an additional $45 million over the 50-year life of the project. The proposed projects have the potential to greatly impact the people, the natural resources, and the economy of the Skagit River basin. For these reasons, it is imperative that the Corps: 1) consider a diverse suite of alternatives; 2) thoroughly evaluate the effectiveness of these alternatives under reasonable projections of future environmental conditions; and, 3) thoroughly evaluate the potential impacts of these alternatives to natural resources and to the people and economic sectors that depend on these natural resources.

The draft FR/EIS evaluates four alternatives: a "no action" alternative; two alternatives that propose to construct new leveed flood bypasses similar to the Yolo Bypass near Sacramento, California; and an alternative termed the Comprehensive Urban Levee Improvement (CULI) which proposes raising the height of current levees and constructing new levees in and near the cities of Burlington and Mount Vernon. All alternatives include adding flood storage capacity in Lake Shannon, and extending the duration of flood storage capacity in Baker Lake. The draft FR/EIS identifies the CULI alternative as the Preferred Alternative, or Tentatively Selected Plan (PA/TSP). The Corps concludes that: 1) this project will be effective at reducing flood hazard risks to less than one percent annual chance of exceedance (ACE)[1] over the 50-year project life span; 2) this project is cost-effective; and, 3) impacts to various natural resources will be avoided, minimized, negligible, or will be adequately mitigated.

General Comments on the Draft FR/EIS

Based on our review of the draft FR/EIS and additional pertinent information, we strongly oppose selection of a PA/TSP at this time. The evaluations and analyses presented in the draft FR/EIS lack sufficient thoroughness, and thus are insufficient to warrant the Corps' conclusions supporting selection of the CULI alternative. In addition, we do not believe the draft FR/EIS provides a sufficient array of feasible alternatives. Our main concerns are:

1. Climate change predictions for this region, pertinent historical data, and existing information on changing conditions in the project area are either not considered at all or are given only cursory attention. These are critical deficiencies. Neglected science and data related to sediment build-up, or aggradation, in the project area is of particular concern. This is discussed more fully in the detailed comments below. This information suggests that effectiveness of the proposed PA/TSP over the 50-year project life span may be seriously overestimated. This has far-reaching implications for: flood risk and flood damages; future improvements aimed at maintaining the desired level of protection in the face of changing conditions; economic costs of any such damages or improvements; and impacts of these efforts on natural resources. Failure to adequately integrate existing science and data related to aggradation and climate change is unwise and dangerous.

   There has been no analysis to determine which alternatives may prove most resilient, self-sustaining, and able to successfully function under a broad array of reasonably foreseeable conditions with minimal need for improvements. As such, there has been no true, unbiased accounting of long-term flood risk reduction, economic performance, and impact to natural resources. The Corps should consider these in the analysis to determine if the PA/TSP truly is the best alternative, or if a different alternative may be functionally, economically, and ecologically superior.

2. Levee setbacks could provide both flood hazard reduction and substantial natural resource benefits. However, this was not presented in any of the alternatives because it was previously screened out. The Corps screening analysis did not evaluate setback configurations most likely to be effective for reducing flood risk. No optimization

[1] One percent ACE is equivalent to a 100-year flood event.

analyses were performed to determine the most cost-effective configurations. In addition, the screening analysis did not consider benefits to natural resources, associated economic benefits, resiliency to climate change, and long-term cost-effectiveness. Levee setbacks should be reconsidered and presented as a viable stand-alone alternative and in combination with other measures such as levee height increases.

3. The three action alternatives presented lack diversity. Two of the alternatives are variations on the same theme of bypass channels. It is difficult to have confidence that the PA/TSP truly is the best option when so few alternatives were considered. In addition, the Baker Hydro Modifications are attached to all action alternatives in the current draft FR/EIS. The Baker Hydro Modifications are functionally independent of the base actions (i.e., the levee raises and the bypass channels) and carry a different suite of natural resource impacts. They also provide a relatively small proportion of flood risk minimization which may be compensated for via other measures. Therefore, it is objectionable to not present any alternatives which do not include the Baker Hydro Modifications. Feasible alternatives should be presented that do not contain the Baker Hydro Modifications.

4. Impacts to natural resources have not been thoroughly evaluated or considered, particularly in three areas:

    a. The evaluation presented for the Baker Hydro Modifications lacks critical areas of analysis on impacts to tribal interests and fisheries resources, including ESA-listed species.
    b. The PA/TSP will permanently degrade lower river (near Burlington and Mount Vernon) habitat and negatively impact many species, including threatened and endangered fish, and there is no evaluation of whether the proposed mitigation activities will offset these impacts.
    c. By widening and raising the existing levees and building new ones, the PA/TSP will preclude critical natural resource restoration opportunities, such as levee setbacks, across a large portion of the lower river and would inhibit habitat restoration and species recovery efforts.

    In general, we found that some impacts were not considered at all, that many evaluations lacked a robust consideration of the existing scientific literature, and that some evaluations neglected existing data. As a result, we have no confidence in the conclusions that impacts to various natural resources will be avoided, minimized, negligible, or adequately mitigated

    It is beyond the scope of this comment letter to provide a full listing of all areas of the draft FR/EIS where analyses should be strengthened. The Corps should collaborate closely with the Service, affected Tribes, stakeholders, and natural resource agencies to identify important areas for improved evaluation, as well as critical data gaps. The Corps should consider funding additional studies to fill critical data gaps, and should consider

contracting relevant professionals for evaluations beyond the scope of their capabilities. The Corps should reconsider selection of a PA/TSP based on these more thorough and robust analyses.

The Corps is mandated by the Fish and Wildlife Coordination Act to give equal weight to natural resource concerns in evaluating alternatives. Furthermore, all federal agencies, including the Corps, are mandated by the Endangered Species Act to conserve endangered and threatened species and aid in their recovery. Providing more thorough and robust evaluations will better facilitate meeting these obligations.

5. The draft FR/EIS does not consider the economic and social aspects of natural resources. Thus, a true accounting of economic costs and benefits of the proposed alternatives is not provided, resulting in a biased comparison of alternatives. For example, Skagit basin fish production supports robust fisheries. One alternative may cost less to construct, but may do economic harm from negative impacts to the fishery resources. Another alternative may cost more to construct, but may provide significant economic benefits to the fishery resources, potentially offsetting the difference in construction cost. We offer this as a hypothetical scenario only; it is not intended to represent the full array of relationships between the GI and Skagit basin natural resource economics. The Corps should consider fully integrating natural resource economics into the FR/EIS to allow for a fair and unbiased comparison of alternatives.

6. In our opinion, the draft FR/EIS does not embody the intent of the 2013 Principles and Requirements for Federal Investments in Water Resources (P&R's). The 2013 P&R's make clear that the United States is moving to more holistic, inclusive, and comprehensive processes for considering water resource development projects. The 2013 P&R's encourage healthy and resilient ecosystems, natural floodplain functioning, watershed approaches to addressing problems, full consideration of ecosystem services, full consideration of climate change, full consideration for natural resource economics and impacts, and full collaboration with Tribes, stakeholders, academia, and federal, state and local agencies. The 2013 P&R's also allow the Corps to consider a project's sustainability and *benefits* to ecosystems and natural resources as selection criteria, not just minimization of harm. We highly recommend the Corps incorporate sustainability and natural resource benefits into the selection criteria, and otherwise embrace the 2013 P&R's.

   We recognize that there may be no legal requirement for the Skagit GI to abide by the 2013 P&R's. However, the 2013 P&R's do state that, "To the extent possible, agencies are encouraged to begin implementing the concepts laid out in these modernized Principles and Requirements consistent with law" (p. 14). We encourage the Seattle District of the Corps to embrace these broad-minded, enlightened, and modern principles and be a leader in ushering in this new era of more responsible and well-thought-out water resource management. As such, we recommend that the Corps reconsider alternatives, evaluations, and selection criteria to better align with the 2013 P&R's.

In addition to the general concerns outlined above, we offer the following detailed comments and concerns.

Detailed Comments on the Draft FR/EIS

The comments outlined below are focused on specific resource issues and add to the general comments provided above.

Aggradation, Climate Change, and Project Effectiveness

Potential sediment build-up, or aggradation, in the project area near Mount Vernon and Burlington warrants careful attention and consideration because it bears significant implications to project effectiveness and impacts to natural resources. Aggradation increases the height of the river bed and diminishes the capacity of the levee system to hold flood waters. Significant aggradation could severely diminish the level of protection provided by the PA/TSP's levee system, or other potential solutions, prior to the end of the 50-year project period. The draft FR/EIS anticipates aggradation in the range of 0.5 to 1.5 ft over the 50 year project period and asserts that this would have a negligible impact on PA/TSP effectiveness. Unfortunately, the draft FR/EIS: 1) omits existing U.S. Geological Survey (USGS) stage-discharge and cross-section data; 2) provides a flawed interpretation of historic data; 3) neglects likely impacts of climate change on sediment supply, sediment transport, and riverbed aggradation; and, 4) does not provide a meaningful evaluation of sediment transport and potential aggradation in the study area. These are discussed in more detail in the following paragraphs.

As a result of these oversights, the anticipated aggradation rate may be severely underestimated. When all available data and climate change impacts are considered and appropriately interpreted, it is not unreasonable to anticipate 5.5 ft or more of aggradation over the next 50 years. This is nearly 4 times the maximum rate anticipated in the draft FR/EIS.

The cursory sedimentation analysis included in the draft FR/EIS is based on three data sources: 1) Corps sediment data from 1931 to 1978 (USACE 1978, cited in USACE 2008); 2) a comparison of eighteen cross-sections surveyed in both 1975 and 1999 (WEST 2000, cited in USACE 2008); and, 3) bed elevation data at the USGS gage near Mount Vernon from 1960 to 2005 (Mastin 2006, cited in USACE 2008). Together, these data suggest that the riverbed in the project area has aggraded at an average rate of approximately 1.7 ft per 50 years[2] between 1931 and 1999. The aggradation rate appears to have drastically accelerated from 1.0 ft per 50 years for the time period from 1931 to 1978, to 3.0 ft per 50 years for the time period from 1975 to1999. Nonetheless, the draft FR/EIS anticipates an aggradation rate of only 0.5-1.5 ft per 50 years, which is less than the 1931to 1999 average (1.7 ft per 50 years), and well below the average for the period between1975 to 1999 (3.0 feet per 50 years). The draft FR/EIS cites inconsistencies in the historic data as rationale for using this low estimate.

[2] The average rate of 1.7 ft per 50 years was calculated assuming bed elevation rise of 0.9 ft from 1931-1974 (1.0 ft per 50 years; USACE 1978, cited in USACE 2008), and 1.5 ft from 1975-1999 (3.0 ft per 50 years; WEST 2000, cited in USACE 2008).

The historic data inconsistencies cited by the draft FR/EIS are not actually inconsistencies at all, but arise from a flawed comparison between the 1975 to 1999 cross-section data and the USGS bed elevation data. Quoting from the draft FR/EIS:

> There is inconsistent evidence related to bed aggradation or degradation in this reach. Cross-section surveys indicate there has been an average increase in overall bed elevation of 1.4 ft for the 25 year time period between 1975 and 1999. However, records for the USGS gage in Mount Vernon (RM 17) indicate there has been about a 1-foot drop since 1959 (USACE 2014, p. 80).

Closer scrutiny of the cross-section data and the USGS gage site data was performed by the Corps in 2008 (USACE 2008). This report compared the two data sources across the same time period (1975 to 1999), and is therefore a more sound comparison than the one in the draft FR/EIS which relied on a mismatched time period (1975 to 1999 for the cross-section data, but 1959 to 2006 for the USGS data). The 2008 report indicated that seventeen of the eighteen cross sections showed increases in bed elevation from 1975 to 1999. Only one cross section showed a decrease: the one at the USGS gage site. The independent USGS bed elevation data at this site also showed a similar decline. The fact that both data sources showed the same trend at this site "…does suggest the broader, overall depositional trend shown by the cross-sections is also reliable" (USACE 2008, p. 20-21). The 2008 Corps report thus found no inconsistencies between the two data sources, and in fact concluded quite the opposite: that the USGS gage site data was consistent with and bolstered the legitimacy of the cross-section data. We agree with this finding.

The 2008 evaluation also demonstrates and underscores the fact that depositional trends at the USGS gage site may not represent overall trends at the broader reach scale. Clearly, depositional trends at the USGS gage site between 1975 and 1999 did not follow the same trends as the entire reach. This is not too surprising since the gage site is almost certainly influenced by hydraulic effects of three nearby bridges. The basis of the draft FR/EIS comparison is that trends at the USGS gage site should mimic reach-scale trends, and if they don't it points to inconsistencies between the two data sources. Basic hydro-geomorphic theory does not support this contention, nor do the specific findings of the 2008 report.

Data from the USGS Mount Vernon gage (USGS 2014) for the time period 1999 to 2014, which were not considered in the draft FR/EIS, indicate that the aggradation rate has continued to accelerate at a rapid rate. The Service performed a specific gage analysis (e.g., Pinter et al. 2001) using publicly available data from the USGS website (USGS 2014). These data show an upward shift in the relationship between discharge and water surface elevation (Figure 1) which indicates aggradation, assuming no drastic changes to channel slope or overall roughness have occurred. This analysis suggests an aggradation rate of approximately 5.3 ft per 50 years between 1995 and 2014, a near doubling of the 1975 to 1999 rate, tripling of the 1931 to 1999 average rate, and nearly quadruple the average rate anticipated by the draft FR/EIS.

These findings are consistent with USGS cross-section measurements 2 miles downriver. In 2012, the USGS collected data from the same cross-sections evaluated by WEST (2000). The USGS has not had funding to analyze the data, but did analyze results from one cross-section

near the Anacortes Water Treatment Plant which showed 10 ft of aggradation from 1999 to 2012 (Figure 2). As discussed in the preceding paragraph, sedimentation patterns at only one or two locations may not represent trends across the entire project area. However, the USGS data and results of the Service's specific gage analysis are consistent with the accelerating aggradation trend apparent in the 1931 to 1978 and 1975 to 1999 data. The magnitude of recent aggradation, implications to project effectiveness, and implications to natural resources suggest that this matter warrants closer scrutiny.

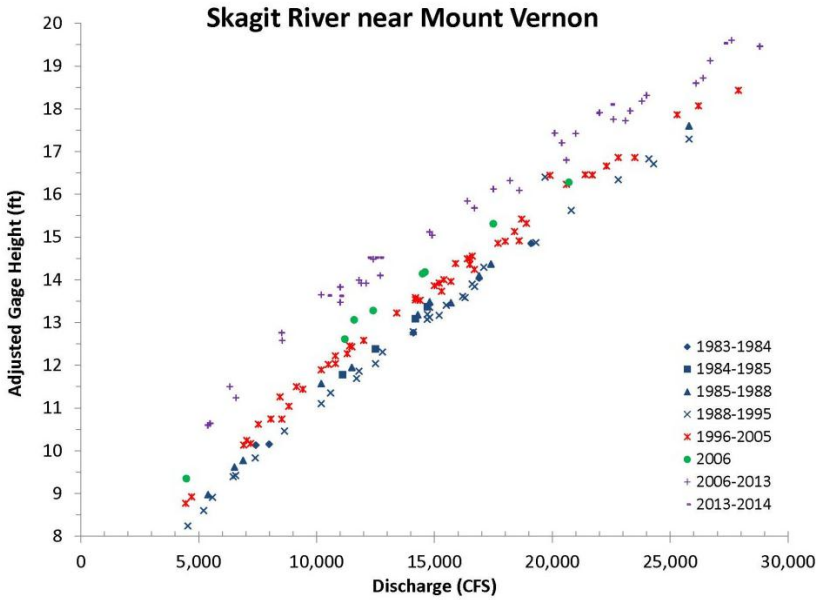

Figure 1. Stage-discharge relationship for the USGS gage near Mount Vernon (data source: USGS 2014). The plot was truncated at 30,000 cfs for clarity and because there were few data points above this point.

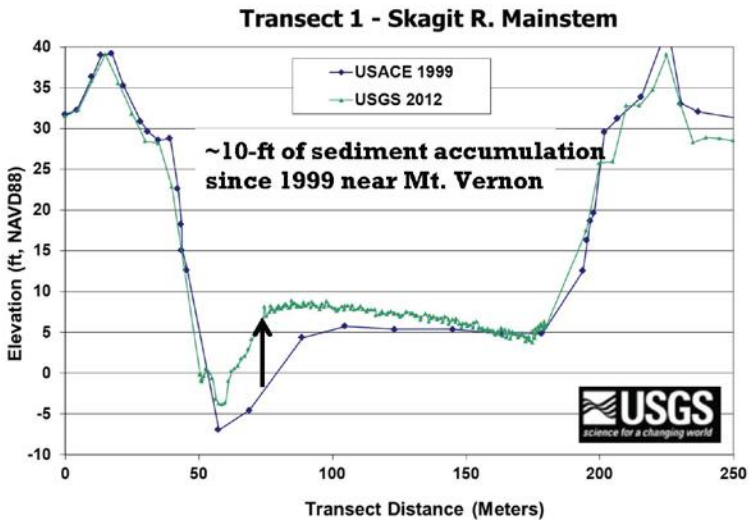

Figure 2. Comparison of bed elevation cross-section data from 1999 and 2012 near the Anacortes Water Treatment Plant (from Grossman and Fuller 2012). The arrow indicates magnitude and direction of bed elevation change due to aggradation.

This apparently increasing rate of aggradation is likely to accelerate even more if climate change predictions for this geographic area hold true. The Skagit River Basin Climate Science Report (Lee and Hamlet 2011) presents evidence and discusses how sediment loads in the Skagit River are likely to increase under current climate change predictions due to glacial retreat, snowpack reduction, bluff erosion, landslides, and increased peak flows, resulting in increased rates of aggradation downstream (p. 128-131). In addition, changes to sediment transport and deposition processes accompany downstream shifts in geomorphic environments, such as the gravel-to-sand transition, and the sand-to-silt transition. These shifts can result in aggradation rates in excess of those predicted by past trends, and may be an expected consequence of increased sediment supply from upstream. These effects are not just theoretical and in the distant future; they are occurring now in western Washington river systems similar to the Skagit[3] (Lee and Hamlet 2011, p. 128-131). Under each action alternative, the draft FR/EIS includes only cursory mentions of increased sediment transport into the project area from increased flows (USACE 2014, p. 74-80). These statements lack analysis, asserting only that effects on deposition will depend on balance between sediment transport and sediment supply. These statements also neglect to mention or consider the likely increase in sediment supply from sources such as glacial retreat, snowpack reduction, bluff erosion, and landslides.

Sea level rise may also influence aggradation in the project area near Mount Vernon and Burlington. Rising sea levels cause coastal rivers to aggrade (Phillips 1997; Blum and Törnqvist 2000; Taha 2006; Stouthamer and Berendsen 2007). Aggradation is not just limited to the part of the river directly affected by tides. Rather, aggradation is expected to propagate upriver as river gradient adjusts to a new, altered base sea level. The FR/EIS does not address this phenomenon.

We are deeply concerned that the draft FR/EIS has likely underestimated aggradation due to omitted data, misinterpreted data, and neglecting available science on climate change. The GI and PA/TSP represent a significant investment of financial resources into flood risk reduction for the project area. Given this degree of investment, a sound scientific evaluation of sediment sources and transport through the project area to determine project effectiveness and impact to natural resources is warranted. We recommend the following:

- A more rigorous, scientifically defensible evaluation of sedimentation and sediment budgets and transport in the project area near Mount Vernon and Burlington, which would include all of the available existing data, likely climate change impacts, and a quantitative assessment of sediment supply and transport, considering possible shifts in geomorphic depositional environment due to increased sediment loads.
- Provide funding to analyze the USGS cross-section data from 2012, specifically to assess project-scale trends in net aggradation and aggradation rate between 1999 and 2012.
- A quantitative evaluation of the effectiveness of each alternative and the PA/TSP under conditions of elevated aggradation.

[3] Although dams within some of the Skagit's subbasins will intercept upstream sediment inputs, the Sauk and Cascade Rivers are two unimpounded Skagit River tributaries that may deliver considerable sediment loads. The Sauk River in particular is impacted by receding glaciers on Glacier Peak.

- Describe contingencies in the event that severe aggradation substantially diminishes project effectiveness over the 50-year project period, and the likely impacts to natural resources of those contingencies.
- Include potential cost of combating aggradation in the project's economic analysis. Cost estimates should include planning, environmental reviews, mitigations costs, construction, and maintenance.

Levee Setbacks and Ecologically Beneficial Solutions

Levee setbacks have the unique potential to provide both flood hazard reduction and significant benefits to natural resources. In addition, setbacks would address the root cause of the flooding problem in the lower Skagit River basin: a river that is tightly confined by the existing levee system to a narrow channel. Compared to raising levees, setbacks may prove more effective in the long run (Criss and Shock 2001; Pinter 2005; Hudson et al. 2008), particularly by providing greater resilience in the face of climate change (Kousky et al. 2013). As such maintenance, repair, and improvement costs are likely to be less over the long-term. By utilizing the river's natural floodplain to provide flood storage and flood hazard reduction, levee setbacks may be considered a "green" or ecologically beneficial solution (e.g., Kousky 2010). Ecological benefits would likely accrue to floodplain wetlands, riparian forests, and freshwater and estuary fish habitat, among others. Such ecological benefits may stimulate economic growth. For example, levee setbacks may enhance the fishery resources enough to stimulate measurable economic activity in commercial and recreational fisheries and allied businesses (e.g., guide services, bait-and-tackle shops, etc.). For these reasons, levee setbacks and other ecologically beneficial solutions should be given careful consideration.

The Corps screened out levee setbacks from further consideration in 2013, and thus setbacks are not considered in any of the alternatives in the draft FR/EIS. The draft FR/EIS does contain information about the screening evaluation and reasons for screening out setbacks (USACE 2014, p. 43-46 and Appendix B, pages 41-44), asserting that the preferred setback configuration was not likely to be cost effective. However, the screening analysis: did not consider alternative setback configurations that may have been more cost-effective; did not perform any optimization assessments to identify cost-effective configurations; did not consider comparative costs of long-term maintenance and improvements relative to other alternatives; and did not consider benefits to natural resources and subsequent economic benefits. These are discussed in more detail below.

The screening analysis evaluated configurations that relied heavily on setbacks in the rural areas between Mount Vernon and Skagit Bay, rather than in the urban areas the project seeks to protect. The rationale for this approach was to "…[increase] downstream conveyance, thereby lowering flood levels for a given flow (USACE 2014, Appendix B, page 41). The hydraulic analyses presumably found that these configurations would not be effective at reducing flood flows in the urban areas. However, configurations that rely more on setbacks in and immediately downstream of the urban areas were not considered. Such configurations would be more likely to provide the desired flood hazard reduction benefits to the targeted urban areas. Setbacks in and near the cities of Mount Vernon and Burlington may seem infeasible on the surface due to

presence of urban infrastructure and development. However, there are large areas of agricultural and recreational land uses along the river throughout the urban corridors which may reduce the costs of setback levees.

The Corps should consider ecologically beneficial solutions, including alternative setback configurations that would be more likely to provide the desired level of protection to Mount Vernon and Burlington. Instead of focusing on conveyance in downstream areas, setbacks that focus on conveyance and storage capacity within and immediately adjacent to the urban areas should be considered. Analyses of ecologically beneficial solutions should include:

- Optimization procedures similar to those described in Zhu et al. (2007), Dierauer et al. (2012), Remo et al. (2012), and Kousky and Walls (2014).
- An assessment of resilience to aggradation and climate change affects, and anticipated costs of long-term maintenance and improvements in relation to other proposed alternatives.
- Land uses on the waterward side of setback levees that are compatible with the corresponding flood risk. Some types of agriculture and recreational uses, such as parks, may be able to remain in place. Other areas could be converted to compatible land uses. This type of approach may help minimize the high costs of buyouts and rezoning.
- Levee setbacks or other ecologically beneficial solutions may provide benefits to natural resources, particularly in regard to salmon and steelhead productivity. Commercial, Tribal, and/or recreational fisheries would stand to benefit. Reconnected floodplain wetlands may provide waterfowl hunting and bird watching opportunities. These and other potential natural resource benefits should be considered for their benefits to the local economy. Kousky (2010) and Kousky and Walls (2014) provide some examples of how various aspects of natural resource economics may be considered in the flood hazard reduction planning process.

Baker Hydro Modifications

The draft FR/EIS proposes to implement Article 107 of the 2008 FERC license, which allows for two actions:

Article 107(a) Increase the time of flood storage capacity in Baker Lake by up to three and a half months. The volume of flood storage capacity will remain the same but the time it is provided may be extended, starting earlier and ending later. Storage may be provided as early as September 1, as opposed to the current November 1 start date. Storage may be provided through April 15, as opposed to the current March 1 end date.

Article 107(b) Providing flood storage capacity in Lake Shannon from October 1 through March 1. Currently, Lake Shannon provides no flood storage.

The draft FR/EIS is unclear and conflicting in places on how the Baker Lake provision, Article 107(a), will be implemented and how it will differ from current operations. For example, page 131 indicates an October 1 drawdown start date, but page 75 suggests the drawdown may start in September. It is also unclear on how the proposed operations differ from current operations. This lack of clarity makes it difficult to provide a robust evaluation of impacts to natural resources. The Corps should provide a clear description of differences between current and proposed operations in terms of drawdown begin date, drawdown end date, refill start date, and refill end date.

Important fishery resources in Baker Lake and Lake Shannon include sockeye (*Oncorhynchus nerka*), coho (*Oncorhynchus kisutch*), and ESA-listed Chinook salmon, ESA-listed steelhead trout, ESA-listed bull trout, and coastal cutthroat trout (*Oncorhynchus clarkii clarkii*), all of which are indigenous to the Baker River watershed. Most of these fishery resources were substantially diminished due in part to the construction and operation of the Upper and Lower Baker dams. However, recent efforts to enhance upstream and downstream fish passage, supplement some naturally-producing stocks with hatchery production, and restore and enhance lake and tributary habitat have allowed several of these species to begin to recover. Sockeye salmon have received particular attention and have responded with dramatically increasing populations. Sockeye salmon are economically and culturally important because they provide nearly half of the income to the Upper Skagit Tribe's commercial and subsistence riverine fisheries. Sockeye salmon also support a robust non-Tribal recreational fishery, which further contributes to the area's economic vitality. The Upper Skagit Tribe has been participating in sockeye rebuilding efforts by releasing hatchery-reared sockeye fry into both lakes. The implementation of the fisheries measures outlined in the 2008 FERC license began in Baker Lake with fry releases in 2009, and continued with fry releases into Lake Shannon starting in 2012. Plans for coho rebuilding efforts are also underway. Bull trout in the Baker River watershed have also seemingly benefitted from these efforts, as their numbers have been increasing in recent years presumably due in part to the increasing forage base provided by increasing juvenile salmon productivity.

The draft FR/EIS provides a very brief (less than a page and a half) and incomplete assessment of potential impacts to the fishery resources in Lake Shannon and Baker Lake. The proposed drawdown of Lake Shannon and expanded window of low water level in Baker Lake carry potentially significant negative implications to fishery resources in these lakes. The draft FR/EIS briefly discusses potential impacts to productivity of zooplankton (an important juvenile salmon food resource) in Baker Lake and Lake Shannon, how this may influence sockeye productivity, and impacts to sockeye spawning. However, the brief summaries contained in the draft FR/EIS do not consider important existing information, do not consider some important ecological relationships, oversimplify other ecological relationships, lack detail, and are almost exclusively qualitative. These are discussed in more detail below. The result is that a thorough or sufficient evaluation of possible impacts to the important fishery resources in these lakes is not provided in the draft FR/EIS.

The draft FR/EIS recognizes that the entire aquatic food chain will likely be impacted by the proposed actions. It further recognizes that "…overall impacts to fish species in both reservoirs is difficult to predict, as very little data exists" (USACE 2014, p. 131). However, despite these

statements, it concludes that "…the overall impacts to fish in both reservoirs will be minor due to several mitigating factors" (USACE 2014, p. 131). We do not believe that sufficient information or analysis has been presented to substantiate this conclusion. For example, the draft FR/EIS cites a 2004 report (Mazumder 2004) indicating that existing prey resources could support 2 to 3 times greater sockeye production. However, the sockeye production cited in the Mazumder (2004) report was from 1994 to 2000, prior to many of the sockeye rebuilding efforts. Since then, sockeye production has substantially increased, conceivably using most or all of the excess carrying capacity cited in Mazumder (2004). This makes it much more likely that impacts from changes to flood capacity storage on the prey base will indeed have an impact on sockeye salmon productivity.

Other mitigating factors cited by the draft FR/EIS include: 1) reduction in euphotic volume (the upper water layer that receives sunlight and produces the zooplankton that juvenile salmon forage on) could increase relative prey density thereby making it easier for sockeye juveniles to find food; 2) changes in euphotic volume matter less in winter (when the changes to flood capacity storage will occur) due to natural variations in zooplankton abundance; and, 3) volume of the drawdowns is below some significant threshold. As presented, these are all speculative statements that are not discussed in any detail or in the context of existing science and literature.

One potential bottleneck to juvenile salmonid production that is not discussed in the draft FR/EIS is predation (Mazumder 2004). In Lake Shannon, predation on juvenile salmonids could conceivably increase due to density-dependent effects of diminished water volumes associated with drawdowns. In Baker Lake, an extended period of lower water volumes may also increase predation via similar density-dependent relationships. This could be compounded by the fact that water temperature will likely be warmer and predators more active during the extended drawdown times (i.e., in September, October, March, and April). To the extent that these drawdown periods diminish juvenile salmon productivity, the decrease in forage base may negatively impact bull trout abundance. The degree of any such effects would depend on relative impacts from other predators in the lakes including but not limited to cutthroat trout and rainbow trout. These relationships warrant consideration and evaluation.

The earlier Baker Lake drawdown will also likely impact sockeye spawning in Baker Lake, Baker River, and other delta and lake tributaries. The draft FR/EIS asserts that peak spawning will be minimally affected. However, there is no discussion of overall impact to the spawning population, quantification of the proportion of the spawning population affected, proportion of spawning area affected, when exactly the spawning season occurs, and time of peak spawning. In addition, lake drawdowns may affect access to spawning tributaries for sockeye and bull trout, and potentially other species. These are not addressed in the draft FR/EIS.

We recommend the Corps expand this section of the draft FR/EIS to include a more thorough, detailed, and comprehensive assessment of potential impacts to the fishery resources in Baker Lake and Lake Shannon from implementing Article 107. These assessments should also address downstream impacts to fishery resources and include all relevant ecological impacts and relationships, all pertinent existing science and literature, and implications to fishery management and recovery plans. How the Corps intends to mitigate for negative impacts should also be discussed. Where possible, effects should be quantified. For example, how much will

the euphotic zone be reduced under the various water storage scenarios, how much will prey base be decreased, how much will carrying capacity and production potential be reduced, how much will natural-spawning sockeye production be reduced? Consider funding empirical studies to fill these critical data gaps. It is beyond the scope of this comment letter to provide a thorough list of all ecological relationships, fishery resources, and critical data gaps that warrant additional attention and evaluation. We recommend the Corps collaborate with the affected Tribes, stakeholders, and resource agencies to identify what these impacts are and how best to address them.

Riverward Levee Widening

The PA/TSP proposes to raise 9.2 miles of levees, which will require widening the base of the levees between 10 and 60 ft (USACE 2014, p. 155). The draft FR/EIS indicates that widening will occur on the landward side of the levees to the maximum extent possible. It is laudable for the Corps to avoid widening the levees riverward where practicable. In fact, the Service considers it imperative to avoid additional permanent degradation in the lower Skagit River due to the existing tenuous state of fish habitat and fisheries resources in the basin. Any further constriction by levees on the riverward side would have serious negative consequences to fish and fish habitat and recovery of ESA-listed fish. However, the draft FR/EIS offers no evaluation of where the levees may need to be widened riverward, with only one exception. Knowing where levees will be widened riverward and how much they will be widened in these areas is critical to assessing the extent and magnitude of impacts to fish and fish habitat. In addition, the draft FR/EIS does not provide any mention or evaluation of the environmental impacts of expanding the levees waterward and further constricting the river.

Riverward levee widening represents permanent degradation of riverine function and/or aquatic habitat and resources in an already degraded system that cannot absorb many more negative impacts. The Corps should identify specific criteria and circumstances that will be used to decide if or where riverward levee expansions will be necessary and how they propose to mitigate or offset these impacts. The Corps should also provide an assessment of where riverward levee expansions are being considered, which criteria or circumstances may necessitate riverward widening in these areas, and the length and width of the possible expansions in these areas. The draft FR/EIS should also include a thorough, scientifically-based assessment of environmental impacts of riverward levee widening. This should include quantitative hydraulic assessments to determine impacts to velocity, permanent impacts to designated critical habitat for ESA-listed fish, effects on survival and recovery of listed fish, and proposed mitigation measures to offset these impacts.

Floodplain Development

Executive Order 11988 seeks to “avoid to the extent possible the long and short term adverse impacts associated with the occupancy and modification of flood plains and to avoid direct or indirect support of flood plain development unless there is no practicable alternative.” We are concerned that the PA/TSP may encourage the very floodplain development that Executive Order 11988 seeks to avoid. The draft FR/EIS asserts that “The proposed action is not anticipated to induce development of the floodplain or to otherwise adversely affect any

floodplain, since the County plans to direct development to existing urban areas…No land use changes are expected to result from the project that would enhance development conditions in the floodplain." However, the relationships between the PA/TSP, the National Flood Insurance Program (NFIP), public perception of risk, and floodplain development have not been evaluated by the Corps.

The current levee system provides protection from 25-year flood events (4 percent ACE). The PA/TSP proposes to increase this to provide protection from 250-year flood events (0.4 percent ACE). Raising the level of flood protection to this level carries NFIP and development implications: leveed areas protected from 100-year flood events (1 percent ACE) or better are no longer considered part of the floodplain, thus the NFIP limitations on floodplain development no longer apply. This may be exacerbated by public perception that flood risk is zero in these areas, and thus they are safe places to develop (Pinter 2005; Ludy and Kondolf 2012). Although the intent of the PA/TSP is to provide flood risk reduction to the urban areas, some rural areas will benefit from the increased protection (USACE 2014, p. 65). These areas may no longer be considered "floodplain" for NFIP purposes and may be at risk for development.

The draft FR/EIS suggests that, since the County plans to direct development to existing areas, the PA/TSP will not induce further development in the floodplain outside the city limits of Burlington and Mount Vernon. However, there is no discussion of what exactly those plans are, whether they are codified in local ordinances, how stringent or flexible they are, how effective they may or may not be at preventing development outside of city limits, or to what degree they are subject to change over the 50-year project period. Thus, simply stating what the County's intentions are at this point in time provides little assurance that they will be effective at preventing floodplain development in the future.

We recommend the Corps provide a more thorough evaluation of how the PA/TSP and other alternatives may encourage floodplain development. Evaluate the relationships between the PA/TSP, the National Flood Insurance Program (NFIP), public risk perception, and floodplain development. Provide maps showing which areas of the floodplain will receive protection at the 100-year event level (1 percent ACE) protection from the NED optimized plan (0.4 percent ACE). Clarify and provide more detail on the County's plans for directing development into city limits, including whether they are codified in local ordinances, how stringent or flexible they are, how effective they may or may not be at preventing development outside of city limits, and to what degree they are subject to change over the 50-year project period. Based on these results, reevaluate whether the PA/TSP would violate Executive Order 11988.

Impact to Recreational Fisheries

Executive Order 12962, Recreational Fisheries, requires that federal agencies evaluate and document the effects of federally funded actions on aquatic systems and recreational fisheries, and otherwise take measures to conserve and enhance recreational fisheries. The draft FR/EIS does not currently address how the proposed alternatives will impact recreational fisheries.

Again, we appreciate the opportunity to comment on the Skagit GI draft FR/EIS. The Service is eager to work collaboratively with the Corps and other interested stakeholders, Tribes, and agencies to address shortcomings in the current proposal. We are confident that, working together, we can identify the sustainable, resilient, and resource-friendly solutions that the people and natural resources of the Skagit basin deserve. Please contact Mark Celedonia (mark_celedonia@fws.gov; 360-534-9327) or Martha Jensen (martha_l_jensen@fws.gov; 360-753-9000) for questions about our comments and/or for future coordination and collaboration on the Skagit GI.

Sincerely,

FOR Thomas L. McDowell, Acting Manager
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