APPENDIX C – FUNCTIONAL ASSESSMENT, IMPACT AND MITIGATION PLAN REVIEW TO THE RECORD OF DECISION FOR SEATTLE, PORT OF (1996-4-02325)

TABLE OF CONTENTS

ENCLOSURES

FIGURES

TABLES

APPENDIX C
TO THE RECORD OF DECISION
FUNCTIONAL ASSESSMENT, IMPACT AND MITIGATION PLAN REVIEW
FOR
SEATTLE, PORT OF
(1996-4-02325)

1. INTRODUCTION: Appendix C contains the U.S. Army Corps of Engineers (Corps) independent analysis and review of aquatic resource functions and potential project impacts. This information was used to determine the adequacy of the Port of Seattle (Port) compensatory mitigation plans for impacts to wetlands and other waters of the U.S. related to the Third Runway and related Master Plan Update (MPU) Improvements construction at Seattle-Tacoma International Airport (STIA). MPU projects resulting in impacts to wetlands and other waters of the U.S. include: construction of the third runway, relocation of 154th Street, establishment of runway safety areas, construction of the South Aviation Support Area (SASA) and an associated bridge, excavation (mechanized land clearing) of material in Borrow Area 1 and placement of fill for a haul road, and construction of mitigation both on-site and off-site.

The Port submitted a Natural Resource Mitigation Plan for this project which was subsequently revised. The initial NRMP, dated December 2000, was reviewed by the Corps and found to be inadequate in several areas for compensating wetland and stream impacts due to project construction. Inadequacies were discussed with the Port, who coordinated their response to our concerns very closely with us. The Port incorporated additional compensatory mitigation components into the NRMP and resubmitted to the Corps. The revised NRMP, dated November 2001,[1] adequately addressed our concerns regarding the December 2000 NRMP. Details of this process are outlined below.

2. PURPOSE: The purpose of this appended document is to summarize the Corps functional assessment and impact analysis for the Port's MPU projects, and to evaluate the adequacy and feasibility of the Port's compensatory mitigation plans (dated December 2000 and revised November 2001) to replace the functions lost due to project implementation.

3. SUMMARY OF PORT SUBMITTALS AND CORPS CONCERNS

The Port provided a *Natural Resource Mitigation Plan* (NRMP) (Port of Seattle, December 2000)[2]. This document includes a brief description of functions replaced by compensatory mitigation. The Port's document did not discuss functions per se, but

[1] When referencing the November 2001 NRMP throughout this document, the amendments dated January 2002 are incorporated by reference.

[2] The Port submitted a revised NRMP (Port of Seattle, November 2001), with amendments dated January 2002, after feedback from the Corps on their initial December 2000 NRMP. The revisions to the NRMP are reviewed in paragraph 9 of Appendix C.

presented numbers of acres enhanced, restored, and created (including the out-of-basin mitigation) as functional replacement for impacts.

The Corps requested the Port perform a detailed wetland functional assessment and impact analysis for the project. The Port provided this in the document titled *Wetland Functional Assessment and Impact Analysis; Master Plan Update Improvements Seattle-Tacoma International Airport* (Port of Seattle, December 2000).[3]

After thorough review, the Corps determined the Port's approach was too general to critically review or substantiate. The Corps expressed this concern to the Port in a letter dated 11 May 2001. The Port subsequently submitted a report titled *Port of Seattle's Response to Corps Request For Information*. This submittal provided a summary of wetland functions by project area and by mitigation area with additional information regarding temporary and permanent impacts. After review of this new information, the Corps requested additional information on each wetland (or wetland system) because the Port remained unclear on how some of their conclusions were reached. The Corps then requested the Port submit the raw data gathered for each wetland that they utilized to determine the relative rating of functions assigned to that wetland.

The Corps' review of the Port's data found several areas that were not consistent with the Corps' field observations or the Port's own functional assessment. Accordingly, the Corps determined an independent functional assessment and impact analysis was warranted.[4]

The Corps' independent assessment and analysis provided the rationale and documentation necessary for requesting additional compensatory mitigation from the Port to address the areas of concern, as outlined below. The Port responded with a revised mitigation plan (November 2001) specifically addressing the inadequacies of the December 2000 NRMP.

4. CORPS FUNCTIONAL ASSESSMENT APPROACH

The Corps used the approach contained in the Hydrogeomorphic (HGM) Functional Assessment Methodology (Ecology Publication #99-166, August 1999) to assess existing wetland functions for analysis of project impacts. The HGM approach examines wetland functions individually and then applies these functions to how they fit into the landscape. The Corps selected this approach because it addresses the extent of potential impacts on a landscape scale.

[3] The Corps performed an independent functional assessment (Enclosure B of Appendix C) and impact analysis (Enclosure C of Appendix C) prior to the Port's submittal of their revised and updated functional assessment and impact analysis (Port of Seattle, November 2001).

[4] As discussed in Paragraphs 9(A) and 10(A)(5) of the ROD, the Corps chose to assess the adequacy of the proposed mitigation on a functional basis rather than on an acreage basis.

Specific sources of information used by the Corps for the functional assessment and impact analysis included the following:

a. Federal Aviation Administration (FAA). June 2000. *Biological Assessment.* Prepared by Parametrix, Inc. for FAA and the Port of Seattle.
b. Port of Seattle. December 2000. *Natural Resources Mitigation Plan*. Prepared by Parametrix, Inc. for the Port of Seattle.
c. Port of Seattle. December 2000. *Wetland Functional Assessment and Impact Analysis*. Prepared by Parametrix, Inc. for the Port of Seattle.
d. Port of Seattle. December 2000. *Wetland Delineation Report*. Prepared by Parametrix, Inc. for the Port of Seattle.
e. Port of Seattle. December 2000. *Wetland Delineation Report, Appendix B*. Prepared by Parametrix, Inc. for the Port of Seattle.
f. U.S. Army Corps of Engineers, Regulatory Branch. February 2001. *Memorandum For Record, Wetland Delineation Confirmation.*
g. Port of Seattle. May 2001. *Wetland Photographs and Maps*. Prepared by Parametrix, Inc. for the Port of Seattle.
h. Port of Seattle. May 11, 2001. *Response To Corps Request For Information - Alternative Analysis - 404(b)(1) Evaluation, STIA Master Plan Update Improvements*.
i. Port of Seattle. 8/11-8/29/1995; 3/29-4/05/2001. *Wetland Raw Data.* Collected and prepared by Parametrix, Inc. for the Port of Seattle.
j. Port of Seattle. August 2001. *Supplemental Information, Cumulative Impacts to Wetlands and Streams*. Prepared by Parametrix, Inc. for the Port of Seattle.
k. Port of Seattle. November 2001. *Natural Resources Mitigation Plan.* Prepared by Parametrix, Inc. for the Port of Seattle.
l. Numerous letters of behalf of ACC from Amanda Azous, Dyanne Sheldon, and Sarah Cooke.
m. All comments received throughout the permit review process in response to the three public notices and in the public hearings regarding wetland and stream impacts and potential mitigation.
n. Scientific Literature (cited throughout). See Literature Cited.

5. SUMMARY OF CORPS ASSESSMENT OF EXISTING LANDSCAPE FUNCTIONS

Enclosure A of this document contains the wetland classes found in the project area as defined by both Cowardin and HGM.

Enclosure B of this document contains the Corps' detailed assessment of functions provided by the existing wetlands by project area. This section also summarizes the Corps' findings in terms of how the wetlands function within the landscape.

The Corps used the terms high, moderate, and low to describe the functions found in the existing wetlands in the project area and at the mitigation site in Auburn.

ASSESSMENT SUMMARY (Enclosure B provides assessment details)

A. WATER QUALITY FUNCTIONS (sediment, nutrient, heavy metals, toxic organics removal)

The Corps' assessment indicated most wetlands in the project area and off-site at Auburn rated high for water quality functions, given the existing land uses, the landscape position of the wetlands, and the lack of water quality treatment ponds within the project area. If not for the existence of these wetlands, untreated stormwater runoff would enter area streams and potentially degrade water quality to an unacceptable level (below state standards).

B. WATER QUANTITY (HYDROLOGY) (reduction of peak flows, decreasing erosion, groundwater recharge and discharge)

The Corps' assessment indicated most of the wetlands in the project area and at the offsite mitigation area in Auburn provide medium to high hydrologic functions. The depressional wetlands provide reduction of storm peak flows at relatively high levels, and prevent downstream erosion in the project area streams. Slope wetlands perform this function at a lower level, while the smaller wetlands in the project area perform this function at a relatively low level, given the limited opportunity and capacity for storage. Some of the wetlands provide important baseflow support for low summer flows and rated high for this function. Groundwater recharge functions are generally lacking in the area given the soil composition and the Vashon Recessional Outwash geology in the area.

C. GENERAL HABITAT SUITABILITY (includes fish and amphibian habitat, aquatic food web conditions, invertebrate habitat, terrestrial bird, waterfowl, and other wildlife habitat, and native species richness)

The Corps' assessment indicated the wetland habitat functions in the project area rated highest for carbon export and food chain support, and to a lesser extent invertebrate, passerine bird, small mammal, and amphibian habitat (mostly non-breeding).

At the Auburn site the Corps assessment indicated the existing wetland habitat functions rated highest for small mammals and invertebrates but habitat functions as a whole rated low because of past agricultural activities, a lack of diversity and structure on the site, and little to no surface water connection between the existing wetlands and the Green River (limited opportunity for carbon export and food chain support).

LANDSCAPE FUNCTIONAL ASSESSMENT SUMMARY

Water Quality Functions

Wetlands rated high for water quality functions include those wetlands with fairly healthy emergent vegetation receiving direct (untreated) runoff from streets and other

impervious surfaces before entering the receiving water bodies (Miller, Des Moines and Walker creeks - e.g. some of the riverine wetlands and A1) and those wetlands which present opportunity for nutrient/sediment trapping coupled with their position in the landscape and the hydrologic connectivity to one another (e.g. the Lake Reba Wetland Complex). Larger depressional wetlands in the landscape also rated high for water quality functions because of their ability to detain water and filter out particulates and contaminants.

Wetlands rated moderate for water quality functions did so because they have the opportunity to treat untreated stormwater but cannot perform at a higher level because vegetation is sparse or lacking (e.g. the Vacca Farm Wetlands and the Tyee Golf Course Wetlands). Moderate water quality functions were also demonstrated in wetlands that had opportunity for nutrient/sediment trapping but were sparsely vegetated and/or were positioned in a slope landscape where the opportunity for stormwater retention/detention was limited.

Wetlands rated low for water quality included those smaller wetlands with little to no emergent vegetation, situated on a slope and/or were further removed from receiving water bodies. The opportunity for nutrient/sediment trapping and treating stormwater is extremely limited for those wetlands rated low for water quality functions.

Hydrologic Functions

Wetlands rated high for hydrologic functions included those wetlands hydrologically connected to one another or the waterways within the project area. Wetland position in the landscape was a determining factor for rating the wetlands. For example, riverine wetlands directly adjacent to Miller, Walker, and Des Moines creeks without berms or hardened banks rated higher for flood storage and desynchronization because these wetlands are still connected to the floodplains of the creeks. Wetlands comprised of woody vegetation rated higher for flood desynchronization and detention than those with just emergent vegetation. Wetlands important to baseflow functions associated with the creeks were also rated high for hydrologic support functions (such as the Lake Reba/Miller Creek Detention Facility wetlands).

Wetlands located at Vacca Farm and Wetland 28 rated high for flood storage because these wetlands are within the 100-year floodplain of Miller and Des Moines creeks respectively. However, these same wetlands rated moderate to low for flood desynchronization because the mowed/farmed emergent community portion of these wetlands have limited opportunity to slow flood waters down. Evapotranspiration rates of a portion of these wetlands are substantially limited by their emergent mowed and farmed conditions.

Well vegetated, larger depressional wetlands in the landscape rated high to moderate for hydrologic functions by capturing stormwater and slowly releasing it as surface water, shallow groundwater, evapotranspiration, or, more likely, a combination of these. Some of the groundwater expressed by these wetlands could be released during low

baseflow conditions, depending on the proximity of the wetlands to the creeks, soil characteristics, and the holding capacity displayed by the wetlands. Most of the depressional wetlands rated moderate to high for their ability to reduce erosion to downstream reaches of Miller, Walker and Des Moines creeks. Slope wetlands rated low to moderate for this function depending upon surface water connection, steepness of slope, and the presence or absence of an outlet.

Small fragmented wetlands rated low for hydrologic functions because their capacity to hold, store, and detain storm and floodwaters are severely compromised by their size and fragmentation.

Habitat Functions

Wetlands located in the project area exhibit a wide range of functionality in terms of habitat suitability for a wide range of factors. Wetland habitat suitability functions were rated according to their vegetation strata, diversity, continuity/connection to one another and the project area waterways, and the hydrologic regime exhibited. Those wetlands not fragmented and containing a somewhat intact migration corridor (Wetlands 18/37 and 28) rated higher for habitat functions than those small and isolated wetlands. Wetlands exhibiting standing water into the summer months rated higher for certain habitat attributes (such as amphibian breeding habitat) than those containing a short or marginal hydroperiod. Forest and shrub wetlands located close to surface waters, with conveyance opportunities, rated high for organic carbon export, while emergent wetlands, not in close proximity to surface waters, received the lowest rating for carbon export functions.

Given the urban landscape exhibited in the project area, only small fragmented wetlands, typical of 'backyard wetlands' received low habitat suitability functions given the likelihood that limited wildlife use occurs in these wetlands because of on-going human disturbances, limited habitat components to support wildlife populations, and/or small size. Wildlife species typically adapted to disturbance and urban environments (such as raccoon and opossum) may utilize the smaller wetlands but likely utilize them similar to upland areas. However, it is likely all the wetlands within the project area receive some limited wildlife/bird use given the urbanization of the watersheds and limited undisturbed resources in the area.

Fish habitat functions generally rated low except for those riverine and slope wetlands providing direct and indirect food chain support to the creeks.

6. IMPACT ASSESSMENT SUMMARY (see Enclosure C for details of analysis)

Table 1 summarizes the on-site impacts by project area, creek basin, acreage, Cowardin and HGM classifications.

The proposed project impacts affecting aquatic resources in the project area and corresponding watersheds include permanent, temporary, temporal and indirect

impacts. The Corps considered the wetland impacts in concert with the time it takes for functional replacement of those wetlands to determine the adequacy of the compensatory mitigation. The intent of compensatory mitigation is to adequately offset the permanent, temporary, temporal and/or indirect impacts to wetlands.

Table 2 presents a summary of what the Corps considered permanent and temporary impacts.

Table 3 presents the details of on-site and off-site permanent and temporary impacts by Project Area, Creek Basin, Acreage, and Cowardin/HGM Classification.

Permanent, temporary, temporal, and indirect impacts are described in the following:

A. Permanent Impacts. Permanent impacts are those impacts, which result in the permanent loss of wetlands and/or waters of the U.S.

A total of 19.62 acres of permanent impacts will occur due to the proposed projects. This total includes: 15.97 acres of direct fill impact and 2.4 acres of indirect impacts to wetlands resulting in a loss of wetland functions through either a change in wetland hydrology, shading impacts (from permanent vegetation removal and bridge construction), and/or fragmentation. The total also includes 1.25 acres of impact for stormwater collection swales and ponds in wetlands 18, 37, A12, A13, and 44a. The constructed stormwater features in these wetlands will be in place for up to 3 years. The Corps considered this a permanent impact (even though these areas are proposed to be restored after project completion) because of the length of time the impacts will occur and the temporal impacts of restoring the suite of functions currently provided by these wetlands.

B. Temporary Impacts. Temporary impacts are those lasting for a limited time and where functions can be replaced in a relatively short period of time (about one year). Some temporary impacts over a long period of time were considered permanent (see Table 2 and paragraph 6A above). Compensatory mitigation is normally not required for temporary impacts to functions if these functions can be replaced (usually) within one growing season of the impact. For example, replacing the functions (such as habitat for small mammals, water quality functions, nutrient uptake) for palustrine emergent (PEM) wetlands can usually be done within one growing season.

The Corps considered the following to be temporary impacts[5]:

Existing wetlands disturbed by mitigation activities and installation of erosion control structures such as silt fencing and vegetation trimming. Activities within the mitigation

[5] Temporary impacts not considered jurisdictional under Section 404 of the Clean Water Act were not included in our calculations. This included activities such as hand planting of enhancement areas (considered incidental fallback). Total acreage for non-jurisdictional work is 16.38 acres (all on-site hand planting of enhancement areas). The Port did include these activities as temporary impacts in Table 3.1.4. *Summary of wetlands disturbed during mitigation activities* of the NRMP (Nov. 2001).

sites include excavation and grading, mowing and discing, some irrigation system installations and temporary roads in palustrine emergent wetlands for access to the mitigation sites and access for maintenance and monitoring of the compensatory mitigation. Temporary impacts from these activities total 28.78 acres, with most occurring off-site at Auburn (23.27 acres). A portion of this total at Auburn includes fill placement in wetlands for a construction staging area for about 3 years and fill in wetlands for monitoring and maintenance roads in place from 5-15 years. This is considered a self-mitigating temporal impact (see below under temporal impacts).

C. Temporal impacts. Temporal impacts refer to those functions which can and will eventually be replaced but cannot and do not achieve similar functionality in a short period of time. In contrast to temporary impacts, temporal impacts for replacing functions, such as song bird habitat in a tree canopy, provided by a middle-aged palustrine forested wetland may take up to 20 years to develop the level of function needed to replace that lost permanently or temporarily at the impact site. Temporal impacts normally require compensatory mitigation.

See above under permanent impacts for those temporal impacts the Corps considered permanent. For this particular project, most temporal impacts were considered permanent (except for at the Auburn mitigation site (see below)), since these impacts were attributed to PFO and PSS systems, the impacts (such as temporary stormwater ponds) would be in place for several years, and some wetland functions would not be expected to be replaced for many years once the impacted site was restored.

The Corps considered the following to be temporal impacts:

The staging area in an emergent wetland at the Auburn mitigation site will impact approximately 3.27 acres for up to 3 years. In addition, 7.12 acres of emergent wetland will be excavated to create wetland basins at Auburn and emergent wetlands will be converted to gravel paths and maintenance roads, allowing access to conduct monitoring and maintenance activities. These roads/paths may be in place from 5-15 years depending upon performance standards. Eventually these areas will be restored.

The Corps considered these temporal impacts (as opposed to grouping them in with permanent impacts) because the mitigation activities at Auburn will provide an increase in wetland acreage and functional lift for all wetland functions such that these temporal impacts are being mitigated on site.

D. Indirect Impacts. Indirect impacts result from activities adjacent to an aquatic resource that may affect the way the aquatic resource functions. Indirect impacts can result from construction activities nearby (e.g. producing sediment which enters the wetland or other aquatic resource). Indirect impacts can also result from changing the hydrology in an area so there is too much or too little water after project construction, thereby changing or limiting wetland function. In some instances, areal impacts will occur to a wetland to such an extent (e.g. 70% or more of the wetland is impacted) the remaining portion of the wetland becomes substantively impaired. In those cases, the

entire wetland is considered adversely impacted and the Corps usually requires compensatory mitigation.

The Corps concurred with the Port in their assessment of quantifiable indirect impacts and included these indirect impacts under permanent impacts (2.4 acres out of the 19.62 acres total permanent impacts). For potential unforeseen or unanticipated indirect impacts, the Port has provided more than adequate monitoring and maintenance plans, stringent performance standards, and contingency plans to identify and compensate for potential indirect impacts if they occur.[6]

Summary of Water Quality Impacts

Loss of wetlands in the Miller, Walker, and Des Moines creek watersheds will likely result in the following impacts to water quality:[7]

- Decreased opportunity for nutrient/sediment trapping.
- Decreased opportunity to detain/retain/filter stormwater to moderate chemical/contaminant introduction into receiving waters.
- Increase pollutant loads to streams.
- Increase sediment loads to streams.

Permanent impacts to water quality from eliminating 19.62 acres of wetlands include the reduced potential of the remaining wetlands to effectively filter out contaminants and sediments. In addition, the remaining wetlands ability to perform nutrient cycling functions may be permanently limited.

Temporary impacts to water quality will potentially occur from construction activities, while soil disturbances are on going and before site conditions have been stabilized. Temporary impacts are likely to be somewhat ameliorated by the application of Best Management Practices (BMPs)[8].

See Enclosure D and Paragraph 7 of this document for details and a summary of the Port's proposed mitigation.

Temporal impacts to water quality are likely to occur until vegetation communities become established in areas disturbed for construction of the project and compensatory mitigation. Emergent wetland communities tend to function at higher levels for water quality functions than woody vegetated communities. Therefore, the application of

[6] The PCHB added a condition regarding maintenance of the pre-construction hydroperiod. As discussed in Paragraph 9(A) of the ROD, the Corps has not added this condition to the permit. Instead a special condition providing additional protocols for hydrology monitoring was added.

[7] The PCHB added several conditions regarding water quality. As discussed in Paragraph 9(C) of the ROD, the Corps has only added some of these conditions to the permit.

[8] BMPs the Port proposes to utilize for project construction are found in the Port's Biological Assessment and the Port's Stormwater Plan.

erosion control seed mixes on bare ground is likely to reduce temporal impacts on water quality functions.

Indirect impacts to water quality include a shift in food chain support organisms and structure (particularly macro- and micro-invertebrate communities) due to implementation of the Port's stormwater plan. Replacing wetlands with water quality ponds could result in a community shift. This, in turn, could have an indirect impact on water quality (e.g. nitrogen fixing bacteria could be impacted).

The Port's stormwater plan (Port of Seattle, 2000), coupled with the in-basin compensatory mitigation (particularly wetland restoration and enhancement), is likely to offset these impacts. Removal of septic tanks and pollutant generating surfaces and activities in close proximity to surface waters may also assist in improving water quality in the project area. See Enclosure D for the Corps' analysis of the Port's proposed mitigation.

Summary of Hydrologic Impacts

Activities associated with implementing the proposed project will include adding new impervious surfaces (new runways, taxiways, parking, buildings, and roadways). This action could change the hydrologic flow regime of Miller, Walker and Des Moines creeks, including increased peak-flow magnitude and frequency, and increased peak-flow duration.[9] The potential effects of high-flow impacts in the stream are increased erosion and sedimentation, habitat damage from scouring flows, and impaired habitat use during high-flow period.

Hydrologic modeling has also demonstrated a potential low stream flow impact due to the proposed projects. If low stream flow impacts were large enough, the wetted stream area of the creeks would be reduced, which would adversely affect fish and aquatic habitat.

The permanent impacts to hydrologic functions from filling 19.62 acres of wetlands within the project area include an increase in erosive forces in the creeks because of an increase in impervious surface area in the subject watersheds. In addition, baseflow impacts to Miller, Walker, and Des Moines creeks could occur from filling slope wetlands with perennial groundwater discharge functions. The low flow analysis performed by the Port (Port of Seattle, 2001) revealed no low flow impacts would occur to Miller Creek due to project construction and implementation (with stormwater facilities in place), but low flow impacts would occur in Des Moines and Walker creeks. The Port has provided mitigation (stormwater storage in large vaults) to address the low flow impacts (see Enclosure D). See also Paragraphs 9(C) and 10(A)(6)(b) of the ROD for additional discussion regarding low flow impacts and mitigation.

[9] The PCHB added several conditions regarding hydrologic impacts. As discussed in Paragraph 9(C) of the ROD, the Corps has only added some of these conditions to the permit.

The temporary impacts to hydrologic functions include a potential for scour and erosion to occur to receiving waters while the different phases of the stormwater plan are implemented and stabilized. The Port has included adaptive management plans to implement, if necessary, to reduce hydrologic impacts to the receiving waters.

The temporal impacts to hydrologic functions are likely to occur before vegetation stabilizes and matures so the planted areas can perform storm and floodwater desynchronization functions at moderate levels.

Potential indirect impacts to the wetlands remaining after construction could occur by changing the hydrologic regime (too much or too little water) of the wetlands from construction of the Mechanically Stabilized Earth (MSE) walls. Indirect impacts to the water budgets of the watershed could also indirectly affect baseflows in the creeks, which, in turn could adversely affect fish habitat in the creeks. Diverting stormwater from wetlands to ponds can also have an indirect impact on the wetlands by changing the hydroperiods currently displayed. Changing a wetland's hydrologic regime can impact the existing vegetation community of the wetland. This, in turn, could adversely affect the wildlife adapted for use of a particular wetland.

Based on the Port's extensive modeling, the Corps believes the combination of the Port's stormwater plan, their proposal to construct water conveyance structures and channels, the low flow mitigation proposal, and the design of the MSE walls to allow and delay release of infiltrated stormwater, will offset the potential hydrologic impacts expected from the project. In addition, adaptive management and contingency plans will reduce the potential impacts even further. See Enclosure D for the Corps overview of the proposed mitigation.

Summary of Habitat Impacts

Under existing conditions in the Miller Creek basin, there are approximately 300 acres of habitat (uplands and wetlands, not including lakes) in parcels either large enough by themselves, or sufficiently contiguous with Miller Creek or other habitat areas, to provide measurable habitat functions. These lands constitute about 6% of the 8-square-mile watershed. The MPU will eliminate about 106 acres of the existing wetlands and upland habitat. The loss of uplands and wetlands resulting from the MPU will reduce the remaining functioning habitat area by approximately 13% and reduce the percentage of habitat within the entire basin to 5%. The project will eliminate 23% of the wetlands in the defined project area within the Miller Creek basin.

Filling the project wetlands has the potential to alter or eliminate populations in lower trophic levels, such as detrital feeders, and thereby impair the energy flow of primary consumers to higher trophic levels. The reduction and possible elimination of food chain organism populations can decrease the overall productivity and nutrient export capability of the subject aquatic systems.

The reduction of wetland plants in the watershed will reduce the volume of organic particulate matter resulting from the death and partial decomposition of wetland plants. The extent of this effect will determine the degree to which the food web would shift from detritus consuming filter feeders to phytoplankton production. This shift could have consequences for both resident fisheries as well as for species using the lower reaches but are not resident, such as coho or chinook and bull trout in the estuaries. Detrital food sources are essential to the development of invertebrate communities on which salmonid fish species feed. Reductions in the productive capacity of the riverine wetland systems could affect fish production.

Another potentially adverse impact is further elimination and reduction of wildlife migration corridors. Because of past development, west-east migration corridors have all been virtually eliminated, creating an isolated segment of what was historically a much larger interconnected system. The corridor is further restricted going towards the west and ultimately to Puget Sound. The project will reduce the west-east and limited north-south migration corridor substantially by eliminating the forested slope and wetlands west of the existing airport. Isolating systems severely reduces a population's ability to deal with increased stresses and could ultimately lead to local extirpations of wildlife species. The permanent impacts to habitat associated with the Port's proposal include the loss of 19.62 acres of wetland habitat and the permanent alteration of the landscape as a direct result of filling the wetlands. Wildlife utilizing the wetlands could perish or sustain harm to themselves and/or their life cycles. The Corps considers the permanent shading of a portion of Des Moines Creek from the placement of a large bridge structure a permanent impact because of reduced plant production and resulting habitat consequences.

Temporary habitat impacts include a disruption to wildlife utilizing adjacent areas and the displacement of species and/or individuals inhabiting the wetlands to be filled. Migration habits could be temporarily disrupted. Wildlife using the wetlands are likely adapted to the urban environment and could potentially find similar habitat requirements in the remaining wetlands. Additional temporary habitat impacts will arise from trimming vegetation in shrub and forested wetlands to place silt fences. Noise associated with construction activities would also be a temporary impact to wildlife utilizing the habitat to remain.

The temporal habitat impacts include the time it will take for vegetation and soil processes to establish in the areas proposed for enhancement and restoration, and for habitat requirements for a broad range of species to reestablish and succeed into a stable ecosystem. The contiguous nature of the Miller Creek buffer in the area of most impact will lessen temporal impacts to migration patterns of some wildlife species. Carbon export functions will be diminished until vegetation biomass is reestablished in the newly planted areas of the mitigation sites. Other temporal impacts to habitat could result from bridge construction over Des Moines Creek, which will necessitate vegetation removal that could impact fish habitat.

The indirect habitat impacts include a potential shift in food chain support functions by reducing species richness in the area and eliminating organic carbon sources from the watersheds. In addition, siltation from construction activities could indirectly adversely affect fish habitat in the creeks.

7. ADEQUACY OF THE PORT'S DECEMBER 2000 NRMP COMPARED TO THE CORPS IMPACT ASSESSMENT (refer to Enclosure D)

General Discussion

The Corps determined the Port's initial December 2000 compensatory mitigation proposal was not adequate because it did not adequately replace carbon export functions, did not adequately address the disruption to landscape functions (corridors and complexity) nor adequately addressed the risk and uncertainty associated with the project. Each of these areas is addressed in more detail below.

When the individual wetlands are tabulated with respect to their functions and values, they have the highest rankings for exporting organic carbon (81% ranked moderate to high), groundwater exchange (54%) and nutrient sediment trapping (54%), followed by small mammals and passerine bird habitat (42% each).

The Corps' independent assessment (Enclosure B) established the most important functions provided by the wetlands and other waters of the U.S. in the subject basins include: carbon export, nutrient cycling, sediment trapping, groundwater exchange, and habitat suitability functions for small mammals, invertebrates, passerine birds and to a lesser extent, amphibians.

Carbon Export Functions:
The functional assessment performed and submitted by the Port rated about 81% of the wetlands as moderate to highly valued for carbon export functions. The Corps concurs with this assessment.

Permanent Impacts

Permanent impacts to carbon export functions will occur from vegetation land clearing activities in both wetland and upland portions of the project area. Land clearing activities will eliminate a large source (some 300 acres) of organic material from the landscape. This material is currently exported from the upland and wetland landscape through storm events (surface flow in channels connected to Miller, Walker and Des Moines Creek basins and overland sheet flow), wind activity, and direct input from existing overhanging vegetation along the banks of the waterways in the project area. A permanent decrease in opportunity will result from the land clearing and construction activities in the upland portions of the project area. Temporary, temporal and indirect impacts are anticipated from land clearing and filling activities in the wetlands (see below).

Temporary Impacts

The amount of organic carbon export may temporarily be reduced by the enhancement activities proposed in the wetlands and upland buffers. While we recognize the removal of shrubby non-native species such as Himalayan blackberry is a positive enhancement activity, the blackberry communities do provide some habitat functions (foraging, nesting, and refuge) for some wildlife species. More importantly however, is the production of detrital matter and organic carbon for export from the blackberry bushes. Replacing the non-native communities of blackberry with native plant communities is likely to decrease the export of organic carbon function over the short-term while the soils restabilize and the plants reach such growth as to replace the biomass of the blackberries. There could be a shift of the food web, as the detrital feeders utilizing blackberry detritus may not consist of the same species utilizing the enhancement plant species. However, with favorable growth conditions for the planted species, the Corps believes the impacts from removing invasive species and reestablishing a diverse native riverine wetland community and upland buffer community will be temporary. The opportunity to export organic carbon from the enhancement areas will not be substantially reduced during the time it takes for the native plantings to reestablish.

Organic carbon export functions at the Tyee Valley Golf Course site are likely to take some time to reach moderate to high levels. However, the Corps anticipates this will occur in a much quicker time frame than the Vacca Farm site, because minimal soil disturbance is required for mitigation activities at the Tyee Golf Course. Turf-dominated wetland and Des Moines Creek buffer will be replaced by a shrub dominated wetland and buffer. The Corps determined the planting activities at the golf course mitigation site and along Des Moines Creek would likely have temporary, minor and short-term impacts. The benefits of these mitigation activities far outweigh the impacts from planting the site and provide a substantive functional lift over baseline conditions at the golf course for carbon export functions.

Temporal Impacts

The Corps recognizes some functional lift will occur to riverine wetlands along the creek corridors due to enhancement activities in the upland buffer areas. However, upland buffers have different functions in comparison to the wetlands themselves - especially in terms of soil chemistry, water quality benefits, and stormwater storage. The enhancement activities (soil disturbance from removing invasive species and planting native species) in the wetlands and upland buffers will likely reduce and interrupt the water quality and flood storage functions on a temporal scale. It will likely take a few to many years to reestablish the soil processes to a moderately functioning level in the disturbed areas.

The Corps acknowledges the replanting of the Vacca Farm site will increase the potential for carbon export functions from the area, providing partial mitigation for the role the existing wetlands fulfill. At Vacca Farm, the Port proposes to excavate and regrade the peat soils. Although planting trees and shrubs will eventually improve

organic carbon export, nutrient cycling and sediment trapping at the Vacca Farm site, it is unlikely to occur any time in the near future as the most productive soils (peat soils) will be excavated and graded. Soil processes in the remaining peat soils are likely to take years to reestablish. As a result, the production of organic carbon will likely be diminished for many years at the Vacca Farm site.

Indirect Impacts

The high levels of dissolved organic carbon (DOC) currently found in both Des Moines and Miller creeks will limit the biological availability of zinc and copper found in the Port's stormwater runoff, effectively reducing the toxicity of the stormwater to aquatic life. The breakdown of detrital material by bacteria and fungi produces DOC. The comparatively high levels of DOC found in Des Moines Creek and particularly the levels found in Miller Creek are likely due to the contribution of organic material from existing wetlands. The loss of DOC in the system from permanently filling 19.62 acres of wetlands will likely effect the food web and increase the bioavailability of toxics and heavy metals, like zinc and lead, especially in the Miller Creek system. This could adversely affect fish and invertebrate populations in the creeks.

The implementation of the Port's stormwater management plan offers opportunities to improve the stormwater quality leaving their property and discharging to the creeks and/or Puget Sound.[10] Providing stormwater treatment in existing areas where none exist now and implementing state-of-the-art water quality and stormwater technologies for the new impervious surfaces and facilities proposed for construction will likely provide opportunity to improve stormwater quality. However, producing cleaner water at specified release rates does not adequately address the issue of organic carbon export and it's integral role in providing water quality functions. Stormwater ponds and vaults do not produce the detrital input or contribute to food web processes essential for organic carbon production and export.

Summary

In summary, based on the Port's December 2000 NRMP, the Corps determined there would be a loss (from permanent, temporal, temporary, and indirect impacts) of organic carbon sources (including upland and wetland forests) due to project implementation. There would be less opportunity for this function to perform at the levels the existing system currently provides. By eliminating slope wetlands that are hydrologically connected in the area, and replacing them with upland buffer and wetland enhancement activities, the Corps believes there would be a decrease in the opportunity (at least temporally and temporarily) for the wetlands to perform this function at moderate to high levels.

The Port's December 2000 mitigation proposal for buffer enhancement would eventually increase opportunity, species and structural diversity over time and the

[10] Several of the PCHB conditions addressed stormwater quality concerns. As discussed in Paragraph 9(C) of the ROD, some of the conditions were added as conditions to the permit.

wetland enhancement activities would increase opportunity for carbon export by increasing woody vegetation. However, it would be several years before the constructed systems function as intended. In addition, enhancement of upland buffers along Miller Creek would not provide as high an opportunity to be organic carbon sources as the existing wetlands do, due to limited overflow and flooding of Miller Creek.

Based on the Corps' assessment, the Port's mitigation proposal (NRMP, Dec. 2000) to enhance the upland buffer along Miller Creek and to enhance some of the remaining wetlands in the project area was determined not to be an equivalent functional exchange for carbon export functions for permanently eliminating 15.48 acres of existing wetlands in the Miller Creek basin. The Port submitted a revised mitigation proposal (NMRP, Nov. 2001) specifically targeting increased opportunity for carbon export functions in the Miller Creek basin. The Corps now considers the impacts to Miller Creek and its associated wetlands adequately mitigated (see Paragraph 9). Regarding Walker Creek, the primary impact is due to potential low flow impacts. These impacts are mitigated for with the low flow mitigation efforts.

The Corps has determined the mitigation activities proposed in the Des Moines Creek basin adequately off-set carbon export functions of the existing wetlands proposed to be impacted in this basin.

Landscape Functions:

The Port's proposed project will result in wetland alterations by changing the number, types and positions of wetlands on the landscape. Maintaining the diversity of hydrologic conditions and regimes to support a suite of functions will become more difficult to achieve because of landscape alterations.

At project completion, the habitat remaining in the Miller Creek watershed will be more contained, partially channeled by a uniform wall, and less complex with a more limited habitat system (reduced by 70**%** on the west side where 15.48 acres of wetlands will be impacted). The ecosystem being impacted could become less resilient to losses in biodiversity due to disturbances such as drought, toxic spills, or sustained heavy rainfall.

The Port's Miller Creek in-basin mitigation plan in the December 2000 NRMP included the restoration of 6.6 acres of wetland at Vacca Farm, approximately 13 acres of wetland enhancement, and about 37 acres of buffer enhancement and creation.[11]

After permanent impacts to Wetlands 18 and 37 are taken into account with the addition of another acre of proposed impact for the 'temporary' stormwater facilities, there will remain about 1.4 acres of what was originally a 9.3-acre complex. The Corps believes there are no enhancement activities that could functionally lift a 1.4-acre

[11] See Paragraph 9 below, Enclosure D, and Paragraph 9(A) of the ROD regarding the credit given for the various aspects of the mitigation.

wetland fragment to perform in an urban landscape as the 9.3-acre complex currently does.

Eliminating a relatively high percentage of remaining wetlands within an already degraded, urbanized watershed such as Miller Creek could influence the remaining wetlands role in protecting water quality, aquatic ecosystem diversity, productivity, and stability. Indirect impacts may potentially cause harm, among them reduced food web support, changes in water chemistry and alteration to invertebrate communities. Although the Port's December 2000 in-basin mitigation plan and stormwater management plan addresses some of these impacts, it fell short in providing assurances that watershed resources would be protected in terms of water quality and quantity and overall habitat health to sustain important associated functions for Miller Creek.

The Port's proposed projects would eliminate wetlands and decrease the complexity, diversity, and connectivity (corridors) of the remaining wetlands in the landscape. By altering the landscape in the project area, the Corps believes it would decrease the opportunity for organic input to the subject watersheds. The proposed projects may result in additional indirect impacts by changing the remaining wetlands ability to store water, and potentially changing wetland hydroperiods and the ability of the wetlands to augment flow during low baseflow conditions.

Although the Port is clearly altering the existing landscape on a permanent basis, this impact is somewhat offset by the Port's proposal to increase the buffers and habitat attributes within the project area. In addition, the decrease in use and impact by human disturbances are likely to display beneficial effects by improving water quality (removing chemical applications, farming activities, septic systems, and retrofitting current stormwater outflows). The most substantive beneficial outcome of the mitigation proposal along Miller Creek in the project area is the instream work directly benefiting stream inhabitants and the creation of a contiguous corridor along Miller Creek by enlarging and enhancing the buffer. The Corps believes keeping the Miller Creek corridor intact allows wildlife migrations to continue and function at a higher level than the current buffer and land uses provide. This feature of the mitigation plan should protect against losses in biodiversity and resilience. The restoration of habitat connectivity in the upper reaches of the Miller Creek basin should provide a continuous forested wetland and riverine corridor connecting currently fragmented wetlands, aquatic, and riverine habitats. The further the Miller Creek buffer enhancement and corridor reaches into the upper watershed, the more functional lift is realized by increasing the continuity of the corridor while allowing water quality and carbon export functions to increase.

The Port is providing, through their mitigation package, an increase in the complexity (native plant richness will increase in the enhancement areas) of the remaining wetlands and buffers and will maintain low baseflows through a variety of mechanisms. The Corps considered these aspects in our review and determined project implementation will create a less diverse system (the Port's efforts are towards PSS

wetlands given the safety concerns with, and proximity to, the airport), lost opportunity because of reduced wetland acreage in the subject watersheds, the permanent loss of large wetlands and wetland complexes. In addition, there exists the potential for indirect impacts (too much or too little water) from project implementation on the remaining wetlands in the area.

Landscape alterations within the Des Moines Creek watershed will primarily occur from construction of SASA (construction requires substantive grading and filling) and the large-scale "scraping" of material from the borrow areas. Most wetlands within the Des Moines Creek basin are being avoided (3.88 acres of total impact). The Corps' primary concern from landscape alterations in the Des Moines Creek basin is the potential indirect impacts to the remaining wetlands once project implementation is complete.

In summary, the Corps' concerns regarding landscape alterations within the Miller Creek basin have been adequately addressed in the revised November 2001 NRMP. The Port included additional mitigation components along the Miller Creek corridor in close proximity to and around Lora Lake as well as providing additional restoration of the creek itself and wetlands adjacent to the headwaters of Miller Creek in the upper part of the watershed at the Des Moines Way Nursery site (details presented in Paragraph 9 of this document). Inclusion of this additional mitigation creates a contiguous corridor reaching further into the headwaters of Miller Creek, with 100-foot average buffers along approximately a 1.5 mile contiguous reach of Miller Creek. The Corps has determined the landscape alterations in Walker Creek have been minimized with the MSE wall, which will preserve the major landscape features in this basin (Wetlands 43 and 44a).

Risk and Uncertainty:

The Corps considered the Port's mitigation proposals' sustainability, long-term management, adaptive management, known technologies, and access to prescriptive science when considering whether the applicant's mitigation proposal was adequate to compensate for project impacts. Review of sustainability was particularly pertinent for the relocation of Miller Creek and maintaining hydrology in the creek and floodplain connection to the creek and maintaining adequate functions in the wetlands proposed to remain after project construction. Because of proximity to the airport, the Port must have flexibility to adaptively manage the wetland and stream mitigation components, as well as the remaining wetlands left after project implementation.

The Port's mitigation proposals contain many aspects of adaptive management. These aspects include a Wildlife Hazard Management Plan (WHMP) for the airport, maintenance of hydrology to remaining wetlands through designs of dispersal trenches and other conveyances, stormwater storage vaults for low flow augmentation to Des Moines and Walker creeks, and potential disaster management (large MSE walls and embankments, sewer lines in the mitigation areas, stormwater or industrial waste water overflow, fuel and other toxic spills). Some of the mitigation aspects of this project are very labor intensive with many physical aspects required to maintain the system in

perpetuity. The Corps acknowledges the Port's response to these concerns by submitting a 15-year mitigation monitoring plan, their willingness to adaptively manage and coordinate all these activities with the Corps and the Port's willingness to spend the finances necessary to ensure the compensatory mitigation is successful.

The Port's requirement to adaptively manage the existing wetlands surrounding the airport when safety may be compromised because of wildlife (particularly avian) activity is ongoing. This requirement, when applied to the in-basin mitigation the Port is proposing to perform as compensation for this project, should not change over baseline, because acreage-wise, there will be less wetlands (and less waterfowl attractants) surrounding the airport after project completion. The Corps does not anticipate any severe manipulations of the mitigation areas due to implementation of the Port's WHMP.

The Corps has determined the potential indirect impacts to the wetlands remaining in the Des Moines, Miller and Walker creek basins after project completion have been adequately addressed by monitoring and maintenance plans outlined in the Port's revised (November 2001) mitigation package, including adaptive management. The Corps will require rigorous monitoring and compliance protocols as special conditions to our permit (see Paragraph 12(M) of the ROD). The ability to adaptively manage water budgets and other factors integral to the success of the mitigation is likely to reduce the indirect impacts on the streams and wetlands in the area, and increase the likelihood of success.

In summary, the Port's revised NRMP (November 2001) adequately addresses the inherent factors that lead to risk and uncertainty for the proposed compensatory mitigation package. The Corps is requiring compensatory mitigation both on-site and off-site, in acreages addressing the risk and uncertainty. In addition, the Corps has required detailed and stringent performance standards and monitoring protocols. Coupled with this, is the ability to adaptively manage certain aspects of the NRMP and a 15-year monitoring schedule.

8. CORPS' COORDINATION OF CONCERNS WITH THE PORT

Based on the Port's Natural Resource Mitigation Plan submittal, dated December 2000, the Corps determined additional mitigation in the Miller Creek basin would be required to offset impacts to organic carbon export functions, ameliorate landscape alterations and reduce the risk and uncertainty of the proposed mitigation.

Through a series of meetings with the Port in mid to late 2001, the Corps expressed the concerns discussed above. The Port responded with additional mitigation as described below in Paragraph 9.

Based on the Corps' independent analysis, we determined additional mitigation within the Miller Creek basin was warranted. Creation or restoration, enhancement, and buffer creation and enhancement should all be components of additional compensatory

mitigation specifically targeted at creating and/or enhancing the functional lift associated with habitat and water quality functions within the basin, particularly organic carbon export. The revised NRMP (November 2001) included additional components to the package (described below) specifically addressing all of our concerns.

9. PORT'S ADDITIONAL MITIGATION SUBMITTAL/CORPS OVERVIEW

The Port's FINAL Mitigation Plan, titled *Natural Resource Mitigation Plan, Master Plan Update Improvements Seattle-Tacoma International Airport,* dated November 2001, contains additional mitigation in the upper Miller Creek watershed. The following briefly describes the salient points of the additional mitigation components (for more details, please refer to the November 2001 NRMP):

Wetland A17 and Water D (refer to Tables 4.1-2, 4.1-3 & Figure 5.2-1 of NRMP, Nov. 2001)

Wetland A17 is approximately 2.66 acres in size and is a discontinuous slope wetland currently segmented by several roads and driveways. Water D, an intermittent channel, flows through Wetland A17 and eventually drains to Miller Creek. Water D is a straightened and deepened channel, most likely a product of homeowner's attempts to control localized flooding in the area. The wetland currently consists of emergent areas dominated by lawn (except for the channel itself, which consists of obligate plant species such as small-fruited bulrush, veronica, and water parsley), shrub species dominated by blackberry and salmonberry, and a forested component dominated almost exclusively by young to middle-aged alder.

Activities proposed in Wetland A17 and Water D include enhancement of existing degraded wetland to native forest, shrub, and emergent communities by removal of invasive non-native vegetation and inter-planting a diverse mix of native vegetation. Activities also include restoration of approximately 125 linear feet of Water D. Restoration will include establishing pre-disturbance topography, removal of three culverts in Water D, and planting the area with native shrub and forest vegetation. Approximately 0.30 of an acre of fill will be removed from Wetland A17 and restored to shrub and forested conditions. Additionally, Large Woody Debris (LWD) will be placed within the intermittent channel of Water D to promote natural channel meandering and reconnection of the channel to the floodplain wetlands.

Providing this mitigation will improve the overall functions of Wetland A17 and it's tributary (Water D) and will have beneficial direct and indirect effects to mainstem Miller Creek compared to baseline conditions in the project area.

Lora Lake (see Tables 4.1-2, 4.1-3, and Section 4.2.1 of NRMP, Nov.2001 for details)

Additional mitigation is proposed around Lora Lake, including:

Wetland restoration through removal of fill, wetland enhancement activities along the lacustrine fringe, and upland buffer creation and enhancement.

Removal of fill adjacent to Lora Lake will restore 1.0 acre of wetlands to the lacustrine fringe of the lake.

Wetland buffer restoration will include 1.81 acres around the north and west sides of Lora Lake.

The shallow water along the margin of Lora Lake will be improved aquatic habitat compared to existing conditions. The replacement of fill, lawns and riprap with restored wetlands, and plantings of riparian tree and shrub vegetation will improve aquatic habitat by providing shade and organic matter input (woody debris, leaf matter, and insects) supporting fish and other aquatic life, and provide breeding and non-breeding habitat for amphibians and small mammals. Replacing grass-dominated plants adjacent to Lora Lake with native woody vegetation will increase the amount and diversity of organic matter available to Miller Creek and the aquatic habitat of Lora Lake. In addition, the pond margin along Lora Lake will be modified to reduce use by waterfowl. Replacing lawns with riparian tree and shrub vegetation will eliminate forage and resting areas used by waterfowl. All of these improvements will indirectly improve the open water portions of Lora Lake.

These activities, in concert with the additional mitigation activities described above in Wetland A17 and Water D, and below at the Des Moines Way Nursery, will substantially increase the corridor connection along Miller Creek and increase the opportunity for organic carbon export functions to occur in the short-term and, especially, in the long-term.

Des Moines Way Nursery (refer to Appendix N & Section 4.2.3 of NRMP Nov. 2001 for details)

Activities the Port is proposing to perform at this site include wetland restoration and enhancement activities on approximately 5.8 acres of land, Miller Creek in-stream enhancement activities, and upland and stream buffer restoration and enhancement.

This additional mitigation includes the restoration of 2.2 acres of wetland with native vegetation and enhancement of 0.86 of an acre of existing wetland (currently dominated by ornamental nursery stock and lawn) with native vegetation. Buffer enhancement and restoration includes about 2.73 acres at the site. This mitigation will enhance riverine and channel conditions to over 450 additional linear feet of Miller Creek.

The actions associated with this mitigation will enhance fish habitat in Miller Creek, improve water quality (by providing shade, ameliorating elevated water temperatures, increasing dissolved oxygen, providing inputs of organic matter, improving sediment retention, and removing potential sources of fertilizer and/or pesticides), enhance the

diversity and complexity of wetland habitats in the upper reaches of Miller Creek, and enhance floodplain functions at the site.

Especially relevant is the functional lift this site will provide in organic matter export. Replacing grass-dominated wetlands, fill, developed property and managed riverine areas with wetlands dominated with native woody vegetation will increase the export of particulate and dissolved organic matter from the restored and enhanced wetlands to Miller Creek. The site will generate higher productivity and greater structural diversity. Placing LWD in the stream channel in this location and removing riprap will result in the restoration of natural patterns of organic matter retention and cycling in the stream channel. This will support stream invertebrates and downstream fish communities, while improving overbank flow in some sections. This overbank flow, coupled with overhanging vegetation will provide additional sources of organic matter export into the stream channel.

The functional lift this site provides over existing baseline conditions is substantial. In addition, this site enables the Port to expand the contiguous wetland/buffer corridor connection between the Port's proposed mitigation at Vacca Farm and downstream from there into important headwater reaches of the Miller Creek basin. The restoration of 2.0 acres of riverine wetland reduces the risk and helps substantively in addressing the decrease in wetland acreage caused by the proposed project construction.

In summary, the inclusion of the above described mitigation components in the revised November 2001 NRMP adequately address the Corps' concerns regarding the inadequacies of the December 2000 NRMP. In short, the revised plan substantially reduces the risk and uncertainty by inclusion of additional in-basin mitigation thereby reducing the potential indirect impacts in-basin. Carbon export functions and associated habitat functions are addressed by providing more in-basin mitigation and additional opportunity directly adjacent to Miller Creek. In addition, landscape functions within the Miller Creek corridor proper will increase over the fragmented baseline conditions that exist currently.

10. FINDINGS REGARDING PORT'S NOVEMBER 2001 REVISED NRMP

In the Miller Creek basin, the additional mitigation proposed by the Port (NRMP, November 2001), increases restoration activities from 6.6 to 11.15 acres (this includes 1 acre around Lora Lake, 2.0 acres at Des Moines Way Nursery, 0.3 acres in Wetland A17, 6.6 acres of prior converted cropland, and 0.80 of an acre of temporary impacts being restored after project completion). Wetland enhancement activities have increased from 13.1 acres to 15.8 acres, while riverine and upland buffer enhancement activities have increased from 36.85 acres to just under 50 acres (49.98 acres).

Mitigation actions in the Miller Creek basin will restore wetland, stream, and riverine functions to approximately a 1.5-mile contiguous reach.

The functions the Corps determined to be critical to offset through compensatory mitigation are: carbon export functions in relation to food chain support; groundwater exchange functions in terms of low flow augmentation; nutrient and sediment trapping functions for water quality and; habitat complexity functions. The Corps has determined the additional mitigation proposed by the Port and outlined in the November 2001 NRMP adequately offsets these adverse impacts to the aquatic environment. The new plan has specifically addressed the Corps concerns regarding carbon export functions, water quality functions, landscape alterations, and risk and uncertainty.

Effective monitoring, adaptive management, maintenance, and contingency actions are planned to evaluate and assure performance standards are met, and to correct deficiencies if needed. Monitoring and reporting of monitoring results for agency review and concurrence will assure appropriate contingency actions are taken, and ecological benefits are ultimately achieved. If monitoring demonstrates the performance standards are not met, then contingency actions will be evaluated and implemented to assure the desired wetland functions are ultimately provided by the mitigation projects (see Section 7.7 of the November 2001 NRMP for a description and list of contingency actions proposed by the Port).

Although landscape alterations in the project area (predominantly in the Miller Creek basin) will be permanent and fairly substantive, the Corps acknowledges the opportunities for in-basin mitigation to compensate for this impact are very limited. Considering this limited opportunity, the Corps has determined the off-site habitat mitigation (within the same WRIA) is justified and adequate in making up for lost or reduced opportunities due to project implementation within the project area sub-basins. This is especially pertinent to avian habitat functions. The Auburn mitigation site, which currently has very limited available habitat for avian species (except for along a narrow margin of the Green River), will offer a substantive lift by performing the mitigation activities at this site. The Port proposes to create a diversity of vegetative species and habitat forms (POW, PEM, PSS, PFO) at the site for utilization by all kinds of birds and waterfowl. The design of the Auburn mitigation site includes many attributes to lure avian species to the site (e.g. nesting boxes, good cover, fruit and seed bearing vegetation).

The PCHB added three conditions regarding mitigation, one of which required mitigation at a ratio no less than 2:1 (see Paragraph 9(A) of the ROD for additional discussion). I have determined these three PCHB conditions do not need to be added to the permit. The State however, can require different or additional mitigation than what is required by the Corps to meet Federal mitigation requirements. The applicant then must comply with both requirements. I have determined the revised NRMP (November 2001) adequately compensates for all impacts from a Federal perspective.

In summary, compensatory mitigation actions as proposed in the November 2001 NRMP, in the Miller, Walker and Des Moines Creek basins, along with the substantive wetland functional lift anticipated at the Auburn off-site mitigation area adequately compensate for all project impacts in all the subject basins.

LITERATURE CITED

a. Wetlands, Second Edition, Mitsch, William J. And Gosselink, James G., Van Nostrand Reinhold Publisher 1993.
b. Azous, Amanda L and Richard R. Horner, editors. Wetlands and Urbanization, Implications for the Future. Lewis Publishers. 2001.
c. Methods for Assessing Wetland Functions, Volume 1, Part 2, Washington State Wetland Function Assessment Project, Washington State Department of Ecology Publication #99-166, August 1999).
d. Port of Seattle. 2000d. *Comprehensive Stormwater Management Plan, Master Plan Update Improvements, Seattle-Tacoma International Airport*. Prepared by Parametrix, Inc. for the Port of Seattle.
e. Port of Seattle. 2001a. *Low Streamflow Analysis. STIA Master Plan Update Improvements.* Prepared by Parametrix, Inc. for the Port of Seattle.