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TRANSMITTAL FORM

To:	**Gail Terzi** **Muffy Walker** **US Army Corps of Engineers**	Date: Project Number: Project Name:	**March 19, 2001** **556-2912-01(03A)** **POS-Master Plan Update**

We are transmitting the following materials:

Responses to comments made by Amanda Azous and Dyanne Sheldon

Map and Aerial Photographs of a Stream Relocation Project on North Creek in Bothell

Examples of geotextile fabric proposed for the Miller Creek Relocation

Comments:

Please call or e-mail me (jckelley@parametrix.com) if you have any questions.

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Sincerely,

James C Kelley

cc:

AR 028165

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Sheldon & Associates, Inc.
5031 University Way NE
Seattle, Washington 98105

February 15, 2001

U.S. Army Corps of Engineers
Regulatory Branch
PO Box 3755
Seattle, WA 98124
Attn: Ms. Gail Terzi, Project Manager

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Washington State Department of Ecology
Shorelands & Environmental Assistance Program
3190 - 160th Ave. S.E.
Bellevue, WA 98008-5452
Attn: Ann Kenny, Environmental Specialist

Re: Port of Seattle, Ref. No. 1996-4-02325

Dear Ms. Terzi and Ms. Kenny;

Sheldon & Associates, Inc. has been retained on the behalf of the Airport Communities Coalition to conduct reviews of environmental documents submitted by the Port of Seattle for the proposed Third Runway project at the Seattle-Tacoma International Airport (STIA) focused on the proposals to minimize hydrologic impacts to the wetlands left on the site, and to the proposed compensation plan within the upper Miller Creek drainage. Given the extent of questions remaining on the analysis of the proposed impacts of the project, I have precluded reviewing or commenting on the proposed off-site compensation project in Auburn as it appears premature to completion of the impact assessment.

I have coordinated my review with Mr. Bill Rozeboom of Northwest Hydraulics to obtain his input on the technical stormwater engineering elements of the proposed plans and technical documents. Documents reviewed included:

Wetland Delineation Report (WDR). Master Plan Update Improvements Seattle Tacoma International Airport. Parametrix, Inc. December, 2000
Natural Resource Mitigation Plan (NRMP). Master Plan Update Improvements Seattle Tacoma International Airport. Parametrix, Inc. December, 2000
Appendices A-E Design Drawings (DD). Natural Resource Mitigation Plan. Parametrix, Inc. December, 2000
Revised Public Notice.(COE PN) #1996-4-02325. Port of Seattle. U.S. Army Corps of Engineers, Seattle District. Dec. 27, 2000
Comprehensive Stormwater Management Plan (SMP), volume 4, Technical Appendices. Master Plan Update Improvements. Seattle Tacoma International Airport. Parametrix, December, 2000

My comments on the submitted plans and documents are based on my hands-on experience gained from 17 years of working as a professional in the wetlands and aquatic resource field. I was the first Wetland Planner for King County, reviewing every development application related to wetlands, streams or aquatic environments. I've reviewed permit applications, conditioned permits, assessed wetland functions, determined wetland impacts, designed compensation/restoration plans for wetlands and streams, and provided construction installation oversight. Most importantly, I have had the opportunity to learn the harsh realities of translating "plans" into the installation of real projects in the ground. I have experienced the unforeseen consequences of construction activities from even the most carefully designed projects. I am acutely aware of the limits and constraints of construction, and the sharp distinction between what was proposed, and what is feasible for a contractor to construct. My professional experience is presented in my attached vitae.

To summarize my findings, the submitted technical documents from the Port for the proposed Third Runway do not provide adequate, substantiated documentation that the impacts to aquatic resources from the proposed projects meet the requirements and provisions of Section 401 of the Clean Water Act or Section 404 of the Clean Water Act as administered by the Washington State Department of Ecology and the Seattle District Corps of Engineers, respectively.

My comments on the plan review are listed first as an overview of key issues, followed by a discussion of each of the key issues and the specific design elements missing from the technical analysis that demand further disclosure or analysis before decisions regarding permitting should be concluded. Key issues are not listed by priority.

Key Issues

1. Conclusions regarding the movement of shallow groundwater through the engineered walls and the project's ability to re-introduce surface waters back into the downslope wetlands are unsubstantiated. This is the keystone for being able to conclude no adverse impacts to the remaining resources downslope of the runway project.
2. The text of the NRMP does not clearly disclose significant technical details that casts doubt as to the long-term success and effectiveness of the compensation proposals.
3. The calculation of temporary wetland impacts under-estimates the extent and permanency of secondary impacts and the issue of construction timing.
4. Conclusions that there will be no adverse impacts to functions in wetlands left to remain within the project area cannot be denied or confirmed in future conditions because no baseline data (pre-project) has been collected.
5. There is no provision for objective construction oversight independent of the applicant's influence.

Issue Discussion

1. **Conclusions regarding the movement of shallow groundwater through the engineered walls and the project's ability to re-introduce surface waters back into the downslope wetlands are unsubstantiated.**

The ability to collect infiltrated surface water and recover existing groundwater beneath the deep accumulation of fills for the embankment is the primary design element that allows the applicant to conclude that placement of massive quantities of fill and engineered retaining walls will have no long-term impacts on the hydroperiod (and therefore the ecological functions) of the downslope wetland complexes and Miller Creek. Breaking it into three simplistic steps, the project has to be able to:

- pick up the existing shallow groundwater under the fill and the 'new' surface water from the proposed fill,
- transport groundwater under the retaining wall while maintaining the structural integrity of the wall
- re-introduce the water back into the existing downslope wetlands and Miller Creek in a manner that replicates the methods, quantities and timing of pre-project conditions.

An analysis of how they have or have not identified the design and engineering requirements for each of those steps follows:

Groundwater Movement Under the Wall

2 The majority of the existing wetlands west of the airport are hydrologically maintained by shallow groundwater and seeps that emanate from a shallow groundwater lens which daylights along the west-facing hillside (NRMP pg. 2-14, WDR pgs. 3-18 to 3-41). The project proposes to place a rock underdrain beneath the fill (Fig.5.2-16 NRMP) to capture 'groundwater' and transport it to the downslope side of the engineered wall.

If the underdrain does not function as it is suggested that it will, the consequences to the downslope wetlands and streams could be substantial. Reduction in the volume of water available, or a fore-shortening of the hydroperiod, to the wetlands caused by changes in the shallow interflow zone could result in: reduced wetland size, reduced export of particulate and/or dissolved organics from the wetlands into streams, reduced habitat functions, and implications as to the likely success of the proposed compensation plans.

Critical design details that are not addressed in the documents I reviewed include:

3 • How will the rock underdrain be designed to assure that it will not eventually become filled with particulates, rendering it no longer pervious? From an engineering perspective, groundwater has to be able to pass through the wall, regardless of the downslope wetland issues: what secondary design elements are proposed to assure that water can get out from behind the engineered wall structure?

4 • Based on a review of the relative infiltration rates modeled through the fill soils compared with infiltration rates tested through existing fills there appears to be some discrepancy between the results (Northwest Hydraulics, Feb.15, 2001). Assuring that waters from the surface of the fill plane can and do infiltrate effectively to the underdrain system is a keystone element in the applicant's conclusion that the hydroperiod of the downslope wetlands will not be adversely effected. The analysis appears to raise some doubts that the rates of infiltration will be as described.

5 • How will the 140+ foot retaining wall be engineered to allow a constantly saturated underdrain to be present?

6 • If the underdrain is placed on the existing ground surface (Fig. 5.2-16), how will it function to collect and transport the shallow groundwater lens that is currently 10 feet (estimated) below the existing ground surface, the primary hydrologic source to the existing wetlands and Miller Creek?

7 • It is not clear in the submitted plans if the proposed underdrain will be placed only in the locations of existing wetlands (proposed to be eliminated) under the fill, or will an underdrain be placed as a uniform blanket across the entire fill zone. If it is only proposed to pick up the waters from the filled wetland areas, then how will the 'groundwater' infiltrating from the other areas of the fill be collected into the discharge system downslope of the wall? How and where will groundwater in the existing upland soils (proposed to be filled) be collected and transported under the wall?

Re-introduction of Water Back Into the Downslope Areas

8 In order to be able to conclude that there will be no adverse impacts to wetlands and stream flows downslope of the proposed fill, the waters from the upslope side of the wall/fill have to be re-introduced into the downslope resources in a manner that replicates previous conditions and/or minimizes adverse effects. The NRMP text does not discuss how waters

8 will be collected and re-introduced into downslope wetlands except in the most general terms that it will just simply be done. The plan sheets (DD) provide some representations about what is proposed to occur, however, they are at best, schematic and representational only.

The implications for the waters not being re-introduced into the downstream resources appropriately include:

- 9 Transforming seep wetlands driven by interflow into wetlands driven by surface flows. This changes the nutrient transport systems within the wetlands, it may serve to reduce the size of wetlands (at the upper margins where seeps are no longer present to 'feed' the wetland water across a broad band).
- 10 A complete change in the hydroperiod of the wetlands from shallow groundwater moving slowing through upland soils throughout the year, to storm event driven systems where the water source is 'metered' from a storm pond outfall into an infiltration trench (see the note below regarding the functional capabilities of infiltration trenches). Such changes most often result in a lengthening of the annual drought the wetlands experience, a potential shift in plant species composition and community composition with a subsequent potential change in habitats, and a potential impact on the extent of wetland conditions (i.e., a decrease in saturated zones and a resulting reduction the size of wetlands).

Critical design details that are not addressed in the documents I reviewed include:

- 11 What is the sequential and functional relationships between the TESC swales, the inner collection swale (east of the Security Road), and the replacement drainage channels? It appears that the inner collection swale is designed to function as a road-side ditch for the Security Road and perhaps as an interceptor ditch for waters draining off the face of the wall. It is unclear from the DD where this water is directed into the stormwater system, west of the wall, and whether the storm water from the surface of the paved road, is engineered to be mixed with the clean groundwater discharging from the rock underdrain. What would be the resultant water quality implication of mixing stormwater and clean groundwater on the downslope resources?
- 12 If the water from the rock underdrain is designed to always discharge into the replacement drainage channels (Fig. 5.2-16, NRMP), then how is it proposed to use that shallow groundwater to recharge wetlands that are not linked to the replacement drainage channels?

  13 On DD Sheet STIA-XXXX-C6, for example, it is nearly impossible to determine what is proposed. On the north end of the sheet, Segment C replacement drainage channel is identified (apparently flowing north). Immediately to the south (and continuous with Seg. C) is identified Segment D replacement drainage channel, also apparently draining north. Both of these drainage channels appear to be the continuation of a north flowing swale that parallels the west side of the Security Road, starting from south of the south end of the plan sheet. That large swale is drawn <u>through</u> the zone identified as Pond D. It is impossible to determine from these plan sheets what is actually being proposed or what will actually occur if it is constructed. How deep are the swales relative to the downstream slope wetlands and will the swales intercept and divert the shallow interflow necessary for those downslope wetlands? What is the long-term function of the large continuous swale compared to the replacement channel segments of C and D (which are discussed in the NRMP text as critical to maintaining long-term wetland hydroperiods). How can a stormwater pond be designed with a swale running through it? If these issues have simple explanations, then it must be said that the engineering

graphics submitted for public and regulatory agency comment, review and conditioning are not effective at conveying the design intentions or consequences.

14 • No discussion is provided in the NRMP of the functional affect of transforming downslope wetlands from seep driven wetland systems (groundwater discharge zones) to wetlands that are driven by surface water input. No analysis is provided of the soil conditions in the areas of proposed 'infiltration swales' to determine if these areas are appropriate for attempting to infiltrate water from the stormwater ponds into shallow groundwater. In fact, in some areas, the infiltration trenches are designed to be placed in the wetlands. Have they calculated those impacts as temporary or permanent wetland impacts?

15 Based on my professional experiences of designing, conditioning, and observing 'infiltration' systems over the last 10 years, I have yet to see one function well in glacial till soils. Usually the rate of water entering the infiltration gallery is faster than the ability of the soils in the infiltration zone (which are usually saturated when 'new' flows enter the system) to transmit water. Therefore, infiltration zones actually function as surface water discharge zones where the saturated conditions within the infiltration trench cause water to be discharged as shallow surface sheet flows. This may not have adverse effects in areas with very flat topography where shallow surface water can move slowly across/through the existing vegetated zone and passively find its way into the downstream stream or wetland. However, in this setting, the discharge areas are invariably located on the side of the west facing slope and surface discharges will likely coalesce into concentrated surface flows, with the potential to cause rills and erosion down into the receiving waters (streams and wetlands). If flows become concentrated as surface flows, the wetlands will experience a change in their hydroperiod and saturation will be concentrated at the point(s) of input, while other zones on the upper margins of the wetlands may experience a decrease in hydrology because the shallow groundwater seeps have been intercepted.

16 **2. The text of the NRMP does not clearly disclose some significant technical details that will clearly reduce the long-term effectiveness and success of the compensation proposals.**

17 The most significant element is that the NRMP text fails to identify that the rerouted Miller Creek will be "lined" with geotextile fabric for its entire length through the former Vacca Farm site. Sheet STIA-9805-C5 of the DD plan sheets clearly indicates geotextile lining the stream bed in Detail 1.C-2. It is shown again on sheet STIA-9805-C7. The NRMP text does not mention it.

18 The significance is simple: placing a 'stream' within a geotextile blanket biologically and chemically isolates the 'stream' and all its ecological processes from the soils of the substrate. One has a visual stream that rests on fabric, isolated hydrologically from the underlying soils. The reason they have designed the re-routed stream to be placed within a geotextile liner is also quite simple: the Vacca farm site is peat, and peat does not allow the creation of a stream channel with gravel substrates. The water will simply disappear into the organic soils, until they are fully saturated, then there will be an open water pond with water flowing through it.

19 This is also the reason why the Miller Creek floodplain is not engineered to function as a natural floodplain. Sheet STIA-9805-C2 (DD) shows the right bank (looking downstream) of the new channel at 2-4 feet higher than the floodplain. A natural

19 floodplain would simply slope gently upwards from the edge of the ordinary high water mark of the entire stream channel, so that floodwaters could easily flow into and out of the floodplain along its entire interface with the stream. This engineered floodplain is designed to be graded so that it drains all to one point at the south end. The rationale provided in the NRMP is that the floodplain will not pond water, therefore eliminating potential waterfowl habitat. However, a natural occurring stream channel, sloping up and away from the OHWM of the stream would not pond water, as floodflows would simply sheet flow back into the channel as the flood waters receded. One cannot engineer a naturally functioning floodplain if one has to line the stream channel with geotextile fabric, one has to design the floodplain to drain **parallel** to the stream channel, resulting in floodwaters re-entering the stream at the bottom of the 'floodplain'. The floodplain and the stream are designed to be hydrologically isolated from one another, except in extreme events when the stream can over-top the ridge line separating them.

20 An attempt to create a fabric-lined stream channel and floodplain wetland in peat substrate was permitted in the mid 1980's by the Seattle District COE on North Creek, in King County. The site has never worked successfully since its installation. The site is located on North Creek, in the northeast quadrant of the intersection of I-405 and SR 522, at the Koll Quadrant Business Park. The web site for a 1994 aerial photograph of the site is located at: http://terraserver.microsoft.com/image.asp?S=10&T=1&X=2806&Y=26456&Z=10&W=2 , and a copy of the aerial is attached to the hard copy this letter.

21 The design for North Creek was quite similar to what is proposed for Miller Creek: create a meandering log and gravel filled stream channel, with an associated forested/shrub floodplain forest, in peat substrates. The weight of the gravel, rocks, woody debris, plus the water in a fabric liner caused the peats in the floodplain wetland to rebound to approximately 18 inches higher in elevation than it was designed. The stream and the reed canary grass dominated wetland remain hydrologically isolated from each other.

22 Even if it is argued that North Creek is still providing the ecological benefits of a real stream in that setting, there is no argument that there is no hydrologic connectivity between the stream and the wetland. There is little basis to conclude that the stream and wetland function as an integrated ecological system. The Koll Business Park provides an excellent illustration of why the same failed technique should not be permitted on Miller Creek . It illuminates that the Port's prediction of creation of floodplain wetland on Miller Creek is unsubstantiated. It also, unfortunately, illustrates the consequences of the extremely limited staff resources of the permitting agencies: this failure has not yet been required to be rectified even though Corps staff at the time was quite aware of the failure of the executed plan. This issue is discussed further in Issue #5, below.

23 • Lining the creek with fabric means that logs and woody debris that they propose to anchor will require slitting of the fabric and 'patching' around the anchor cables. No discussion of the resulting risk of the stream "springing a leak" is provided, nor any discussion of contingency actions if such a leak occurs. To patch a system which remains vulnerable to ultimate unrecoverable failure due to an initial fatal design flaw.

24 • Based on the proposed elevations of the floodplain for Miller Creek on Vacca Farms, Miller Creek will not flood the floodplain except in the extreme 100 year event (B Rozeboom, pers. com.). If the floodplain on Miller Creek doesn't flood the floodplain, the "wetland" will be hydrologically isolated because the fabric liner in the stream will isolate

the water from entering the peat soils in the floodplain and wetland conditions may not form.

25 • No stream flow augmentation from the groundwater in the peat soils is possible for the entire length of stream that is lined. It is implied that the peat soils of Vacca Farm will provide low-flow augmentation to Miller Creek: unless those waters can flow out the south end 'exit' of the floodplain, they cannot get into the lined stream channel.

3. **The calculation of temporary wetland impacts under-estimates the extent and permanency of secondary impacts and the issue of construction timing.**

26 Table 3.1-3 (NRMP, pg. 3-6) identifies a total of 2.05 acres of temporary impacts to wetlands within the project action area. Impacts are identified in the NRMP as "temporary" as a method to reduce the calculation of total acreage of permanent wetland loss. Examples are provided below of the various situations in which the applicant has identified impacts as 'temporary', and an explanation of the potential for permanent or long-term (multiple decade) impacts is provided.

27 • Placing sediment control ponds <u>in</u> wetlands during the construction phase of the embankment fill (examples: WL 18, WL 37A)
They provide schematic drawings (DD, sheet STIA-XXXX-C9) that provide a simplistic rendering of before/after pond conditions. Anyone who has ever designed or dealt with stormwater ponds understands that the engineering of those ponds is determined by the elevations of the pipes, conveyance swales, and transport mechanisms required to get the stormwater into the ponds. The DD renderings show idealized situations where the bottom elevations of the temporary ponds correspond nicely to the restored wetland bottom elevations. There is no indication of an engineering analysis of the required stormwater management plan to substantiate pond dimensions (depths as well as overall size). Such an analysis is required prior to being able to substantiate whether a wetland impact will be temporary or permanent. There is no assessment of impacts to the downslope resources if those temporary ponds had to be excavated to depths deeper than the downslope wetland sub-surface.

28 • There are areas where temporary ponds and ditches are proposed to be restored to wetland conditions. The NRMP provides no discussion of how they propose to backfill ponds and ditches and re-establish the groundwater movement through these restored areas. The renderings (DD, STIA-XXXX-C9) simply show ground elevations matching for before and after conditions, even though the DD indicate proposed stormwater ponds excavated to a depth of 10 feet. In order for the restoration of the wetland area to succeed, they need to show how they propose to recreate a pervious upper soil layer over an underlying impervious zone that matches the upslope and downslope conditions of the existing wetland. The design, based on an analysis of the soils in real conditions, has to illustrate how shallow interflow from groundwater will be effectively re-established.

29 • How will the permanent stormwater facilities effect downslope wetlands? For example, Pond D (Stormwater Management Plan, App. D, Ex. C134.1) is shown to be excavated 20 feet deep in the location of existing WL 41A, and just upslope of WL 39. It is not apparent that they've collected any groundwater or shallow piezomter data in WL 39 to determine if a 20 foot deep pond located upslope from it will have any impacts on the wetland's hydroperiod.

30 • Areas where they are proposing to place ditches crossing wetlands, for the purpose to conveying sediment laden water to the sediment control ponds, (example: WL A12), would appear to have the potential for permanent impacts. There is no discussion in the NRMP regarding how placement of a ditch within the upper reaches of a wetland, perpendicular to the groundwater movement into and through the existing wetland, might pick-up and dewater the lower wetland and effect the continuation of the 'natural' groundwater movement. There is no discussion in the NRMP for how long these temporary ponds and ditches are proposed to be in place. If one assumes that they will be required for the duration of the construction of the embankment fill, then NRMP should also disclose any impacts expected within that time frame (i.e., this is not a 'normal' construction season of one year or one summer growing season).

31 • The depth to which the permanent ponds have to be excavated to provide the storage needs for stormwater will effect the shallow interflow assumed to be feeding the downslope wetlands. Will the deep temporary ponds intercept/interrupt groundwater movement from upslope into the lower portions of the 'untouched' wetland? There is no soil log data from which they could determine whether adverse impacts will occur downstream of the area of the pond.

32 • The temporary TESC ditch between Ponds A and Pond E poses a potential adverse effect on the downslope wetland. No data is provided to show how deep the proposed ditch is in relationship to the shallow groundwater that maintains WL 18. There is no data (piezometer wells) on the portions of WL above or below the ditch to substantiate their conclusions.

33 • The NRMP does not identify if the area of the wetland that is proposed to be converted to a permanent drainage channel is counted as part of the permanent wetland loss or if it is considered in the NRMP to still be wetland.

34 It is unclear in the NRMP text how the acreage of impact was calculated, and whether or not it included assumable secondary impacts as well as direct physical intrusions. For example, WL 18 is 3.56 acres (WDR, pg. 3-12). The proposal is to permanently eliminate 2.84 acres (NRMP, pg. 3-2) and temporarily impact an additional 0.22 acres (NRMP. pg. 3-6) leaving 0.5 acres of 'intact' wetland. However, when one looks at plan sheet STIA-XXXX-C5 (DD) one can see that Temporary Ponds A and E are both proposed in WL 18, as well as Segment B of the Replacement Drainage channel. It is quite difficult to determine where a half-acre of intact wetland 18 might be left. Does the impact analysis analyze the impacts of the construction of the 'temporary' ponds and swales on this wetland?

Another example of how impacts are not totally accounted for is wetland R-1. It is 0.17 acres in size; they say they will permanently impact 0.13 acres, leaving 0.04 acres intact. That remaining portion of wetland is not going to be functional as such a small fraction of the original wetland. It should all be calculated as permanent loss.

4. **Conclusions of no adverse impacts to functions in wetlands to remain within the project area cannot be denied or confirmed in future conditions because no baseline data (pre-project) has been collected.**

35 One of the most disturbing elements missing from the NRMP is the baseline data on the hydroperiods of the wetlands proposed to be left after the project. In the absence of such data, no one (applicant or reviewing agency) will be able to make a determination of adverse effect post construction of the embankment fill when there is no pre-existing data? If one wants to be

35 able to determine whether or not the downslope resources have been affected by the project or whether or not their proposed compensation has been effective, then the key parameter that success/failure should be measured by is the maintenance of the groundwater elevations within the wetlands over time. If no pre-project data exists, how can any one determine success or failure?

Given the length of time the applicant has been in the permitting process, there could be a very substantial quantity of pre-project wetland data compiled by which to compare pre and post project hydroperiod conditions and rainfall data. Without out pre-project data (and that means pre-filling in the upland contributing areas of the project wetlands) there is no basis for the reviewing agencies to determine success of the proposed compensation. Such pre-project hydroperiod data should have been collected by the applicant over this time period.

36 An example to illustrate the necessity of pre-project data: my firm assisted in the design of a groundwater infiltration facility for the City of North Bend to re-introduce surface water above a forested hill-seep wetland. We collected ground-water data in the forested wetland for two growing seasons before construction above the wetland occurred. Post-construction, we've now collected groundwater data for the last four years. Groundwater data is correlated to precipitation data. After the first summer, post-construction, we found groundwater levels in the forested wetland dropped precipitously. Analysis of the stormwater system identified that the contractor had built the wetland by-pass infiltration system "backwards" so that no water was diverted into the infiltration system. The comparison of before/after data allowed the construction mistake to be identified and remedied. In subsequent years, the groundwater data in the forested wetland remains substantially below pre-project conditions. This has prompted additional review and analysis of the design and construction of the infiltration system and additional contingency actions are currently being taken. Without pre-construction groundwater data for that wetland, there would have been absolutely no manner in which to hold the applicant fiscally responsible to respond to the various problems which have arisen. Without pre-existing data there is no possibility, except disagreement between 'experts' as to what pre-project conditions were. At least two water years of pre-existing data is required to preclude the chances that one year's data does not reflect an anomalous year.

5. **There is no provision for objective construction oversight independent of the applicant's influence.**

37 Research conducted by King County (Mockler, 1998) and Washington State Department of Ecology (2000) has documented that the incidence of 'mitigation' failure is often linked to poor design, poor installation, and no follow-through by the permitting agencies to assure that designed plans are installed properly.

38 A simple point to be made in light of the myriad technical weaknesses of the submitted plans, is that none of the regulatory agencies for this project have the staff time or budget to commit one or more staff to the long-term construction oversight role this project will demand if it is permitted. Without such objective construction oversight, and without an objective technical review of the proposed compensation plans (both on-site and off-site), I would have to conclude, based on my professional experience that the proposed project will have far greater permanent adverse impacts on the downstream resources than these plans and permit applications identify.

39 Design flaws, confusing plan submittals, and overlooked technical details pose a very real risk to the aquatic resources identified within the project area. Approval of the permit applications, under the

provisions of CWA Section 401 and CWA 404, require that the permitting agencies have at least reasonable assurance that the long-term effects of the permitted action will not degrade waters of the U.S. including wetlands. The submitted documents do not provide sufficient data nor accurate analysis of proposed and existing conditions for reviewing staff to draw those conclusions.

Sincerely,

Dyanne Sheldon, Principal
Sheldon & Associates, Inc.

Enclosure: vitae

Sheldon & Associates, February 15, 2001

1. Movement of water through the fill and MSE wall has been properly analyzed. Several studies and technical memoranda have been prepared detailing how water will flow through embankment fill to recharge groundwater or be collected and transmitted through the MSE wall to maintain the hydrology of downslope wetlands. Documents that describe and substantiate that the hydrology of the wetlands located downslope of the embankment and wall will be maintained include:

- *Sea-Tac Runway Fill Hydrologic Studies Report* (Pacific Groundwater Group 2000). This report was funded by the Washington State Department of Ecology
- *Geotechnical Report* (Hart Crowser 1999)
- *Wetland Functional Assessment and Impact Report* (Parametrix, Inc. 2000)
- *Seattle-Tacoma Airport Master Plan Update-Low Streamflow Analysis* (Pacific Groundwater Group 2000)

Wetlands located downslope of the embankment are maintained by groundwater discharge seeps located beneath then and at their margins, seasonal periods of shallow interflow, and (in the case of Wetland 18, 37, and 44 some channelized flow).

2. The primary purpose of the drainage layer at the base of the embankment fill is to prevent the build-up of excess pore pressures in the overlying fill material by preventing the development of fully saturated conditions at the base of the fill. It does this by providing a high-permeability pathway that allows drainage to occur to the toe of the embankment if the rate of infiltration and seepage through the embankment exceeds the permeability of the underlying native soils.

The primary hydrologic source for the wetlands (groundwater discharging through a shallow aquifer) will remain in place. Groundwater will continue to recharge the shallow aquifer located beneath and east of the embankment and pass beneath the embankment before discharging to the wetlands. The weight of the embankment on the aquifer will result in some compression of the soil structure beneath it, the resulting reductions in porosity, void ratio, and permeability are conservatively estimated to be less than 5% under the maximum height of the fill (*Sea-Tac Third Runway-Aquifer Compaction*, letter, to Port of Seattle from Hart Crowser, December 9, 1998) and so the groundwater flow will continue largely unimpeded.

Most of the wetlands that will remain downslope of the embankment are fed by groundwater flow from the shallow aquifer, which surfaces as seeps in these wetland areas. The groundwater flow in the shallow aquifer is sustained from the area to the east (primarily the areas east of the Third Runway), and currently flows through the subsurface materials that will form the foundation for the embankment. These soils will almost entirely remain undisturbed by construction. Only limited areas where low-permeability wetland soils are present will excavation occur. In these areas, soils will be replaced (typically 1 to 3 feet below existing ground surface) with more permeable drain material.

A secondary hydrologic source for downslope wetlands is interflow from the existing slopes above the wetlands. The interflow component supporting wetland hydrology lost due to embankment construction will be replaced by collecting seepage water from the underdrain conveying it to the outer swale and downslope wetlands. Recharge calculations show that more water will be available from this source than is currently the case under existing conditions, and that it will occur for a longer duration than currently. Both these factors are expected to extend the hydroperiod of the wetland, and improve rather than detract from the current condition of the wetland.

Another function of the drainage layer is to prevent the build-up of excess pore pressures in the overlying fill material, by preventing the development of fully saturated conditions at the base of the fill. It does this by providing a high-permeability pathway that allows water to flow to the toe of the embankment if the rate of infiltration and seepage through the embankment exceeds the permeability of the underlying native soils. The drainage layer also allows existing channelized surface and seepage flow to be collected and directed to downslope wetlands.

3. **The System is Designed to Prevent Rock Underdrain Clogging.** The underdrain is designed and constructed in a manner that expressly avoids the build-up of particulates within the drain rock. The grain-size distribution of the Group 1A material that are specified for drain construction meets the standard civil engineering requirements for performance as a filter medium (i.e., it is designed not to clog when exposed to seepage from the proposed embankment soils). Part of the design requirement for this layer is to avoid clogging if exposed to the invasion of soil particles into the filter medium. Filters of this type have been used successfully for more than 50 years, and are specified for a wide range of civil engineering (Soil Mechanics in Engineering Practice, Terzaghi & Peck, 1948; ibid, 3rd Edition Terzaghi, Peck, & Mesri, 1996).

The material placed in the backfill zone behind the MSE wall will be granular Group 1A or 1B material that will be relatively free-draining and will therefore allow water to drain from behind the engineered wall without build-up of excess pore pressures. Design requirements for the embankment address the invasion of soil particles into the filter medium, as discussed above, and groundwater movement would not move particles to the extent that the drainage layer would clog.

4. **Fill Infiltration.** (See Northwest Hydraulics, Response #34 to Comment #13)

5. **Constantly Saturated Underdrain.** There will not be a constantly saturated underdrain beneath the embankment or MSE wall. The capacity of the underdrain to transmit lateral flow substantially exceeds the ability of fill to convey flow into the drain and the volume of water that would be directed to it. Therefore, the drain would not be constantly saturated, except in places where it is picking up subsurface seeps from below the embankment. This may occur in limited areas, typically where there are existing seeps and wetlands that will be buried beneath the fill. The drainage layer will be thickened in these areas to further reduce the likelihood of saturation. A key purpose of the drain is to prevent the build-up of positive pore pressures in the embankment. This could occur if the base of the fill was allowed to become saturated; the drain is designed to prevent this from happening, and thus to avoid potential instability.

6. **Shallow Groundwater Flow to Wetlands.** As explained above, the embankment design will allow shallow groundwater flow to downslope wetlands to continue. The lateral groundwater flow regime in the existing subsurface shallow aquifer will not be affected by the wall or the underdrain since, as the commenter correctly observes, the drain will be largely constructed on the natural ground surface, well above the underlying groundwater (except where the embankment is constructed over wetlands and seeps). Subgrade improvements will rely on free-draining backfill or gravel and will not impede groundwater flow, as discussed in Appendix L of the Port's SMP. The primary hydrologic source to the existing wetlands and Miller Creek – i.e., shallow groundwater flow – will therefore be maintained. PGG and Hart Crowser both predict that the hydrologic source to the existing wetlands and Miller Creek will be enhanced by the increased time of travel for water infiltrating into and passing through the through the embankment fill prior to moving into existing soil layers.

7. **Uniform Fill Blanket.** The embankment design includes a drainage layer for its full length and width. The drawings (e.g., as shown in the Port's Phase 4 construction drawings) show that the underdrain will be placed as a continuous layer (minimum thickness: 3 feet) of Group 1A material beneath the base of the embankment. Groundwater from upland areas will continue to flow (as it does now) thorough the existing soils beneath the embankment. As a result, the presumed interruption to the hydrology of the wetlands and Miller Creek the commenter has posited will not occur.

8. **Reintroduction of Water.** While the Port plans to use infiltration facilities for the disposal of stormwater as part of the SMP, it is largely groundwater seepage water from the underdrain (as observed in Phases 1 and 2 of embankment construction) that will be collected by the replacement drainage swale for dispersal to the wetlands. This relatively steady flow will in fact enhance the wetland hydrology because it will increase the length and duration of the hydroperiod, potentially improving the condition and function of downstream wetlands.

The adequacy of plans showing the distribution of water to from drainage channels to wetlands is addressed in response #13 below.

9. Existing wetlands located west of the embankment already receive channelized flow (see descriptions of channels in the *Wetland Delineation Report, Wetland Functional Assessment and Impact Analysis, Natural Resource Mitigation Plan*, and letter to Eric Stockdale (21 September 2000)). The channels, in part, convey water from Wetlands 19 and 20 to Wetlands 18 and 37. Ditches along 12th Avenue South also convey channelized flow to Wetlands 18 and 37. Channelized flow also occurs in Wetland 39, 44, R9, where runoff is concentrated by topography, streets, driveways, or culverts. The purpose of the replacement drainage channels is to maintain this existing hydrologic condition, including the channelized flow to Wetland 18, 37,and 44. The channels also provide contingency options to augment wetland hydrology if monitoring demonstrates the wetland hydrology must be supplemented elsewhere.

As demonstrated in the above responses, groundwater required to maintain seep wetlands located west of the embankment will continue and a collection system to collect interflow and channelized flow will further maintain wetland conditions. This drainage system is designed to maintain existing hydrologic conditions, and includes new channels that will convey existing surface flows and replace existing channels. The replacement channels will disperse flow over a broader area than the existing ditches and culverts that they replace, so increase in channelization would not occur. The maintenance of these varying sources of hydrology will maintain seep areas in the wetlands, and assure that reductions in the size of these wetlands do not occur.

The existing ground surface below the embankment will be left largely undisturbed prior to fill placement. Shallow interflow seeps, expressed where perching layers surface on the slope, will continue to discharge into the underdrain, or will continue to flow downslope within the subsurface soils below the underdrain. Areas of soft soils that need to be removed to provide embankment foundation support will be backfilled with free-draining sand and gravel hydraulically connected to the underdrain. In this way, existing seepage into the wetlands that are filled will continue to be available as seepage through the underdrain. This water will flow down gradient to the west, and eventually reach downslope wetlands and Miller Creek. If reduced wetland hydrology is observed during construction and/or post-construction monitoring, contingency actions including additional flow dispersion, and would be implemented adaptive management techniques would be implemented to ensure downslope wetlands maintain the appropriate hydroperiod required to maintain existing functions. The 10-year monitoring plan and adaptive management approach will be instrumental in assuring maintenance of the wetland hydrology.

Because hydrologic conditions will be maintained in downslope wetlands (i.e. the wetlands will continue to receive groundwater seepage and channelized flow) nutrient dynamic in the wetlands following construction will be similar to current conditions. The removal of pollution generating surfaces and incorporating the wetlands located west of the embankment within the Miller Creek Wetland and Riparian Buffer Area will reduce anthropogenic sources of nutrients to the wetlands. Removing non-point pollution sources from lawns, parking areas, septic systems, fertilizers, and other sources will enhance wetlands and uplands in the Lora Lake/Vacca Farm area. Additionally, planting native trees and shrubs, removing areas of invasive non-native plant species, and monitoring the success of the enhancement will enhance the area.. For example, the wetlands at the Vacca Farm site will shift from a wetland dominated by bare ground, Himalayan blackberry, and soft rush to a native shrub-dominated wetlands with areas of cedar trees. This shift in plant communities will increase sediment trapping, and organic matter input from the wetland complex to the creek.

As described in Appendix B of the *Wetland Functional Assessment and Impact Analysis* (Parametrix, Inc. 2000), subgrade improvements will be composed of permeable soils (mostly gravels) and will act like outwash soils, not till. Subgrade improvements also include stone columns, which will be installed to strengthen the native soils beneath parts of the embankment. The stone columns that will be installed to strengthen the native soils beneath parts of the embankment will also act like outwash soils.

10. As explained above, no "complete change in the hydroperiod of the wetlands" is expected to occur. The plan does not require water to be "metered from a storm pond outfall into an infiltration trench".[1]

The embankment design and its potential impacts to wetland hydrology have been the subject of independent reviews. These evaluations, summarized in the *Wetland Functional Assessment and Impact Analysis* report, have found that the delay in water movement through the embankment would extend the period of groundwater discharge from the area and that this could benefit low flow conditions in Miller Creek and downslope wetlands.

11. Appendices A and B of the *Wetland Functional Assessment and Impact Analysis* report identifies the design and purpose of the TESC swales and the inner collection swale. The Appendices show that portions of the TESC swale, following construction, are incorporated into the replacement drainage channels. These swales will serve to collect and direct construction runoff to sedimentation ponds. Water from these ponds will be pumped to stormwater treatment and detention ponds and discharged to Miller Creek at existing outfalls.

The inner collection swale will serve to collect water from the embankment, MSE wall, and security road. Water from this inner collection swale will be conveyed under the security road to the replacement drainage channels, and ultimately to the wetlands located west of the project area.

The paved security road located west of the embankment will have limited use (approximately one vehicle per hour) and is thus not classified as a pollution-generating surface according to

[1]For Wetland 39, potential impacts to the uppermost portion of the wetland (0.02 acres) are mitigated using hydrology from a stormwater detention pond.

King County Stormwater Management standards. Therefore, runoff from the road that reaches either the inner collection swale or the replacement drainage channels is expected to meet water quality criteria. No anticipated impact is expected to occur as a result of mixing runoff from the embankment, the Perimeter Road, or the MSE wall with ground water collected by the replacement drainage channel.

The replacement drainage channels will be located west of the MSE wall, embankment, and security road. These channels will serve to collect seepage diverted from the inner collection swale or seeps from the embankment underdrain. Water within these channels will be directed to wetlands to help maintain their hydrology.

12. Wetlands not linked to the replacement drainage channels will continue to receive water via shallow groundwater that will be recharged as water infiltrates through the embankment and into the existing subsoils that will remain. Additionally, riparian wetlands not associated with the replacement drainage channels will continue to receive water through overbank flow from Miller Creek. The changes in the hydrologic conditions related to the embankment are discussed in detail above.

13. The design sheets illustrate the required information regarding project mitigation. As the reviewer has correctly determined, Segment C and Segment D of the replacement drainage channels are north flowing. Segment C conveys water to Wetland 37, Segment D conveys water to Wetland R9 and A13. The swale located upslope of these areas continues to Pond D, but this segment is not part of the *Natural Resource Mitigation Plan*, as identified in the documents.

The swale shown in Pond D on Sheet C6 is the TESC swale that will be constructed prior to the construction of stormwater Pond D. This TESC swale will be used only during initial construction and construction staging. Prior to completion of the project, Pond D will be constructed in the footprint shown on this sheet. When this pond is constructed, the portion of the swale in its ultimate boundaries will be removed. The finished grading plan for Pond D is shown in Appendix I of the *Wetland Functional Assessment and Impact Analysis Report*.

The drainage channel segments identified in the *Natural Resource Mitigation Plan* mitigation are the minimum channel lengths required to replace channel lengths being impacted. The remainder of the channels shown on plan sheets with buffers may also collect seepage water from the embankment or the inner collection swale and are also part of the mitigation. The additional lengths of channel provide flexibility in how and where the seepage water is discharged to the wetlands and Miller Creek, if redirection is deemed warranted during the monitoring program.

The 1-foot contours provided on the design drawings show that the replacement drainage channel depths are 0-3 feet in depth. The relationship of the swales to the downslope wetlands can also be determined from the grading plan. Where the swale crosses wetlands, the west side of the swale is shown to be at the elevation of the wetland. Thus, water collected by the swale can disperse into the downslope wetland. The distribution of water o the wetlands from the drainage channels will occur over a broader area than is found where culverts currently concentrate flows, and increases in channelization in the remaining wetlands are not expected.

The drainage swales located upslope of the mitigation channels are not part of the project mitigation. These channels are located in areas that generally lacked seeps and wetlands; thus they are expected to be dry much of the time.

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14. As discussed above, the project will not transform "downslope wetlands from seep driven wetland systems (groundwater discharge zones) to wetlands that are driven by surface water input."

There are no infiltration swales shown in the *Natural Resource Mitigation Plan* design drawings and no infiltration swales are planned or required to maintain wetland hydrology. Sheet C8 of Appendix D to the *Natural Resource Mitigation Plan* shows flow dispersal trenches. The flow dispersal trenches are not designed for infiltration. They are designed to allow water to disperse over broad areas into wetlands, and they are designed to avoid concentrating water in wetlands.

All wetlands impacts identified in the *Wetland Functional Assessment and Impact Analysis* (Parametrix, Inc. 2000) have been properly calculated. These calculations include all construction activities in wetlands, including the impact of the replacement drainage channels. Appendix D (Sheets C5 and C6) of the *Natural Resource Mitigation Plan* identify the impacts of these channels to wetlands.

15. The mitigation does not depend on a constructed infiltration system to maintain proper hydrology in wetlands located west of the embankment. Saturation of the soils at the flow dispersal facilities will demonstrate that the reintroduction of water is occurring as planned and the water transmission capacity of the soil has been reached. This condition will be beneficial to downslope wetlands, and may even cause an increase in the size and improvement in condition of the affected wetlands. This saturation is expected to continue well into the dry summer months, due to the buffering effect of the thick vadose zone created by the embankment.

16. Significant technical details required to understand how mitigation will be constructed are included in the *Natural Resource Mitigation Plan*, Appendices, and associated reports.

17. The design drawings in Appendix A show that the relocated segment of Miller Creek will be lined with geotextile fabric. The use of geotextile fabric as part of the relocation project is also identified in the *Natural Resource Mitigation Plan* text (Figure 5.1-3, and page 5-14).

18. The proposed geotextile fabric is highly permeable, and is designed to permit groundwater exchange[2]. Because the geotextile fabric will be permeable-the stream will not be hydrologically isolated from the high groundwater table or the underlying peat soils. The geotextile will facilitate constructability of the channel in the peat soils.

There is no concern regarding the disappearance of water into organic soils, as monitoring reported in the *Natural Resource Mitigation Plan* demonstrates that a high water table is present on the site and that the elevation of the stream channel will be very close to the elevation of the groundwater.

An "open water pond" would not occur on the site (except during flood events) because existing and proposed grades allow surface water drainage of area through the south end of the Vacca Farm area.

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[2]Geotextile liners are by definition permeable, unless identified as "impermeable geomembrane liner". The geotextile's permeability of 60 to110 gallons per minute per square foot is much greater than that of the underlying peat.

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19. The following discussion responds to the commenter's concerns regarding the function of the Vacca Farm Restoration project as a natural floodplain. During floods greater than the mean annual flood, the low channel bank that defines the west side of the stream channel (Sheet C5, Appendix A) will be overtopped by flood flows. At these times, floodwaters would move from the channel laterally across the floodplain, submerging low-lying areas of the floodplain located to the west. In addition to overbank flooding from the creek, "backwater" flooding could occur by floodwater overtopping the existing creek banks downstream of the relocated segment. Backwater flooding is a natural condition that is present along many large and small stream systems (another example is shown in Figure 7.2-4 of the *Natural Resource Mitigation Plan* that maps the backwater floodplain area near the off-site mitigation). During flood events smaller that the 1-year flood, much of the floodplain would flood as a result of a backwater condition. As correctly pointed out, the floodplain area is designed to drain freely to the south following flood events. Thus, floodwaters flow through the entire floodplain and wetland restoration area.

Chapter 5, Section 5.1.1.6 describes the estimated flooding frequency. The channel has been designed to overtop its banks at flows greater than 40 cfs, which occur approximately once a year during annual peak flows. This frequency of flood event is not an 'extreme event' and the design provides a direct hydrologic connection between the wetland floodplain and the stream channel.

The function of the creek channel, and whether or not it is lined, are independent from the design of the adjacent floodplain. The post-construction topography will allow floodwater to pond until the flow in the creek recedes, thereby providing a direct connection to the floodplain and channel.

Also see Comment Number 24 of NW Hydraulic Letter.

20. The Miller Creek relocation has been designed using appropriate and current standard engineering practices for topographic, geologic, hydrologic, and ecological conditions found in the Vacca Farm area. Because of the unique characteristics of the site, general conclusions about other sites, which have different site conditions, design approaches, and permit standards are not directly applicable to the Miller Creek design.

The creek relocation project on North Creek in Bothell was recently examined by the Port (March 15, 2001) during a rainstorm (about 0.7 inches measured in nearby Redmond). The creek was observed overtopping the channel banks in several locations within the mitigation site, flooding portions of the adjacent wetlands. Based on examination of pre-project aerial photographs and the recent site conditions, it appears that this project has successfully enhanced a previously ditched stream channel by creating floodplain wetlands and natural channel conditions. The site differs from that planned by the Port in that it the North Creek site includes flood control levees, which are not part of the Port's proposal.

21. The Miller Creek relocation site design responds to existing site specific hydrologic, geologic, ecological, and topographical conditions of the area. The project design meets requirements to maintain a creek channel with fish habitat, replace lost floodplain area, restore wetlands, and provide water quality benefits.

22. Design and establishment of the creek channel and floodplain on the Vacca Farm site has been substantiated during the development of the mitigation plan. The bearing strength of peat, potential erodability of peat, other soil conditions, groundwater conditions, and channel hydraulics have been considered in the Miller Creek design, and the design approach with the geotextile liner is determined to be stable, without adversely affecting groundwater movement. Because the Vacca Farm floodplain already floods in a backwater condition, and the relocation

project will not alter this feature, even if the relocated creek section failed to overtop its bank, the natural flood storage functions of the restored wetland would be realized.

Currently, there is no direct surface water connection between the Miller Creek stream channel or associated wetlands and floodplain. The stream is channelized and currently overflows its banks with at least a 2-year frequency. The new channel will be designed to allow the creek to overtop its banks with approximately 1-year frequency, thus improving the hydrologic connection to the floodplain. Additionally, the current design will create a forested and shrub riparian buffer, which will increase shade to the creek, decrease temperatures, and provide an increase in organic material.

The Miller Creek floodplain has a high groundwater table. Excavation in the floodplain soil will enhance groundwater saturation throughout the upper soil horizon within the floodplain, thus improving wetland hydrology. Supporting data on groundwater elevation in this area are provided in the *Natural Resource Mitigation Plan*.

23. The reviewer correctly identifies that the installation of logs will involve cutting of the geotextile fabric. However, since the geotextile fabric is permeable (see above), there are no design, operational, or reliability consequences to this approach. All geotextile fabric used during stream construction will be permeable, therefore, there will be a direct connection with the groundwater and "springing a leak" is not a concern.

24. The flood frequency of the wetland is described above, as is the ability of the permeable geotextile fabric to permit groundwater movement. The wetland and areas of high groundwater west of the stream are currently and will continue to be maintained by high groundwater conditions. Maintenance of wetlands in this area is not dependent upon floodwater, and peat soils would not be expected to form in wetlands that were maintained solely by floodwater.

The stream will flood its banks in less than an extreme 100-year flood event. The proposed channel will convey flows as indicated in the *Natural Resource Mitigation Plan*, and spill over to the floodplain with flows in excess 40 cfs, which is less than the mean annual flow (See page 5-12 and Table 5.4-1). The relocated channel and the floodplain "swale" are connected at the south end of the new creek, which is the point that will control the water surface level in the floodplain. The area draining to this point also includes drainage from Des Moines Memorial Drive, Lora Lake, as well as overflow from the new channel.

The 100-year flood elevation in the vicinity of the relocated channel currently forms a broad shallow backwater area rather than simply fringing the creek channel.

25. Geotextile fabric will be permeable; as a result, groundwater will be able to seep into the stream channel and supplement stream flow during low flow periods.

26. The *Natural Resource Mitigation Plan* identifies temporary impacts to wetlands in areas where wetlands can be avoided by the finished project, yet, to accommodate facilities to manage construction stormwater during the initial construction phase, they will be temporarily modified. Because these impacts are temporary, they are not classified as permanent. Upon completion of construction, the wetland areas will be restored to pre-construction conditions. Chapter 2 of the *Wetland Functional Assessment and Impact Analysis* (Parametrix, Inc. 2000) describes how these impacts were calculated and explains them in detail (see especially Section 2 and Section 4.2). Additionally, Chapter 5 Section 5.2.4 of the *Natural Resource Mitigation Plan* describes the temporary construction related impacts of the third runway embankment and how those impacts

were calculated. The temporary construction related impacts located outside the project footprint are identified in the Technical Memorandum *Temporary Impacts to Wetlands during Third Runway Embankment Construction* (HNTB 1999) (Appendix A of the *Wetland Functional Assessment and Impact Analysis* (Parametrix, Inc. 2000)).

Where temporary fill in wetlands results in small fragments of remaining wetlands, the remaining wetland area has been considered permanently impacted, and tabulated in Table 3.1-1. This includes Wetlands A5, A6, A8, 35, A18, portions of Wetland 18, and portions of Wetland A12. Where, following construction, the impacted wetlands could be restored and integrated into adjacent wetland areas or buffer mitigation, impacts were considered temporary because, in these areas, the full suite of existing wetland functions could be restored.

27. The evaluation of temporary sediment control ponds as a temporary impact is appropriate. These facilities are temporary, are not a permanent feature of the project, and will not cause permanent impacts to downstream wetlands. The temporary stormwater ponds are located at critical elevations relative to project construction activities, as explained in Appendix A of the *Wetland Functional Assessment and Impact Analysis*. The stormwater pond locations are at the very lowest elevations adjacent to the embankment so construction runoff from the all upslope areas can be collected and treated. Where located in wetlands (i.e. Wetlands 18, 37, and 44) the collection ponds will collect construction runoff prior to it being pumping upslope to the treatment systems. One benefit of this approach is to reduce the area of temporary impacts. The conveyance of runoff to these systems is in part via the TESC swale shown on plan sheets, with additional conveyances from the embankment itself likely.

The designed footprint of temporary ponds is shown on Figure 5.2-14, Figure 5.2-17 and Appendix D (Sheet C5 and C7) of the *Natural Resource Mitigation Plan*. The temporary ponds will not be excavated to 10 feet below the ground surface of adjacent wetlands, because this would cause the excavation to simply fill with groundwater.[3] There is no need or desire to collect groundwater and pump it upslope for treatment. The ponds will be lined, to prevent any movement of water from the pond into the wetlands. However, even lined ponds must be located at the ground surface, since high soil groundwater would cause the liner to "float", resulting in a loss of storage function of the ponds. The ponds have been designed so that the combination of storage volume and pump capacity provides the ability to collect and transfer at least twice the anticipated stormwater volume to the upstream treatment ponds.

28. Two sedimentation ponds (Ponds A and E) will be installed within a portion of Wetlands 18 and 37, and the restoration of these areas is described in detail in the *Natural Resource Mitigation Plan* (See Section 5.2.4, and Appendix D). The temporary ponds are to be constructed in areas of groundwater discharge, and not where wetlands occur on impervious perching layers. Since groundwater discharge maintains the wetlands in these areas, maintaining interflow during or after construction will not be required (in these groundwater discharge areas, soils saturated to the surface throughout the rainy season prevent interflow). For this reason, and because no significant excavation will occur during pond construction, there is no need to recreate impervious subsurface layers.

Wetlands18 and 37 will be restored to pre-construction topography by removing fill used to create berms and backfilling the pond with native soil that is similar in texture to the soil removed during excavation. The requirements for treating soils during restoration of these areas are

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[3]Minor changes to the ground surface elevations could occur due to clearing and grubbing of vegetation and surface roots.

identified in Section 5.2.4.6 of the *Natural Resource Mitigation Plan*. If the disturbed areas are treated as described, soil conditions will be suitable for the growth of wetland plants and sufficiently friable and permeable to allow groundwater discharges to continue.

29. The information the commenter has requested is part of the Public Notice. The potential impact of permanent stormwater detention ponds on the hydrology of downslope wetlands has been analyzed in the *Wetland Functional Assessment and Impact Analysis* report (See Section 4.3.2.12 and Appendix I). Groundwater data for this area, in relation to the ground elevation is shown in Appendix I and discussed in the *Wetland Functional Assessment and Impact Analysis* report. Because of the excavation, a small indirect impact to the uppermost section of Wetland 39 could occur where the pond is excavated below the elevation of the wetland. Because Pond D has been designed to infiltrate water into the soil, and with an additional orifice to discharge treated stormwater to the wetland, the potential indirect impact may not occur.

30. Permanent wetland impacts were assumed for the portion of Wetland A12 that is crossed by the TESC swale. The area where the swale runs through Wetland A12 was calculated as a permanent impact (0.08 acre).The area west of the swale (0.03 acre) will remain a wetland because of groundwater seepage and the replacement drainage channel that conveys water to the remaining portion of the wetland. Additionally, this wetland area will be enhanced through planting native trees and shrubs thus maintaining the primary functions of this wetland.

The *Natural Resource Mitigation Plan* describes and illustrates how water will be discharged to the downslope wetlands. The replacement drainage channels are described in Section 5.2.3 of the *Natural Resource Mitigation Plan*. Design details showing the channel grades, cross sections and flow dispersal trenches are shown in Appendix D (Sheet C8) of the *Natural Resource Mitigation Plan*. Additionally, page 28 in Appendix B of the *Wetland Functional Assessment and Impact Analysis* (Parametrix, Inc. 2000) describes facilities to maintain water supplies to wetlands located downslope of the embankment and MSE wall that assure the function of the downslope wetlands and mitigation.

As described in the *Wetland Functional Assessment and Impact Analysis* report, temporary wetland impacts will not occur for the duration of the project. Section 4.2.3 of the *Wetland Functional Assessment and Impact Analysis* report states that "these temporary impacts will be approximately one to two construction seasons". Appendix A of this report also describes the type of temporary impacts and that, for Wetland 37, they will be during a 1-2 years timeframe (see page 4, *Temporary Construction Impacts to Wetlands)*. Similar timeframes will occur for other temporary impacts, but the exact timing depends on the time of year construction is started, weather conditions, and other factors.

31. Based on hydrogeologic findings and field observations, the remaining wetlands downslope of the embankment are located in areas where groundwater discharge is occurring and they are not fed by shallow interflow. Numerous geotechnical explorations have been conducted for this project and these explorations are sufficient to design the permanent stormwater ponds and assess downstream impacts. Appendix I of the *Wetland Functional Assessment and Impact Analysis* report (Parametrix, Inc. 2000) show cross sections of the permanent stormwater ponds in relation to groundwater and ground surface elevations. Section 4.3.2.12 of this report evaluates the potential impact of the embankment on downslope wetlands.

32. The grading plans that are part of Appendix D (Sheet C8) of the *Natural Resource Mitigation Plan* show the TESC swale to be 2-3 feet deep in upland portions adjacent to Wetland 18 and 37. This swale is about 1 foot deep where it crosses Wetland 18 and 37. The swale is

designed to be as shallow as possible where it crosses wetlands. By using a shallow swale across the wetlands, the amount of groundwater collected in the stormwater ponds during the winter months will be minimized, as are potential impacts to downslope wetlands.

As described in the *Natural Resource Mitigation Plan*, the temporary ponds will be restored the pre-construction topography by regrading and backfilling with soil similar to those excavated. Shallow groundwater and seeps that feed Wetland 18 and 37 will be maintained through construction of the underdrain, collection swales, and replacement drainage channels.

33. The replacement drainage channel is considered to be a temporary impact, except where the design drawings indicate the impact is permanent (Appendix D of the *Natural Resource Mitigation Plan*). The channel is designed to be nearly flat, shallow, and broad where it enters Wetlands 18 and 37. For these reasons, and the emergent and shrub vegetation planted in and near it, the channel will replace the wetland functions that will be temporarily lost during construction.

34. All wetland impacts are accounted for in the above-referenced documents. The calculation of permanent, temporary, and indirect wetland impacts are discussed above and in responses to Azous (2-16-01) comment letter.

35. Post-construction groundwater monitoring data is not necessary to establish hydrology performance standards and to evaluate potential impacts to the wetlands located downslope of the project. As described in the *Natural Resource Mitigation Plan* in Section 5.2.3 the Port will monitor the hydrology in downslope wetlands on a monthly basis during years 0 through 5, year 7, year 9, and year and 10. Within these wetlands, the depth from the ground surface to the static water table will be measured. The data will be used to determine if wetland areas downslope of the embankment continue to experience wetland hydrology, and if present, whether the duration of soil saturation is sufficient to maintain the existing wetland plant communities and the existing hydric soil conditions observed at various locations in the wetland.

This is a scientifically valid monitoring approach. The data collected from hydrologic observations can be related to the wetland indicator status of wetland plants, the information on vegetation tolerance of various hydrologic regimes, and the intensity of reducing soil conditions (i.e. iron reduction (creating mottled and gleyed soil colors) or organic matter accumulation). This analysis provides insight into the <u>long-term</u> hydrologic regime that the wetland has developed under, and will provide an objective methodology for determining whether the post-construction hydrology observed through monitoring can reasonably be expected to continue to support the wetland soils and vegetation observed.

The evaluation parameters used in this monitoring approach are superior to pre-construction groundwater monitoring because the criteria based on vegetation and soil conditions are free of short-term variation and aberrant conditions. For example, if preexisting groundwater data existed for two years, the implication is that adequate information is available to establish a performance standard for ground water elevation. However, in reality, since precipitation is different each year, there is no real way to relate a change in ground water elevation to a precipitation trend or a project impact. Relying solely upon hydrologic data to determine whether the wetland is functioning is problematic because hydrologic data is not always conclusive and can be misleading. For example, hydroperiod within a particular wetland is not the same each year and can vary statistically according to climate and antecedent conditions.[4]

[4] Mitsch, William J. and James G. Gosselink. 1993. *Wetlands*. Van Nostrand Reinhold, New York.

Baseline wetland hydrology data have been gathered were during wetland delineations, during geotechnical explorations, and during periodic site investigations. Performance standards for downslope wetlands have been developed based upon existing wetland hydrology and observations of soil types (see page 5-108 of the *Natural Resource Mitigation Plan* for complete performance standards). The monitoring standards proposed for the areas are as follows:

- Flowing water will be present in the lower portions of the replacement drainage channels from December to June in years of normal rainfall.
- Wetland areas with predominantly organic soils (Portions of Wetland 18, 37a, R14a, A14b, and 44a) will have soils saturated in the upper part to mid-June in years of normal rainfall.
- Other wetlands with predominantly mineral soils will have soils saturated in the upper part to mid-April in years of normal rainfall.

Using these performance standards, as well as data gathered after standard groundwater monitoring wells are installed, it will be possible to identify if the drainage channel features or shallow groundwater is not supporting the downslope wetlands as anticipated.

If the results of the hydrologic monitoring reveals that wetlands located downslope of the embankment are not exhibiting wetland hydrology during the growing season (in years of normal rainfall) then the reason for the absence of anticipated wetland hydrology will be determined and contingency measures employed.

Due to the land acquisition process between the Port of Seattle and the private landowners within the acquisition area, property access to the wetlands of concern has been sporadic throughout delineation process. Access to some property began in the spring of 1998, but most areas were not available until late 1998 or early 1999. Several landowners refused entry to the Port or their representatives until the property was sold (e.g. Parcel 177 sold 12/14/1999). Others allowed the Port access only for the short period of time required to delineate wetlands on the parcel (e.g. Parcel 302 and 303). Therefore, consistent and repetitive hydrological measurements within all wetlands were not possible until recently.

36. See response to Comment #35.

37. The Port is following applicable regulations and procedures to assure that no net loss of wetland area or function occurs. Many of the mitigation projects evaluated in the King County study failed to meet performance standards because the wetlands had inadequate hydrology; did not contain appropriate plants adapted site conditions; were planted with non-native plants; were not maintained; or because the mitigation plans were not properly implemented. In many cases there was a lack of proper weed management or there was a failure to monitor the wetland mitigation site. Some mitigation sites were never built.

To ensure that the Port's mitigation is successful, each mitigation project has been carefully planned to avoid the problems listed above. The projects also incorporate many of the recommendations of the King County study. For example, the Port has obtained over four years of hydrologic data at the Auburn site. This data, as well as other detailed analysis contained in the *Auburn Mitigation Site Draft Hydrologic Report* (Parametrix 1997) provides the necessary information to construct the wetland mitigation site and obtain the desired water levels. This approach is consistent with the findings by King County that adequate hydrology is one of the most important aspect of wetland creation. As a contingency, if optimal water levels are not obtained, simple modifications (i.e., adjustments of outlet control structures) may be made to adjust water levels to desired depths. These weirs provide flexibility to ensure that water levels match the ecological requirements of the proposed plantings.

Following recommendations of the King County Study, a temporary irrigation system will be installed at mitigation sites (Auburn, Vacca Farm, portions of the Miller Creek buffer, and Tyee Valley Golf Course) to enhance survivability and growth during the first two years following planting.

As recommended by the King County study, plants to be installed at the mitigation sites are native and have been selected based upon their tolerance to the hydrologic regime for the mitigation site. For instance, Oregon white ash, red alder, black cottonwood and western red cedar have been chosen to be components of the mitigation areas because they can tolerate the seasonally saturated soils that occur or will be established on mitigation sites.

Following the findings of the King County study, the Port has planned a top soil mix at the mitigation sites that is appropriate for the planned vegetation communities. For example, as described in the *Natural Resource Mitigation Plan* (Parametrix, Inc. 2000), the top layer of soil would be mixed with compost to provide rich soil to promote rapid plant establishment. In addition, soils that may be compacted during construction would be amended and/or scarified to provide a friable soil structure suitable for plant establishment.

As required by Ecology and the Corps, the Port has prepared and will implement detailed monitoring plans to determine if the mitigation is successful. Monitoring will continue for ten years (five years longer than the monitoring period recommend by King County). The Port will extend this monitoring period if, after ten years, the performance standards for the mitigation sites are not met.

Also, in accordance with the King County recommendations, the Port has made pre-project topographic surveys of the mitigation areas. Post-construction topographic surveys will be made to ensure that the planned topography was achieved.

The *Natural Resource Mitigation Plan* (Parametrix, Inc. 2000) identifies that a site specific weed management strategy will be implemented. These strategies would be used to reduce the percentage of non-native invasive plant species colonizing the planted areas to ensure the survivability of the planted species.

The King County report identifies, that with incorporation of some of the above planning and design methods into mitigation projects, wetland mitigation success would increase. Since the Port has already implemented the significant recommendations made by King County and involved Ecology, Corps, EPA, and USF&WS experts in the mitigation design process, a high probability of success exists for the mitigation projects.

A number of wetland and stream mitigation projects have been successfully planned, implemented, and monitored in the Puget Sound area. The following projects are similar to the mitigation the Port is proposing and demonstrate that wetland mitigation can be successful:

- Metro West Point Wastewater treatment facility (wetland creation)
- Emerald Downs wetland mitigation in Kent (wetland and stream restoration)
- U.W. Branch Campus-Bothell (wetland creation and stream restoration)

- Metro wastewater treatment facility in Kent (wetland creation)
- Paine Field (wetland creation)
- Boeing Long Acres (wetland creation)

38. Plans submitted by the Port contain the requisite technical information needed by the reviewing agencies to reach a permit decision.

Comment noted.

The evaluation of permanent, temporary, and indirect impacts is described in detail in project report, responses provided above, and in response to the Azous letter (02-16-01).

The proposed plan and permit application sufficiently mitigates the identified impacts.

39. The documents submitted by the Port and its consultants provide sufficient data and analysis for reviewing staff to evaluate the project impacts and the adequacy of the mitigation to offset them. Plan submittals show detailed mitigation designs and explanations and provide sufficient information to support the conclusion that the stream and wetland mitigation should function to meet the design goals. The plans also provide detailed monitoring plans that are based on evaluating enforceable contingency standards. For each mitigation element, a variety of contingency actions are provided, so that corrective action alternatives can be immediately implemented in the unlikely event that the desired wetland functions are not achieved by the initial mitigation plan a particular site.

February 16, 2001

Mr. Jonathan Freedman, Project Manager
U.S. Army Corps of Engineers (USACE)
Regulatory Branch
Post Office Box 3755
Seattle, Washington 98124-2255

AZOUS ENVIRONMENTAL SCIENCES

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Ms. Ann Kenny, Environmental Specialist
Washington State Department of Ecology
Shorelands and Environmental Assistance Program
3190 - 160th Avenue Southeast
Bellevue, Washington 98008-5452

Reference: Seattle, Port of, 1996-4-02325 Comments on impacts to wetlands, streams and fisheries resources resulting from proposed 3rd runway and related development actions at Seattle-Tacoma International Airport.

Dear Mr. Freedman and Ms. Kenny,

Azous Environmental Sciences (AES) has been retained on behalf of the Airport Communities Coalition to review the impact of the Port of Seattle's proposed development at SeaTac airport on wetlands, streams and fisheries resources. Comments were submitted on the 1999 Wetlands Delineation and Wetland Functional Assessment documents as well as the June 2000 Natural Resources Mitigation Plan and related documents in letters dated August 16th and September 1st of 2000 to the Department of Ecology and the U.S. Army Corps of Engineers. The purpose of this letter is to provide comments and analyses of the December 2000 updates of these documents. A complete list of materials examined in preparing this critique is provided below.

List of Documents Reviewed:

- *Natural Resource Mitigation Plan (NRMP)*; Seattle-Tacoma International Airport; Master Plan Update Improvements dated December 2000, Parametrix, Inc.
- *Natural Resource Mitigation Plan (NRMP) Appendices A-E Design Drawings* dated December 2000, Parametrix, Inc.
- *Natural Resource Mitigation Plan (NRMP) Revised Implementation Addendum* dated August 2000 Parametrix, Inc., Number 556-2912-001 (03).
- *Wetland Functional Assessment and Impact Analysis; Master Plan Update Improvements*; Seattle-Tacoma International Airport, December 2000 by Parametrix, Inc.
- *Wetland Delineation Report; Master Plan Update Improvements*; Seattle-Tacoma International Airport, December 2000 by Parametrix, Inc.

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- *Pacific Coast Salmon Essential Fish Habitat Assessment; Master Plan Update Improvements*, Prepared for FAA and Port of Seattle by Parametrix, Inc., December 2000. Number 556-2912-001 (01) (48).
- *Biological Assessment, Master Plan Update Improvements*; Prepared for FAA and Port of Seattle by Parametrix, Inc., June 2000.
- *Supplement to Biological Assessment, Master Plan Update Improvements*; Prepared for FAA and Port of Seattle by Parametrix, Inc., December 2000.
- *Seattle Tacoma International Airport (STIA) Wildlife Hazard Management Plan*, developed by Seattle-Tacoma International Airport in cooperation with US Department of Agriculture, Animal and Plant Health Inspection Service Wildlife Services, August 2000.
- *Comprehensive Stormwater Management Plan, Master Plan Update Improvements*; Technical Appendices J, Q and R, by Parametrix, Inc., December 2000.
- *Feasibility of Stormwater Infiltration, Third Runway Project Sea-Tac International Airport, Sea-Tac, Washington*, prepared for Port of Seattle by HartCrouser, December 6, 2000. J-4978-06

I am an environmental scientist, founder of Azous Environmental Sciences and a professional wetland scientist (SWS 001067). I am co-editor and co-author of *Wetlands and Urbanization* (CRC/Lewis Press 2000), a professional reference book on how best to protect and manage wetlands in an urbanizing environment. I hold a Masters degree in environmental engineering and science and a Bachelor of Arts in landscape architecture, both from the University of Washington. I have worked as a scientific analyst for over 20 years and have specialized in natural resource science since 1991. A package describing my background and experience is attached to this report.

1

Activities that degrade or destroy special aquatic sites, such as filling wetlands, are among the most severe environmental impacts the Clean Water Act and Section 404 Guidelines are intended to prevent.[1] The stated principle guiding decision-making for Section 404 permits is that degradation or destruction of special sites may represent an irreversible loss of valuable aquatic resources. Under the Act, dredged or fill material may not be discharged into the aquatic ecosystem unless it can be demonstrated that the discharge will not have an unacceptable adverse impact, either individually or in combination with known and/or probable impacts of other activities affecting the ecosystem. Accurate determination of the adversity of an impact and identification of commensurate acceptable mitigation to offset adverse impacts depends on careful analysis of the following factors:

- The physical area of the wetland loss.
- The functions provided by the wetland loss.
- The cumulative effect of all identified losses including area and functions.

Without this information, it is simply not possible to determine the effectiveness of mitigation. Without this information, the acceptability of adverse impacts cannot be decided. Although these requirements were clearly pointed out in comments made in my September 1, 2000 letter, essential data and analysis remain missing:

2

- The keystone of the mitigation proposal, the analysis of wetland functions being eliminated, is still unaccountably absent, and the wetland assessment is unsupported as a result. This omission has apparently led the Port to propose a mitigation package that offers to replace the wrong functions.

[1] Section 404 (b)(1) Part 230.1(d) Purpose and policy.

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3 • Calculations of the extent of permanent and temporary wetland area losses remain unscientific and are contrary to common sense.

4 • Astoundingly, there continues to be no analysis of cumulative effects. Simply listing other projects and identifying project level adverse impacts does not constitute an analysis of the cumulative effects of all the projects.

5 These serious voids leave USACE and the Department of Ecology with insufficient information to make a reasonable judgment as to whether the proposed discharge will comply with the intent and purpose of the Clean Water Act. To illustrate better what is missing from the NRMP, the Biological Assessment, and the Wetland Functional Assessment documentation, I have prepared a series of analyses that address these voids using the data provided by the Port's documents. The following new analysis of data will illustrate why the agencies must find either that there is insufficient information to have reasonable assurance of no significant adverse impacts, or that there is inadequate mitigation to offset the significant adverse impacts of this project.

Wetland Functional Assessment of Losses in the Miller Creek and Des Moines Creek Watersheds

6 Although the December 2000 NRMP appears at first to have increased proposed mitigation of losses from constructing the Third Runway over previous plans, the appearance is false because the mitigation actually proposed remains largely unrelated to the environmental functions that will be eliminated by loss of watershed systems. To illustrate the kinds of information missing from the assessment of functions performed by Parametrix for the Port of Seattle, I assembled data provided in Table 1-2 of the December 2000 Wetland Functional Assessment, and Tables 3-1 and 3-3 of the December 2000 NRMP into a spreadsheet and produced Figures 1, 2 and 3 showing the wetland functions affected by the project.

7 Table 3-3 gives one of five rankings (low, low-to-moderate, moderate, moderate-to-high, or high) to each function of the wetlands to be eliminated. All rankings of low, low-to-moderate, and moderate were placed in one category ("Low-Moderate"), and all rankings of moderate-to-high and high were placed in a second category ("Moderate-High"). Figure 1 is a bar chart illustrating the functional rankings of the acres of wetlands to be eliminated from both Miller and Des Moines Creek watersheds, using the two categories.

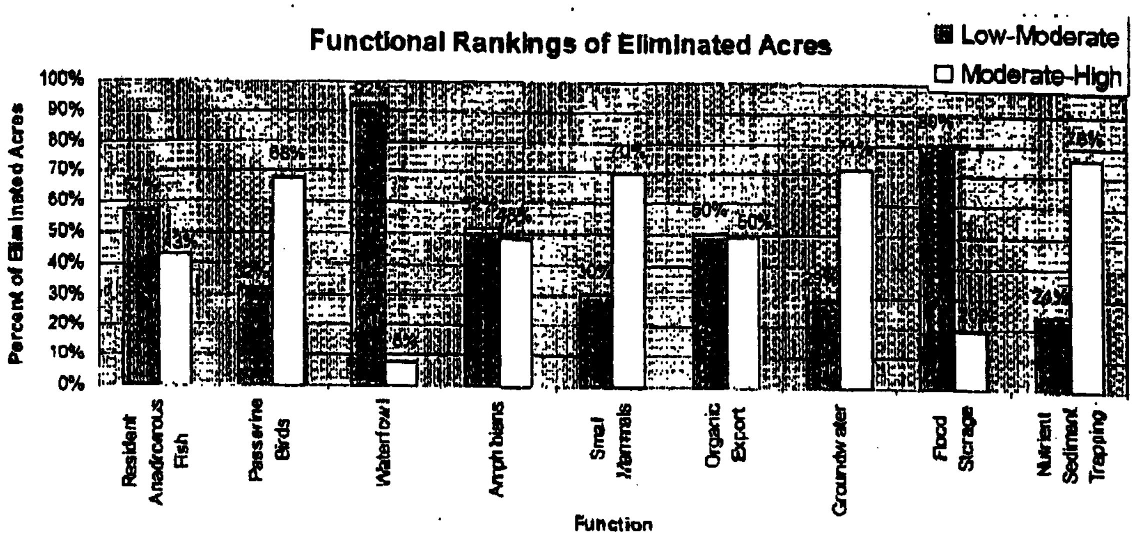

Figure 1. Functional rankings assigned to wetlands being eliminated for the Third Runway Project.

8 Figure 1 shows that the highest-ranking functions being eliminated from the watershed in the greatest proportion are habitat for passerine birds (68%), small mammals (70%), groundwater discharge/recharge (71%), and nutrient sediment trapping (76%). Forty-three percent of the wetland acres being eliminated are ranked moderate-to-high for anadromous fish habitat, forty-eight percent are ranked moderate-to-high for providing amphibian habitat, and fifty percent are highly valued for export of organic material.

9 Significantly, *92 percent* of the eliminated wetlands are low-to-moderate for waterfowl habitat, and 80 percent are low-to-moderate for flood storage. These are proportionally the *lowest*-ranking functions among all the wetlands being eliminated, yet waterfowl habitat and flood storage are the primary functions targeted for replacement in the NRMP.[2] The grossly misplaced emphasis makes no environmental sense at all and serves to create the impression of mitigation where no effective mitigation in fact exists. The mitigation proposal appears to be tailored to the needs of the project rather than the requirements of the Clean Water Act.

10 Figure 2 shows the ratings of wetlands in the Miller and Des Moines Creek watersheds, using Department of Ecology's (DOE) Wetland Rating System. Starting at the left of each chart in Figure 2, the first bar shows the proportion of wetlands being eliminated for each of the three pertinent DOE ratings. The second bar shows the percent of wetland acres in the Port's entire project area that have that rating and are being eliminated. For example, the Miller Creek Basin chart in Figure 2 shows that 58 percent of the wetlands eliminated by the Third Runway in the Miller Creek watershed are rated Class II. It also shows that 45 percent of all the Class II wetlands identified within the Miller Creek Basin project area will be eliminated.[3]

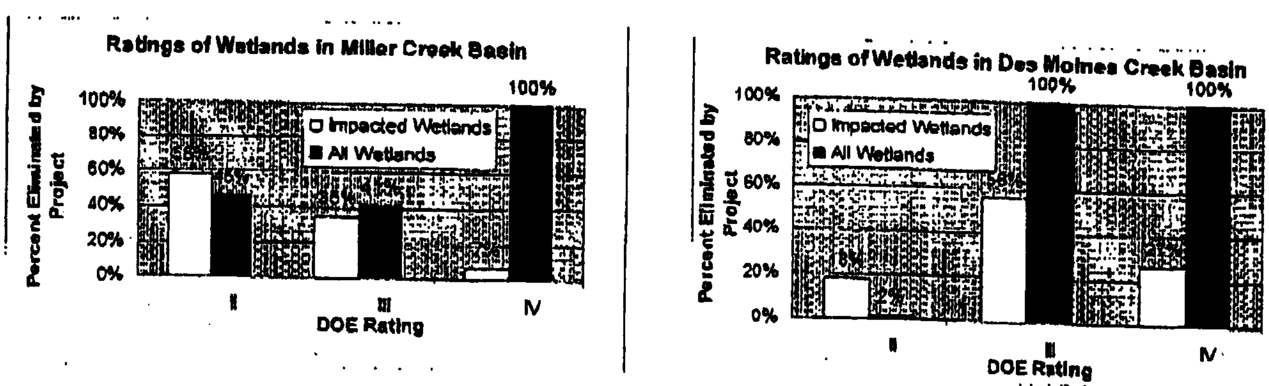

Figure 2. Department of Ecology (DOE) ratings for wetland acres eliminated.[4]

11 The bar charts in Figure 2 illustrate that the majority of wetland acres being eliminated for the Third Runway project in the Miller Creek watershed are more highly rated Class II wetlands, rather than lower quality Class III and IV wetlands. This evidence directly contradicts the repeated statements

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[2] NRMP Table 1.3 1 and pages 1-1 and 1-2.

[3] Ideally the second bar would show the percent of wetlands being eliminated *in the watershed* by DOE rating but that data was not available.

[4] NRMP Table 2 1.1 is source of data for charts.

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11 made in the NRMP and Wetland Functional Assessment that the wetlands to be eliminated are degraded to the extent that they provide few valuable functions.[5]

12 Another important measure of wetland function is proportion of habitat types, such as emergent, scrub-shrub, or forested wetlands. Figure 3, below, identifies the types of habitat that will be eliminated in the Miller Creek and Des Moines watersheds. The charts show that the majority of wetland acres to be eliminated in Miller Creek are forested wetlands, followed by emergent habitats. Shrub wetlands constitute the smallest component of habitat types being eliminated.

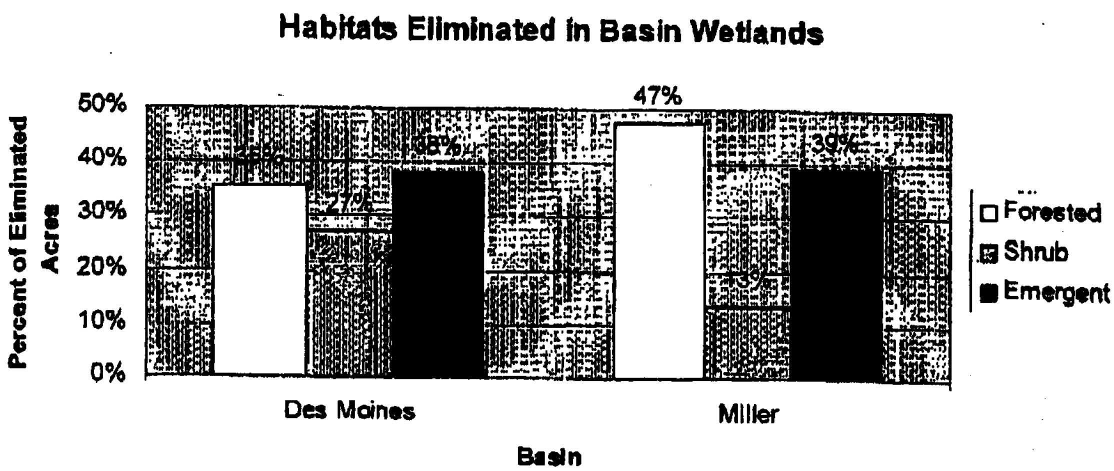

Figure 3. Proportion of wetland habitats eliminated.

13 Based on the results revealed in Figures 1, 2 and 3, commensurate mitigation for these lost functions would require replacement of habitat for passerine birds, small mammals, and amphibians. It would require assurances that the sediment and nutrient trapping functions be compensated for, as well as groundwater exchange functions. To comply with Section 404 Guidelines, a plan would have to ensure that sources of organic export within the affected watersheds be maintained and that there be no net loss of fisheries habitat (resident or otherwise), particularly in light of recent and proposed Environmental Species Act (ESA) listings. An acceptable plan would include creation of wetlands rated Class II or greater and would provide habitat dominated by forested and emergent wetland systems.

In contrast, the in-basin mitigation being offered within Miller Creek watershed ignores these key requirements. Instead, the Port proposes to replace the existing wetland functions, identified clearly in the data gathered by its own consultants, with a questionable restoration of a scrub-shrub wetland, the least common habitat type found in the watershed. Further, the restoration is designed to replace "lost" flood plain, which is not identified anywhere in the wetland functional assessment as a significant function provided by the impacted wetlands.

[5] NRMP Section 2 and Wetland Functional Assessment Section 4.

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Determining the Extent of Permanent and Temporary Wetland Losses

I pointed out the Port's unrealistic approach to determining what constitutes permanent versus temporary wetland impacts in my August 16th and September 1st comment letters. The December 2000 Wetland Functional Assessment may reflect an attempt to clarify permanent impacts from temporary
14 impacts, but is still founded on unsupportable optimism regarding how much wetland can be eliminated from a system and still leave a wetland viable. The assumptions regarding what constitutes a temporary versus permanent impact remain ill-defined. Moreover, the Port significantly underestimates the extent of indirect impacts.

How Much Wetland Area Can Be Eliminated From a Wetland and Still Leave it Viable?

The NRMP makes the argument that the acres of wetland lost is commensurate with the proportion of functions provided by that acreage.[6] In other words, according to the Port's reasoning, if
15 half a wetland is eliminated, the remaining half will necessarily provide half the previous functions. Within some ranges of values, there may be a one-for-one relationship between function and size of a wetland. Nevertheless, there is ample evidence that as wetland size diminishes the value of the wetland decreases in greater proportion because the remaining functions are qualitatively less significant.

Interestingly, this increased degradation ratio phenomenon is demonstrated in the data gathered by Parametrix for the wetland functional assessment. When one compares the average size of wetland within the DOE Rating Classes (see Table 1), it is apparent that smaller wetlands were less highly rated
16 than the larger wetlands. By reducing the size of a wetland, one removes significant value in greater proportion than the percentage of lost area, to the extent that the wetland is rated lower when assessed at the reduced size. Moreover, the Port's argument is based on the erroneous assumption that wetlands have uniform conditions, whereas they often have a high degree of internal diversity. Large area reductions can eliminate entire populations of small mammal or amphibian species using the wetland by reducing or eliminating key features of their required habitat such as needed emergent areas or a forested buffer.

Table 1. Existing conditions: DOE Rating and average wetland size.

	DOE Rating		
	II	III	IV
Smallest Wetland in Category (acres)	0.57	0.01	0.02
Largest Wetland in Category (acres)	35.45	4.63	0.87
Average Sized Wetland in Category (acres)	**6.60**	**0.47**	**0.20**

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Table 2, below, shows the total wetland acres and total acres impacted for each of the wetlands identified by the NRMP. Most of the wetlands are 100% impacted and are properly accounted for in terms of permanent impacts. A few have between zero and 13 percent of their areas permanently
17 impacted, an effect whose significance may not be readily predictable. However, wetlands 18, 37, A12, and R1 all have *more than 70 percent* of their areas permanently impacted.

It is highly improbable that wetlands 18, 37, A12, and R1 could retain their DOE ratings or value if the physical basis of their functions were reduced over more than 70 percent of their area. Such a high

[6] NRMP Section 3.

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degree of loss is likely to eliminate whole habitats within these wetlands, affecting their suitability for wildlife, nutrient sediment trapping, and organic export functions.

Table 2. Total wetland acres and total acres impacted for each of the wetlands identified by the NRMP.[7]

Wetland ID	Total Wetland Acres	Wetland Acres Impacted	Percent of Wetland Eliminated	Revised Acres for Permanently Impacted Wetlands
5	4.63	0.14	3%	0.14
9	2.83	0.03	1%	0.03
11	0.5	0.5	100%	0.5
12	0.21	0.21	100%	0.21
13	0.05	0.05	100%	0.05
14	0.19	0.19	100%	0.19
15	0.28	0.28	100%	0.28
16	0.05	0.05	100%	0.05
17	0.02	0.02	100%	0.02
18	**3.56**	**2.84**	**80%**	**3.56**
19	0.56	0.56	100%	0.56
20	0.57	0.57	100%	0.57
21	0.22	0.22	100%	0.22
22	0.06	0.06	100%	0.06
23	0.77	0.77	100%	0.77
24	0.14	0.14	100%	0.14
25	0.06	0.06	100%	0.06
26	0.02	0.02	100%	0.02
28	35.45	0.07	0.2%	0.07
35	0.67	0.67	100%	0.67
37	**5.73**	**4.11**	**72%**	**5.73**
40	0.03	0.03	100%	0.03
41	0.44	0.44	100%	0.44
44	3.08	0.26	8%	0.26
52	4.7	0.54	11%	0.54
53	0.6	0.6	100%	0.6
A1	4.66	0.59	13%	0.59
A12	**0.11**	**0.08**	**73%**	**0.11**
A5	0.03	0.03	100%	0.03
A6	0.16	0.16	100%	0.16
A7	0.3	0.3	100%	0.3
A8	0.38	0.38	100%	0.38
B11	0.18	0.18	100%	0.18
B12	0.78	0.07	9%	0.78
B14	0.78	0.78	100%	0.78
E2	0.04	0.04	100%	0.04
E3	0.06	0.06	100%	0.06
FW5	0.08	0.08	100%	0.08
FW6	0.07	0.07	100%	0.07
G2	0.02	0.02	100%	0.02
G3	0.06	0.06	100%	0.06
G4	0.04	0.04	100%	0.04
G5	0.87	0.87	100%	0.87
G7	0.5	0.5	100%	0.5
R1	**0.17**	**0.13**	**76%**	**0.17**
W1	0.1	0.1	100%	0.1
W2	0.24	0.24	100%	0.24
TOTAL	75.05	18.25	24%	21.33

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[7] Data taken from NRMP Table 2.1-1 and Table 3.1-1. Bold values exceed 70% loss of original acres.

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18

Furthermore, the NRMP does not even attempt to account for the temporary impacts to these wetlands in addition to the permanent ones. The Wetland Functional Assessment lists each of these wetlands as sustaining temporary impacts as well as permanent ones.[8] Wetlands 18 and 37 are subjected to 0.93 acres of temporary impacts, including a temporary storm water pond located in Wetland 37. Temporary disturbance from construction activities are virtually inevitable in Wetlands R1 and A12, but the amount of area is not specified. The plain result is that of the 2.35 acres remaining between wetlands 18 and 37 after permanent impacts, 0.95 acres will be "temporarily" impacted by construction activities and the construction of a storm water management pond, leaving 1.4 acres of what was originally a 9.3-acre wetland complex. Arguing that the same functions present in a 9.3-acre wetland will proportionately scale down on a one to one ratio within a grossly reduced 1.4-acre wetland defies logic, ignores well-known objective features of wetlands, and significantly undermines the scientific credibility of the Port's analysis.

19

Classifying the construction zone around the embankment and wall and the construction of temporary storm water ponds within wetlands as only "temporary" impacts is misleading. While the Port has not revealed its timeline for use of these "temporary" ponds, it is probably at least several years judging from their function in the construction scheme. Furthermore, excavation and compaction activities that occur in constructing the temporary ponds will detrimentally affect soil characteristics and microorganisms that are fundamental to establishing wetland plants and a healthy and diverse wetland ecology. The life cycles of amphibians, mammals, and insects that historically used the wetland system will be disrupted, with the likely consequence of eliminating entire populations. The extensive delay encompassing initial impact, use during construction, and final restoration effectively eliminates habitat use of the area for a decade or more. Such cumulative disruptions to the system will likely be significant enough that new recruitment of species cannot occur. Impacts of this significance effect wetland ecosystem processes for decades.

20

It is my professional opinion that wetlands with greater than 70 percent of their area eliminated and subject to significant "temporary" construction related impacts are altered in ways that will affect their functionality for time scales on the order of 50 years. These wetlands should therefore be considered permanently impacted. If such wetland remnants are included in the calculations of permanent wetland impacts, it brings the total permanently impacted wetland acres from 18.25 (18.33 minus the 0.12 acres for off-site mitigation also included in Table 3-1.1 of the NRMP) to 21.33 acres, a significant and unmitigated increase.

Cumulative Effects Analysis

21

Part 230.11 (g) of the Section 404 Guidelines for implementing the Clean Water Act requires that cumulative effects attributable to the discharge of dredged or fill material in waters of the United States be predicted to the extent reasonable and practical. Cumulative impacts are the changes in an aquatic ecosystem attributable to the collective effect of a number of individual discharges of fill material. Although, on its own, the impact of a particular discharge may constitute a minor change, the cumulative effect of numerous such piecemeal changes can result in major impairment of water resources and interfere with the productivity and water quality of existing aquatic ecosystems. Thus, by definition, analysis of cumulative effects must consider impacts to wetlands on a larger scale than that of individual projects.

A list of impacts confined to individual activities, even if comprehensive, is not a substitute for analysis of their cumulative effects. Instead, cumulative impacts must be measured in an appropriate

[8] Wetland Functional Assessment, December 2000, Table 4-5, p. 4-13.

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22 manner, depending on the resource management issues of concern. Typically, a planning area such as a watershed would be selected. A proper analysis identifies measurements of function, such as acres of wetlands, acres of uplands, and acres of contiguous habitat, for the pre-project and post-project conditions. Only such broad-scale metrics can give the required comprehensive picture of the outcome, a task for which descriptive lists necessarily fall short. These are generally recognized standard analytical methods for evaluating cumulative impacts.

23 For example, under existing conditions in Miller Creek basin, there remain 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 approximately six percent of the eight-square mile watershed.[9, 10] The Third Runway Project will *eliminate approximately 75 acres* of the existing wetland and upland habitat and proposes to replace it with 36.85 acres of upland habitat restored from land that is currently used as residential housing. The loss in uplands and wetlands resulting from the Third Runway Project will reduce the remaining functioning habitat area by approximately 13% and reduce the percentage of habitat within the entire basin to *five percent*.

24 An evaluation of the proportion of only wetlands eliminated within the watersheds (not including uplands) would be extremely important information in assessing adverse impacts particularly the loss of wetlands associated with or hydrologically connected to the creek systems. However, the Port has not provided the data required for such an evaluation, and I was unable to adequately estimate wetlands remaining in the basin from aerial photographs alone. Until these data can be presented and evaluated, it is impossible to assess fully the impact of wetland losses on primary productivity and its consequent effect on in-stream and downstream fisheries resources, including the estuarine habitat located at the outlet of Miller Creek that is frequented by Chinook salmon.

25 Similar metrics were prepared for the SeaTac International Airport (STIA) project area in order to assess localized impacts. The STIA project area located within the Miller and Walker Creek watersheds encompasses the central third of sub-basins appertaining to Miller Creek, and also includes the headwater and upper 25 percent of sub-basins belonging to Walker Creek. Within the area encompassed by these sub-basins, existing functioning habitat areas constitute about 242 acres in approximately 1650 acres of the Miller Creek drainage basin located within the STIA boundary.[11] Functioning habitat represents about 15 percent of the STIA project area under existing conditions. When completed, the area of functioning upland habitat in the STIA project area (assuming the enhancement activities are successful) will be limited to 10 percent. A five percent decrease in functioning habitat is a significant reduction, but in this instance is particularly egregious, as it is *fully a third* of the already reduced habitat that remains.

26 Table 2-1 of the Wetland Functional Assessment provides the number of acres of wetlands found within the SITA project area for the Miller and Des Moines Creek watersheds. Combining these data with data from Table 3.1-1 of the NRMP reveals that that 23 percent of the wetland acres found in the project area within the Miller Creek watershed and seven percent of those within Des Moines Creek watershed will be eliminated.

27 This analysis of cumulative affects is limited to the raw data provided in the mitigation plan documents and what I was able to estimate from aerial photos, but serves to illustrate the kind of metrics that are needed in order to fully evaluate the significant adverse impacts that are cumulative.

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[9] NRMP 2000 p. 2-7, Section 2.2.1.1

[10] These estimates of habitat area were calculated using 1997 aerial photographs of the watershed.

[11] See Figure 1 of the Supplement to the Biological Assessment etc. December 2000.

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27 Without such metrics, it is likely that the adversity of the impacts on the resource will be underestimated leaving no reasonable assurance of protecting public resources.

Even with limited data, this analysis reveals a net loss of habitat within the Miller Creek watershed. The Port's addition of upland buffer to the mitigation plan is not sufficient to offset the acres of habitat lost from development activities. The loss of wetlands in addition to the loss of uplands will permanently and significantly degrade a watershed that has limited remaining habitat areas. The enhancement proposals may be well meaning and might help improve some habitat remnants, but will not offset significantly the substantial area loss, particularly of wetlands. Permitting the proposal as it
28 now stands would allow the "dead is dead" philosophy referred to in my August 16th comment letter to prevail.[12] This philosophy states that since certain natural resources have been degraded by human activities over time (in this case by urbanization and the construction of the existing airport), it makes sense to sacrifice those degraded systems to create other sites that are (theoretically) better protected. However, this philosophy is not consistent with the state of the existing habitat and wetlands at the STIA site or with the requirements of the Clean Water Act. The area in question is not dead: it is home to three creeks and attendant wetland systems which have, despite pressure from STIA, managed to maintain their viability and water quality sufficient to support resident and migrating salmon species. USACE and DOE are required to protect them under the Clean Water Act.

Are There Opportunities for In-Basin Mitigation?

It is fair to ask whether there are reasonable alternatives that would allow in-basin mitigation to prevent further degradation of the Miller Creek watershed. Port consultants have repeatedly argued that
29 the threat of bird strikes renders in-basin mitigation unacceptable. However, a close reading of the Position Paper regarding Off-Airport Mitigation of Wetland Habitat Function and the analysis of mitigation site alternatives provided by Table 7.2-2 in the December 2000 NRMP, reveals significant confusion between bird species that pose a threat to aircraft and the species of birds that would actively use wetlands associated with Miller and Walker Creeks.

Avian species that threaten aircraft are primarily Canada geese and other waterfowl that use open landscapes adjacent to open water.[13] Managing the threat is largely a matter of removing their preferred habitat from the safety area. Wetlands can be constructed that discourage use by problematic species, as exemplified by the restoration goals of Vacca Farm. Forested and emergent habitat under a relatively
30 closed canopy provide numerous critical wetland functions, including habitat for birds of species that do not cause safety concerns. In general, the bird strike hazards produced by locating created wetlands in sites 8 and 12 would not be significant if the wetlands were designed to avoid open landscapes with open water. It is unreasonable to eliminate in-basin wetland mitigation for bird-strike reasons, because there is sufficient knowledge of bird species requirements to manage the threat by appropriate wetland design. In addition, the elevation of the runway in relation to the mitigation sites would effectively eliminate as hazards many species that might use the wetlands but typically do not fly as high as the runway would be in relation to the wetlands.

Potential mitigation Sites 8 and 12, listed in Table 7.2-2 and shown on the map in Figure 7.2-3, of
31 the NRMP comprise a total of 39 acres in the Miller Creek watershed. These sites are in-basin and adjacent to Miller creek. The table states that Site 8 is within the runway footprint, but the map in Figure 7.2-3 shows Site 8 to be located outside the runway footprint.

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[12] *Dead is Dead. -An Alternative Strategy for Urban Water Management*, Brian W. Mar, Urban Ecology, 5 (1980/1981), pp 103-112.
[13] *Wildlife Hazard Management Plan*, Section 3.4, Vegetation Management.

32 In Table 7.2-2, the Port contends that both sites 8 and 12 are surrounded by roads on two sides and are therefore not suitable for a mitigation site. That assertion must be examined in context. In effect, the Port argues that it is more suitable to create "compensatory" wetlands completely outside the watershed with no hope of countering local environmental degradation than to create in-basin wetlands that may be more isolated, but provide locally key functions that prevent degradation within the watershed. This issue is particularly critical because at stake in the permitting process are many wetlands associated with salmon-bearing streams and located in watersheds where few wetlands remain.

33 Furthermore, the map in Figure 7.2-3 shows there are additional opportunities to provide upland habitat to buffer wetlands created within sites 8 and 12, using undeveloped land with greater than five percent slope, forested and unforested. By using sites 8 and 12 for creation of new wetlands, and adding upland buffers commensurate with the area of undeveloped upland being eliminated by the Third Runway Project, there is a far greater chance the project could be constructed without the significant adverse effects within the Miller Creek watershed that are inevitable under the current proposal. In addition, the project would help prevent the destruction of remnant natural sites within an area already significantly affected by development.[14]

Other Significant Concerns

1. Failure to Take Well-Established Wetlands Functions into Account

34 One particularly disconcerting void in the Port's evaluation of potentially significant alterations is the lack of discussion on the contribution of wetlands in the Miller and Des Moines creek watershed to primary productivity in the creek systems. Although approximately half of the wetland acres to be eliminated are ranked moderate-to-high for the function of organic export (see Figure 1), there is no discussion of the effect of that loss on the food webs of Miller and Des Moines creeks.

35 It is now universally accepted that wetlands are among the most productive ecosystems on the planet. The boundary zones (ecotones) between land and inland wetlands and streams are the principal routes for the transport of organic matter and nutrients within a watershed.[15] A *Carex* sedge meadow typically will produce three or more times the organic carbon than is produced by a woodland shrub land complex (1000 g C/m^2 versus 270).[16] The condition of plants growing in water or saturated soil provides a steady supply of water and nutrients that have the potential to support high productivity. The typically anoxic soil makes a suitable environment for nitrogen-fixing bacteria associated with the plant roots. As a result of these processes, wetland communities have a profound influence on the nutrient supply to natural waters.

36 The wetlands within the Miller and Des Moines Creek watersheds are extremely important because of their value for production of organic carbon and for their role in moderating nitrogen export. Reducing remaining wetlands within this watershed will alter the interception of nitrogen and increase the supply of nitrogen to the estuary at the mouth of the creeks. Since nitrogen is a limiting nutrient for phytoplankton production in coastal waters, the reduction of wetlands within the watershed could result in increased eutrophication in the shoreline environment. The reduction of wetland plants in the watershed would also reduce the volume of organic particulate matter that results 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.

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[14] 404 guidance Part 230.75.

[15] Hillbricht-Ilkowska, Phosphorus and Nitrogen Retention in Ecotones of Lowland Temperate Lakes and Rivers, HYDROBIOLOGIA, 1993, Vol. 251, No. 1-3.

[16] Barnes and Mann, Fundamentals of Aquatic Ecosystems. Tables 4.1 and 11.1.

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37 This shift could have enormous consequences for both resident fisheries as well as for species that use the lowest reaches but are not resident, such as Chinook. This is because detrital food sources are essential to the development of invertebrate communities on which salmonid fish species feed. Reductions in the productive capacity of the riparian wetland systems are certain to affect fish production. [17]

Evaluation of loss of wetlands is also important because the Port claims the high levels of dissolved organic carbon (DOC) found in both Des Moines and Miller creeks will limit the biological availability of zinc and copper found in their storm water runoff, effectively reducing the toxicity of their stormwater to salmon.[18] DOC derives from the breakdown of detrital material by bacteria and fungi. The comparatively high levels of DOC found in Des Moines Creek and particularly the levels found in Miller Creek are very likely high because of the contribution of organic material from existing wetlands.
38 It is noteworthy that although the Port's conclusion of no adverse effects to fish and other aquatic organisms from discharges of zinc and copper relies on the presence of high concentrations of dissolved carbon, there is no discussion about what constitutes the source of that carbon and how it will be maintained after the project is built. This is a truly a fundamental and revealing oversight because the DOC concentrations on which the Port depends to reduce the toxicity of zinc and copper in their stormwater discharges originates in the wetland systems they propose to degrade and eliminate.

The loss of wetlands will negatively affect fisheries resources. The loss of DOC in the system will affect the food web and will likely increase the bioavailability of toxic metals, especially in the Miller Creek system. Both of these alterations could have serious adverse impacts to resident and migratory Coho salmon and could affect the essential fish habitats for ESA listed Chinook salmon populations located at the mouths of Des Moines and Miller Creeks.

2. *Ignoring Hydrologic Effects of Clearing*

Borrow Sites 1, 3 and 4, located in the Des Moines Creek Basin at the south end of the STIA, are currently mostly undeveloped and covered by upland coniferous forest and wetland second-growth deciduous forest. These lands contribute to the headwater area of Des Moines Creek and constitute much of the forestland remaining in the basin. The proposed clearing and excavation of the borrow
39 areas will significantly alter land cover, affecting infiltration, eliminating evapotranspiration and generally reducing the contribution of precipitation to groundwater. This will have a long-term effect of reducing seepage flows and diminishing base flows in Des Moines Creek. In addition the lining of the IWS system, although beneficial for preventing pollutant releases to groundwater, is likely to alter low flow conditions significantly in Des Moines Creek.[19]

Several wetlands are situated down gradient from Borrow Site 1, including 48, 32, B15, B12, and B4. The December 2000 NRMP Table 5.3-6 of performance standards for these wetlands states that water will be redirected to the wetlands in order to keep soils saturated to the surface from December
40 to March or April in normal rainfall years. On what basis was this performance standard developed? Has the Port measured the existing hydroperiods of these wetlands? Is the performance standard proposing to match the existing conditions or is it intended to create new and improved hydroperiod conditions? No information is provided to answer these fundamental questions, and no detail is provided on the engineering methods to be used to extend and prolong the hydroperiod of wetlands that are currently fed by shallow groundwater.

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[17] *Dissolved Organic Material and Trophic Dynamics*, R. S. *Wotton, BioScience, Vol. 38, No. 3.*
[18] *Pacific Coast Salmon Essential Fish Habitat Assessment, P.4-8.*
[19] See Item 10 for additional information in comments made by Northwest Hydraulic Consultants dated February 15th, 2001.

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41 Moreover, even if water flow can be maintained to meet the performance standard, the standard is unlikely to have sufficient duration to preserve wetland functions. Uplands commonly retain saturated soils until March or April. Such a short water season is little guarantee that wetland functions will be preserved.

42 A similar situation is present near Borrow Site 3. The highest elevations of the site will be cleared and excavated leaving a 50-foot buffer around wetlands B10, 29, B9, 30, B7, B6, and B5. The performance standard requires that soils be saturated in Wetland 30 until May and that there be standing water in Wetland 30 from December until April. That is too narrow a window for successful amphibian breeding in many years, especially if temperatures are cooler than normal. Water must be provided until the middle of June to insure habitat is available for the entire breeding season.

43 The effective season for supporting aquatic dependant species requires water to be present through the second week in June. Without a more wetland-friendly performance standard, the activities within the Borrow Sites will adversely alter existing wetland functions, in addition to reducing base flows in Des Moines Creek.

3. Effects of Non-permitted Degradation

44 Impacts to wetlands have *already* occurred, in particular hydrologic and habitat isolation, in advance of the permit. In October 2000, I examined September 2000 aerial photographs of the Third Runway Project area to determine the extent of pre-permit construction activities. Several wetlands were at least partially surrounded by fill and construction activities. The resolution of the aerial photography was insufficient in many instances to determine whether a 50-foot buffer was left intact, but it was clear that several wetlands were completely or very nearly isolated by clearing and fill deposits.

These activities affected wetlands 12, 13 and 14, and R1, R2, and R4, which are associated wetlands to Miller Creek. Also affected by fill activities were wetlands 23, G3, 52, and 53. In addition, grading and fill activities were apparent within as little as 50 feet of the eastern lobes of wetlands W1, W2, 18, and 19.

45 Although in these instances a buffer of sorts exists, what remains does not constitute protection to a wetland when adjacent fill and clearing effectively isolate the wetland biologically and in all likelihood hydrologically. Moreover, it is likely that fill activities have continued since September, when the aerial photos were taken, resulting in further damage and isolation to the project area wetlands. These activities have reduced and continue to reduce the value of the wetlands, possibly eliminating normal functioning within these wetlands for decades. They appear to be activities that would require a permitting process, with prior review of the adverse environmental effects.

46 Even more flagrant is that forested habitats are being permanently removed that may affect listed endangered species prior to the completion of the ESA consultation for the project. At the very least, the Port's activities should be stopped before they do additional damage to Miller Creek's few remaining wetlands. Further, evaluation of the proposal should begin with the proposition that as a first step current damage from circumventing the permitting process must be reversed before approvals under the Clean Water Act are decided. Otherwise the baseline, which underlies the Port's application, will have been rendered false at the outset.

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4. Contradictory Treatment of Seepage Flow Issues

47 In previous communications with Mr. Erik Stockdale, Wetland Specialist for the Department of Ecology, I discussed the issue of how seepage flows will continue to hydrate the wetlands located at the base of the MSE wall and embankment and expressed concerns regarding how the system will actually work. I pointed out several discrepancies between illustrations in the Appendices to the August 2000

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47 NRMP and the grading and drainage plans shown in the Stormwater Management Plan (SMP). He indicated that the inconsistencies would be discussed with Port consultants, and my understanding was that these inconsistencies would be remedied in the final documents.

48 Unfortunately, how seepage flows are to be captured and returned to the wetlands remains vague and inconsistent even in the December 2000 documents. *This is a significant issue.* The hydroperiod of a wetland affects its functions because it controls the input and output of nutrients and their availability for habitat.[20] Maintaining seepage flow hydrology to the wetlands located at the base of the wall and embankment is essential to their continued viability and highly challenging to engineer. If the Port cannot demonstrate how seepage flows can be successfully maintained, then the mitigation requirements must be substantially higher than proposed.

49 The Port had failed to provide sufficient information to ascertain what is being proposed, let alone whether the proposed discharge will comply with Section 404 guidelines. As an example, it is unclear how wetland hydrology will be maintained to Wetland 39 because Pond D is located such that it would intercept ground and surface water flows to Wetland 37. It is also unclear why a ditch will be located adjacent to the embankment wall within Wetland 37. As currently shown, it appears the ditch will capture seepage flows and carry them *away* from Wetland 37, rather than allow seepage flows to infiltrate to Wetland 37. This impression is not clarified in the NRMP or SMP discussions, which offer insufficient information to assess the outcome in conjunction with inconsistent information provided between the NRMP and the SMP. Additional detailed examples of similar inconsistencies are provided in comments submitted to you by Dyanne Sheldon.[21]

5. *Effect of MSE wall on microclimate variables in Miller Creek and adjacent remaining wetlands.*

50 There is no discussion in the documentation provided about the impact the MSE wall itself will have on remaining wetlands and Miller Creek. Due to the unprecedented size and mass, the wall could significantly alter temperatures in the remaining wetlands by producing an increase in shade effects during the morning, effectively shortening the growing day for many species. In contrast, late afternoon temperatures may rise significantly during sunny periods, should the wall capture heat and radiate it to adjacent aquatic habitats. This could result in significant alterations to the phenological development of plants, amphibians and insects using Miller Creek and associated wetlands. The cooler temperatures created by the wall from shading effects are likely to shift the emerging and breeding season later by a few weeks, which could put water dependent species that use the seasonal wetland habitats at greater risk. Higher summer temperatures could increase water temperatures in Miller Creek and adversely affect fish habitat and food web resources.

Review Comments Made in Previous Letters that Remain Unresolved

I commented on previous versions of the Port's documents on August 16th and September 1st of 2000. The majority of concerns expressed in those comment letters remain unresolved. The comment letters are important to understanding the background and context for this report and are included as attachments. The following are summaries of continuing issues:

51 1. The mitigation ratios for in-basin mitigation are exceedingly low, unrelated to the predicted losses, and are not even close to meeting Washington State Department of Ecology Guidelines. The mitigation package as proposed will inevitably produce a net loss of wetland functions within the Miller Creek watershed.

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20 Wetland Ecosystems Studies From a Hydrologic Perspective, James W. La Baugh, Water Resources Bulletin, American Water Resources Association, Vol. 34, No. 6 1986.

21 Dyanne Sheldon February 16th comments on Port of Seattle Reference No. 1996-4-02325.

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52 2. Use of a water resource inventory area (WRIA) as a pretext for allowing out-of-basin mitigation is scientifically indefensible from a resource management standpoint and inconsistent with the Clean Water Act and Section 404 guidelines. Further, the mitigation package proposed by the Port is not consistent with the intent and requirements of RCW 90.74.005 to 94.74.020, which specifies that mitigation outside the impacted area be completed in advance of impact and intends that it be timed, designed and located in a manner to provide equal or better biological functions and values when compared to traditional on-site, in-kind mitigation.[22]

53 3. The Port proposes to create open stormwater ponds that will likely attract undesired wildlife even while the Port refuses to create in-basin mitigation wetlands. In addition, the proposed remedial action of installing netting over the ponds creates a hazard to all wildlife. Stormwater ponds also tend to operate as ecological sinks, attracting animals, and depending on their management in relationship to water depths and temperature, are often death traps. There is no indication that these inconsistencies have been adequately addressed.

54 4. The wetland restoration planned for Vacca Farm continues to have significant problems, including the lack of habitat values, questionable removal of peat soils, and lack of adequate hydrology to maintain the system as a wetland. The excavation of the existing peat will provide little additional storage while removing highly valued wetland soils capable of storing water and releasing it at the end of the rainy season, one of the primary functions of a wetland. The peat soils provide important hydrologic support during the late spring and early summer for a period of several weeks.

55 Vacca Farm is designed such that the majority of the wetland will receive water only during extreme storm events such as a 100-year flood, effectively reducing the wetland's value for biological support. The wetland plan shows the wetland will be graded so that any water is quickly discharged via an approximately 200 foot wide shallow swale to Miller Creek. Therefore, although hummocks have been added to the December 2000 NRMP to provide more topographic relief in response to comments previously made, in the absence of adequate hydrology, such habitat measures are largely ineffective. The "restored" wetland will not convey water sufficient to maintain wetland functions. Moreover the redesigned Miller Creek Channel is unlikely to convey water from the Vacca Farm storage facility because the Port's plans reflect that the creek channel will be hydrologically disconnected from the peat soils by a geotextile liner, needed to hold the water in place.[23] This condition is described in additional detail in comments on the project made by Dyanne Sheldon.[24]

56 5. Secondary effects on the wetlands that are anticipated as a result of the construction include altered hydroperiods, altered substrate conditions due to construction activities, and possible water quality issues that may have significant adverse effects on life stages of aquatic life forms.

57 6. The plan provides no pre-project monitoring of wetland hydrology to provide data for measuring post project success. There are therefore no baseline data to compare against when determining whether hydrologic impacts to wetlands have occurred. Without these data, there is no basis for enforcing further mitigation or adapting management because there is no clear target defined for the post-construction condition. The Port has had years to collect the data. Their absence precludes approval of the application at this time.

58 7. The headwater of Walker Creek continues to be incorrectly and inconsistently reported. Map 14 and Image #14 of the December 2000 Wetland Delineation Report show correctly that there are three tributaries to the start of Walker Creek within Wetland 44. These constitute the headwater of Walker

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[22] Revised Code of Washington, RCW 90.74.005 to 90.74.020 is located in Title 90 Water Rights-Environment.

[23] NRMP Appendices A-E, Sheet STIA-9805-C5.

[24] Dyanne Sheldon, February 16th comments on Seattle, Port of, 1996-4-02325

Creek, which begins east of SR509 in Wetland 44. The tributaries are seasonal seeps in the upslope areas, one of which is located east of 12th Avenue South. From there, Walker Creek travels west through a culvert crossing under SR509 to Wetland 43.

58 Although the correct information is available in the wetland delineation report, maps of the area in the NRMP shows the headwater of Walker Creek as the outlet of Wetland 43, and the text contained in Section 4.3.2.11 of the Wetland Functional Assessment and Impact Analysis (December 2000) repeats this misrepresentation. The report incorrectly states, "There are no perennial 'headwater seeps' that provide significant base flow to Walker Creek in the area where the embankment fill impacts Wetland 44." In fact, both Map 14 and Image #14 clearly show three tributaries to Walker Creek. Two of them become one perennial stream within the location of the embankment fill. Figure 5a shows the delineated boundary of Wetland 44 presented in Map 14 of the NRMP. Next to it, Figure 5b shows a map of the runway embankment footprint, as shown in Figure 3.1-1 of the NRMP, overlaid on Figure 5a. It shows that the southern-most tributaries are scheduled to be under the embankment fill.

57 In a previous version of the NRMP (August 1999), Map 10 of the Wetlands Atlas shows Walker Creek originating from the culvert under SR509 and flowing west and northwest until it disappears in under the wetland vegetation (provided in Figure 6a). Curiously, this creek channel, which actually exists, is not shown in the December 2000 Wetland Delineation Report map of Wetland 43 (provided in Figure 6b). This conceals the facts that the embankment construction will fill a portion of the headwaters of Walker Creek and that significant disturbance will occur within the remainder of the headwater wetland from construction activities. This serious harm to the headwater of Des Moines Creek hidden in contradictory reports subverts the permit review process.

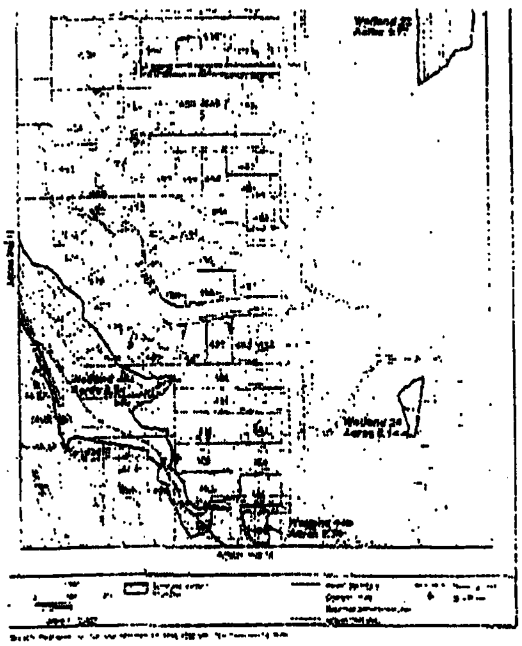

Figure 5a. Wetland 44 boundaries.

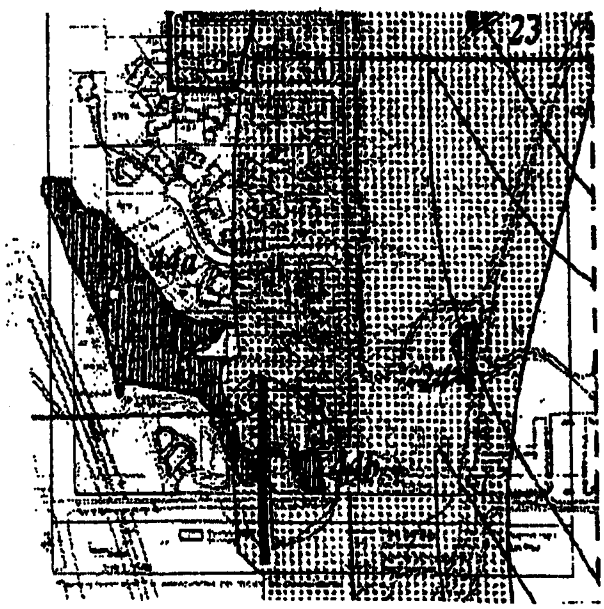

Figure 5b. Embankment footprint in relation to Wetland 44 boundaries.

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Figure 6a. Map 10 from August 1999 NRMP shows Walker creek channel.

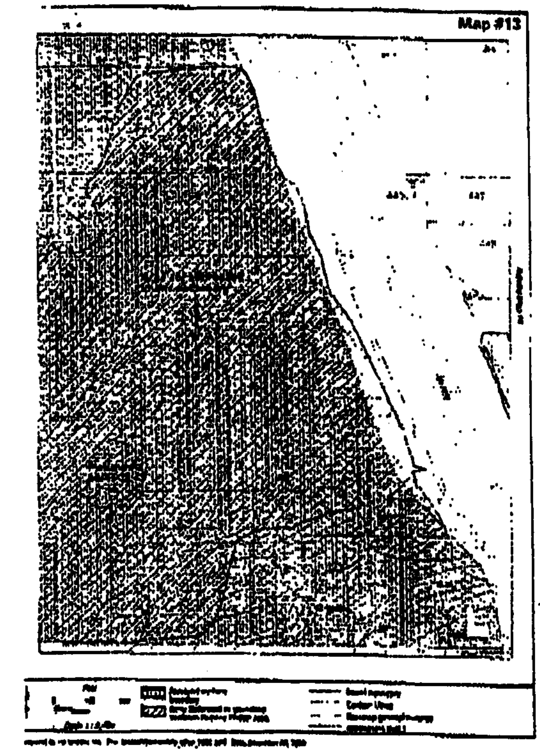

Figure 6b. Map 13 from December 2000 NRMP shows no creek channel.

The NRMP states that the stormwater system of SR509 is the headwater to Walker Creek because of its contribution to Walker Creek flows.[25] Although stormwater flows from SR509 may substantially increase Walker Creek, they cannot accurately be construed as the creek headwaters. The landscape position of Wetland 44 in relationship to 43, the presence of a clearly defined channel, and the perennial stream flows cited in the descriptions of Wetland 44 are clear evidence that Walker Creek's headwater is located in Wetland 44 and not in Wetland 43.

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Tributary flow volume is an unusual definition of a headwater. Although there are different ways to define a headwater, the generally accepted definition is that a headwater is defined by the furthest upstream tributary (from the mouth) that has a perennial flow. Using this more appropriate definition, Wetland 44 and its tributaries comprise the Walker Creek's headwater. Headwater wetlands and tributary seeps have an important ecologic and hydrologic role in maintaining function in a creek system and are protected for that reason. Filling a headwater wetland will alter a stream's condition profoundly. The runway embankment fill will negatively affect the Walker Creek system by filling the upland seeps and portions of the wetland that comprise Walker Creek's true headwater.

Summary

The proposed fill activities in wetlands simply do not comply with Part 230 of the Section 404 Guidelines, nor do they preserve water quality in the Miller and Des Moines Creek systems. They are likely to result in significant degradation of the aquatic ecosystem under Part 230.10(b). The proposed

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[25] Wetlands Functional Assessment, p. 4-64.

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61 project does not include all appropriate and practicable measures to minimize potential harm to the aquatic ecosystem. Moreover, in several key areas, there is insufficient information to support the claim that the proposed discharges will comply with Section 404 approval requirements. These shortcomings include no analysis of cumulative effects, no clear proposal of how to maintain hydrology to remaining wetlands, and no analysis of the impact the loss of the critical remaining wetlands in the Miller and Des Moines Creek watersheds will have on water quality and fisheries resources. Finally, the proposal ignores practicable in-basin mitigation alternatives that would likely have much less adverse impact on the affected aquatic ecosystems.

Thank you for your time spent in reviewing this material. Please call me or email me if you have any questions or comments.

Sincerely,

Amanda Azous

Attachments:

Azous Environmental Sciences Comment Letters Dated:
A. August 16, 2000
B. September 1, 2000
C. Vita: Amanda Azous

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Azous Environmental Sciences, February 16, 2001

1. Information regarding area of wetland loss, functions provided by impacted wetlands, mitigation to replace and/or restore impacted functions, and cumulative effects is available and the Port has provided this information in numerous documents, including the *Natural Resource Mitigation Plan, Wetland Functional Assessment and Impact Analysis, Final Supplemental Environmental Impact Statement, Final Environmental Impact Statement*, and *Biological Assessment.*

2. Analyses of wetland functions being impacted are presented in detail in the *Wetland Functional Assessment and Impact Analysis* report and are summarized in the *Natural Resource Mitigation Plan*. As explained in Chapters 3, 4, 5 and 7 of the *Natural Resource Mitigation Plan*, the mitigation plan has been designed to replace wetland *area and functions,* which will be impacted by the project. The mitigation plan has been designed to replace the suite of functions impacted by the project. For example, organic carbon export, resident and anadromous fish habitat, nutrient/sediment trapping, flood storage, groundwater exchange, passerine birds, etc. (see Table 30-3 of the *Wetland Functional Assessment and Impact Analysis*; Chapters 3, 4, 5, and 7 of the *Natural Resource Mitigation Plan*).

3. Evaluations of permanent and temporary impacts are based on methods described in the *Wetland Functional Assessment and Impact Analysis* report. These methods, and the criteria for determining impacts, are consistent with agency guidance and are based on an analysis of the specific areas impacted by project construction, the timing of construction, construction methods, pre and post-project wetland conditions, and operation of the projects.

4. Cumulative effects are discussed in the *Wetland Functional Assessment and Impact Analysis* report (Section 4.4). In addition, the *Natural Resource Mitigation Plan* includes discussions of cumulative effects related to each of the mitigation projects. See General Response to Comment #9.

5. The documents submitted for the Public Notice and supporting references provide the Corps and the Department of Ecology with extensive analysis and information on which to make informed and reasonable decisions as to whether the Master Plan Update projects meet Section 404 and Section 401 criteria. The Port's response to the commentor's assertion that information is missing from the *Natural Resource Mitigation Plan, Biological Assessment*, and *Wetland Functional Assessment and Impact Analysis* documents is discussed in the responses below.

6. The 2000 *Natural Resource Mitigation Plan* provides specific additions and enhancements to the mitigation plan in response to agency comments (see Table 4.1-3, *Natural Resource Mitigation Plan*). These additions in the quantity and quality of mitigation are related to the functional impacts of the projects on wetlands and streams, and provide increased assurance that the mitigation will compensate for project impacts.

The mitigation proposed by the Port has been specifically targeted at replacing functions impacted by the project that are described in the *Wetland Functional Assessment and Impact Analysis* report. For each mitigation project the *Natural Resource Mitigation Plan* provides mitigation goals, objectives, and performance standards that define specific ecological functions required to mitigate wetland and stream impacts. Chapter 4, Table 4.1-1, and Table 4.1-2 of the *Natural Resource Mitigation Plan* also summarize how the project impacts are mitigated.

7. The commentor's analysis of the Port's functional assessment lumps the five rankings used by the Port into two functional rankings. The comment fails to provide scientific justification for why rankings of "low", "low-moderate", and "moderate" should be reassigned to a single ranking of "low to moderate". Likewise, the rankings of "moderate-high" and "high" are reassigned to a single ranking of "moderate-high" in the comment. This re-ranking is not supported by objective scientific criteria and alters the Port's actual data and the conclusions that can be drawn from that data, as well as obscuring important information that is present in the Port's analysis. For example, the commentor's Figure 1 purportedly demonstrates that for two functions, groundwater exchange and nutrient/sediment trapping, more highly ranked wetlands are being impacted than low ranking wetlands. However, most of the wetlands in the lower category for nutrient/sediment trapping actually are ranked 'moderate' for that function in the Port's analysis (Table 3-3, *Wetland Functional Assessment and Impact Analysis*). For groundwater exchange, most of the wetlands in the lower category rank 'low' for the function. In this example, the commentor's analysis treats low ranking and moderate ranking wetlands the same. The use of only two functional rankings in Figure 1 results in a less than accurate picture of the relative functional ranking of wetlands being impacted.

The Port's analysis provides detailed information on the relative ranking of each function for each wetland being impacted by the project (Tables 3-3, *Wetland Functional Assessment and Impact Analysis*). This information allows for detailed analysis of the types of functions being impacted and the relative level of functional impact for each wetland. The Port has used this information, not only in the impact analysis, but to design mitigation that replaces, restores, and enhances functions relative to existing conditions.

8. The percentages of wetland acres lost reported by the commentor are based on assumptions that are not supported by the record, and do not reflect the actual acreage of lost wetlands. Likewise, the commentor's ranking system does not reflect actual wetland conditions.

9. The commentor's evaluations and conclusions regarding the targeted functions of the mitigation site do not reflect the goals and objectives stated in the *Natural Resource Mitigation Plan* for each mitigation project. The *Natural Resource Mitigation Plan* provides mitigation goals, objectives, and performance standards that define specific ecological functions required to mitigate wetland and stream impacts. Chapter 4, Table 4.1-1, and Table 4.1-2 of the *Natural Resource Mitigation Plan* also summarize how the project impacts are mitigated. These tables identify mitigation in-basin and out-of basin to mitigate for the suite of wetland functions impacted by the project. Waterfowl habitat and flood storage are not the primary functions targeted for replacement in the *Natural Resource Mitigation Plan*, and they are not referenced as such in Table 1.3-1 or pages 1-1 and 1-2 of the *Natural Resource Mitigation Plan*.

The mitigation plan is designed to replace, restore, and/or enhance *all wetland functions* impacted by the project, as clearly explained in the *Natural Resource Mitigation Plan*. Furthermore, the mitigation as designed will restore degraded wetland, stream, and stream buffer areas to higher levels of ecological function, for the broad range of functions impacted. For example, the proposed mitigation will restore wetlands adjacent to Miller and Des Moines Creeks that are currently dominated by turfgrass or farmland, with forested or shrub vegetation, greatly increasing organic carbon export, nutrient and sediment trapping, and amphibian habitat functions. This action will create some habitat for passerine birds and small mammals, and will eliminate some waterfowl habitat. The wetland mitigation along Miller Creek, including the riparian buffer enhancement and the Miller Creek instream enhancements will all improve habitat for resident and anadromous fish compared to existing conditions.

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The functions that are the focus of the mitigation plan proposed for the Miller and Des Moines Creek basins are:

- resident/anadromous fish habitat
- amphibian habitat
- exports organic matter
- sediment/nutrient trapping
- groundwater exchange
- flood storage (minor component at Vacca Farm)

The selected mitigation sites and design approaches will generally provide these functions at moderate to high levels.

The functions targeted for restoration at the off-site mitigation at Auburn *include all of the above*, (except resident and anadromous fish habitat) *plus:*

- waterfowl habitat
- passerine bird habitat
- small mammal habitat

Flood storage is a minor, but important function restored at the Vacca Farm site and flood storage functions will be established at the Auburn Mitigation site, but are ancillary to the greater concerns for wildlife habitat. Waterfowl (i.e. avian) habitat replacement is a component of the Auburn mitigation site, but not of the on-site mitigation. Creation or enhancement of wetlands in the airport environs will be subject to the requirements of the August *2000 Wildlife Hazard Management Plan*, which contains procedures for minimizing hazardous wildlife-attractants. Even though avian habitat replacement is one of the goals of the Auburn mitigation site, most of the Auburn mitigation will replace, restore and enhance high quality forested and shrub wetlands. These wetlands are designed to function at high levels for passerine bird habitat, waterfowl, amphibian habitat, small mammal habitat, nutrient and sediment trapping, groundwater exchange and flood storage.

10. Commentor's Figure 2 does not present new information on the scope of wetland impacts. The *Natural Resource Mitigation Plan* Table 3.1-2 shows the relative impacts to Class II, III and IV wetlands from the project. This table illustrates that in the Miller Creek basin 14.37 acres of wetlands will be impacted, and that 8.37 acres (58%) of this area is Class II wetlands, 5.03 acres (35%) is Class III and 0.97 acres (7%) is Class IV.

11. The analysis presented in the comment does not contradict the statements made in the Natural *Resource Mitigation Plan* and *Wetland Functional Assessment and Impact Analysis* report. These documents state that the wetlands to be eliminated are degraded, and their ability to provide most of the functions analyzed is significantly reduced because of the historical wetland degradation.

The commentor's observations relating to the loss of Category II wetlands cannot be extended to determine the loss of wetland functions because the Washington Department of Ecology's rating system is not a functional assessment system. For example, *Class II wetlands can be degraded functionally*, and receive a low or low to moderate rating for one or more functional categories. This is the case for wetlands filled in the Vacca Farm area (which are degraded by farming and draining) and Wetlands 18, 37 (which have been degraded due to grazing, residential development, ditching, and logging).

The project mitigation for wetland impacts to all wetland categories (Category IV, III, and II) focuses on efforts to restore and enhance functions in degraded Category II wetlands (the Vacca Farm area, wetlands riparian to Miller Creek, and the Tyee Valley Golf Course).

12. The mitigation is designed to replace and enhance the function of impacted wetland habitat.

Much of the forested and emergent habitat being impacted is degraded (forested habitats lack mature trees and native understory vegetation, while most emergent wetlands consist largely of lawns or golf course turf). The mitigation plan will replace the functions of these wetlands by replacing degraded farmland, emergent turf grass lawns, or golf course with forested or forested/shrub wetlands. Further mitigation, especially in buffer areas will restore a native shrub layer and increase tree density in areas that are partially treed areas of residential landscaping.

The substantial off-site mitigation being proposed includes large areas of forested wetland and upland habitats. The Auburn wetland mitigation, approximately 36 acres of forested wetland, 6 acres of emergent wetland and 6 acres of shrub wetland will be restored/enhanced. This mitigation will convert upland and Category III wetlands to Category II wetlands.

Constraints at the Tyee and Vacca Farm mitigation sites related to wildlife hazards limit the areas that can be restored as forested or emergent wetland; therefore, the Tyee site and portions of the Vacca Farm site are dominated by shrub wetlands. However, in-basin mitigation includes approximately 15 acres of forested wetlands, and 10 acres of shrub wetlands. Overall, the mitigation design includes mostly forested wetland (about 51 acres), with smaller amounts of shrub (about 16 acres) and emergent (about 6 acres) wetland.

13. The proposed mitigation complies with Clean Water Act Section 404 guidelines. As described above, the mitigation is designed to replace all functions impacted by project including:

- Resident/anadromous fish habitat (on-site)
- Amphibian habitat (on-site and off-site)
- Sediment/nutrient trapping (on-site and off-site)
- Organic carbon export (primarily on-site)
- Small mammal habitat (primarily off-site)
- Passerine bird habitat (primarily off-site)
- Waterfowl habitat (off-site)

As explained above, mitigation in the Des Moines and Miller Creek basins is not limited to creating scrub-shrub wetland. Flood plain restoration is a minor component of the Vacca Farm mitigation project, and must be included in the plan due to engineering designs for the third runway that require placing fill in the existing floodplain. Floodplain habitat restoration at this site will also replace important sediment/nutrient trapping, amphibian, and small mammal habitat.

14. The *Wetland Functional Assessment and Impact Analysis* report and supporting documents identify how permanent, temporary, and indirect impacts to wetlands were evaluated.

As explained below, the commentor's statements regarding the project design, potential wetland impacts, and mitigation measures, particularly for Wetlands 18 and 37, are not supported by the scientific evidence in the record. The commentor has based conclusions on an incomplete review of project materials and incorrect assumptions regarding project design, potential wetland impacts, and mitigation measures. As a result, conclusions made regarding temporary and indirect impacts to wetlands, especially Wetlands 18 and 37, are not supported by the record.

15. The commentor's position that the acres of wetland lost are commensurate with the proportion of functions provided by that acreage is valid in the case of evaluating wetland impacts to Wetlands 18, 37, R1, A12 and other wetlands partially impacted by the Master Plan Update projects. However, the comment disregards the Port's impact analysis and justification for why this determination is valid which leads to the incorrect conclusion that the impacts of the project have been underestimated. To properly conduct the analysis requires consideration of each of the habitat (fish, bird, waterfowl, amphibian, small mammals), hydrologic (groundwater exchange, flood storage, nutrient/sediment trapping), or other function (organic matter export), as was done in the *Natural Resource Mitigation Plan.*

The Port's approach of considering the impact proportional to the loss of wetland area is conservative and protective of wetland resources. Moreover, project information demonstrates that for several wetland functions, reductions in wetland size will result in little or no impact to wetland functions. For example, Wetlands 18 and 37 are rated as moderate and high, respectively, for resident and anadromous fish functions. This rating reflects the location of the wetlands adjacent to Miller Creek where wetland vegetation adjacent to the stream provides sediment/nutrient trapping, shade, and direct input of organic matter to the stream. Since project impacts will not remove overhanging vegetation or alter the stream channel in this location, fish habitat functions of the wetland will not change significantly. Because the project will not fill floodplain in this location, the floodplain functions of these wetlands will also remain unchanged.

Wetlands 18 and 37 provide high function for groundwater exchange (much of the wetlands are sites of groundwater discharge and provide baseflow functions to Miller Creek). The Port's analyses demonstrate that the project and its mitigation will not significantly alter the baseflow functions of the area. The combination of embankment design, stormwater management, and replacement drainage channels will maintain the base flow functions that Wetlands 18 and 37 provide. These analyses also indicate that the distribution of baseflow function is likely to be extended later into the summer months, and the function may thus increase.

Wetlands 18 and 37 provide high function for export of carbon to Miller Creek because of the riparian location, drainage channels, and roadside ditches associated with the wetlands that carry organic matter to the creek. Because project mitigation will replace these ditches and channels on a 1 to 1 basis, and vegetate their buffers with native tree and shrub wetland or riparian vegetation, the organic matter export functions of the wetlands would remain similar to their predevelopment condition. Over time (3-10 years) this function could increase, as all the replacement channels will contain native forest and shrub vegetation along their margins, where as existing roadside ditches are bordered by mowed grass.

For passerine bird, waterfowl, amphibian, and small mammal habitat functions, the assumption that functional losses are proportional to the loss of wetland area is justified. These wetlands contain relatively uniform emergent, shrub, and forest habitat types that will be lost proportionally by fill. The assumption is conservative however, because for both wetlands, the eastern portions that are subject to fill have also been subject to more recent vegetation clearing. The vegetation in the eastern area typically provides somewhat less habitat value for wildlife than the vegetation in the western portions of the wetland that are riparian to Miller Creek. Thus, pasture grasses and soft rush typically dominate the affected emergent communities, while the wetter emergent communities that would not be filled contain small-fruited bulrush and skunk cabbage. Some shrub communities that will be filled consist primarily of blackberry, while those that will not be filled include greater amounts of willow and red osier dogwood. The forested areas to be filled are typically young alder (10-20 years of age) while those preserved include

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some more mature alder and tall black cottonwood trees. The analysis of habitat impacts is also conservative because, as a result of the project:

- existing detrimental impacts to habitat functions (human use, vegetation management, grazing, and domestic pets) will be removed,
- remaining wetland and buffer areas will be enhanced with native vegetation, and
- the remaining wetland will be incorporated into the Miller Creek Buffer mitigation area.

Nutrient and sediment trapping functions of the remaining portions of the wetland will remain. And the replacement drainage channels will provide biofiltration functions. The replacement of existing development that lacks stormwater management facilities and generates non-point pollution with the project and stormwater management facilities will further assure that wetland losses do not result in water quality impacts.

16 The commentor's contention that a 1.4 acre wetland (the remaining size of Wetland 18 and 37) would not provide significant ecological functions is not supported by the field observations of wetland functions and discussion above. A review of the data in the *Natural Resource Mitigation Plan* Tables 1-2 and 3-3 shows that many wetlands much smaller than 1.4 acres have functional ratings as high or higher than Wetlands 18 and 37.

The Department of Ecology's rating system responds variously to wetland areas in classifying wetlands into one of four categories (Categories II, III, and IV for wetlands in the Master Plan Update project area). An example of how the Department of Ecology's wetland rating can be independent of wetland area[1] is the distinction between certain Category III and Category IV wetlands. Per the rating system, any wetland, regardless of how diminutive, is at least a Category III wetland if it is hydrologically connected to another stream, wetland, or pond. Alternatively, an isolated wetland as large as 2 acres can meet the criteria of a Category IV wetland. These ratings must be assigned independent of any specific evaluation of all the wetland functions that a functional assessment similar to that completed by the Port's would provide. While the rating approach helps identify a general ecological value a wetland may provide, it cannot be used to infer what the specific functional performance of a wetland may be. Thus, the commentor's conclusion that "smaller wetlands are less highly rated than the larger wetlands" is not reflective of how the functional assessment was completed, or of its results. In short, wetland functional performance is not necessarily affected by wetland size.

The commentor's hypothesis that by reducing the size of a wetland, one removes significant value in greater proportion than the percentage of lost is not borne out by an objective evaluation of the pertinent data and cannot be predicted by reliance on the Department of Ecology rating system as an accurate predictor of wetland function.

The Port has not assumed that "wetlands have uniform conditions" and recognizes that the degree of internal diversity is often correlated to the functional performance they may provide. As discussed in reports and above, each impact area has been assessed for habitat conditions and other indicators of various wetland functions. The impact assessment is based on these site-specific determinations, and not on assumptions.

17. The impact assessment for Wetlands 18 and 37 is discussed in detail above, and similar analyses were completed for Wetland A12 and Wetland R1. Wetland A12 is a 0.11 acre Category III shrub dominated wetland. Using Department of Ecology criteria, the specific features found in this wetland indicate it does not provide significant wildlife habitat. The scrub-

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[1] A careful study of the rating system will indicate that there are many other criteria used to rate wetlands that are independent of wetland area.

shrub vegetation and adjacent habitat around portions of the wetland allow it to provide "low to moderate" habitat function for passerine birds. A wetland of this size is likely unable to support all life history function of even a single pair of breeding birds, and it is simply a part of the overall upland habitat matrix available to birds and small mammals. With no unique habitat features lost and no loss of surface water, the wetland remaining after construction, and mitigation (i.e., incorporation into the Miller Creek buffer) would continue to provide the same (although proportionately less) habitat functions. The analysis is conservative, because as shown on Sheet STIA-XXX-L5 of Appendix B to the *Natural Resource Mitigation Plan*, both the wetland and buffer would be enhanced with native vegetation.

Wetland A12 was rated "high" for groundwater support functions. As demonstrated by the analysis of the embankment and mitigation for impacts on baseflow, groundwater functions of this wetland will remain following construction. The wetland was rated "moderate to high" for nutrient and sediment trapping functions. Considering loss of this function proportional to loss of wetland area is justified because following construction and mitigation, existing upslope development lacking stormwater facilities will be removed and the stormwater management facilities planned for the project will retain nutrients and sediments. The Department of Ecology rating for this wetland (Category III) would not change following construction.

Wetland R1 would remain functional following construction as explained on page 4-62 of the *Wetland Functional Assessment and Impact Analysis* report. The "low-moderate" habitat function for passerine birds and small mammals would be maintained or enhanced by the removal of adjacent houses, wetland enhancement, and re-vegetation of buffer areas. The remaining portion of the wetland fringing the stream would continue to provide organic matter inputs to the stream, and this function would be enhanced by the buffer enhancement plantings. The fill of portions of the wetland would not alter groundwater exchange and flood storage capabilities of the remaining wetland as the remaining wetland would continue to receive floodwaters, groundwater inputs, retain nutrients, and trap sediments. The Department of Ecology rating of this wetland (Category III) would not change as a result of the project.

18. All temporary and permanent wetland impacts are identified and accounted for in the *Natural Resource Mitigation Plan*, including temporary disturbances from construction. Where temporary construction impacts are indirect (i.e. noise disturbance of wildlife) the areas of impact are not quantified. Given the existing noise, human, and pet disturbances in the project area, the adaptation of existing wildlife to urban environments, and the temporary nature of the impact, substantial changes in wildlife use are not anticipated.

Wetlands 18, 37, R1 and A12 have been evaluated for fill impacts, indirect impacts, and temporary construction (both direct and indirect) impacts. These impacts are accurately determined and listed in the project documents. The scientific analysis used in determining these impacts is conservative and is discussed in the reports, in the responses given above.

19. The timeline for construction in Wetland 18 is anticipated to be last approximately 4 to 5 years, however the exact duration will depend on construction timing and the need to manage and treat stormwater during construction. However, it is important to note that the Port has considered impacts to Wetland 18 in the Pond E footprint and drainage channels located upslope of the pond to be permanent impacts and mitigation for these impacts is part of the mitigation for permanent impacts (See Appendix D, Sheet C5).

The timeline for construction near Wetland 37 is expected to range from 1 to 2 years.

The permanent stormwater detention ponds will not be excavated in wetlands, as the resultant interception of groundwater would result in lost storage capacity. Rather, they will be bermed

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facilities, generally constructed above the elevation of the existing ground (cross-sections are provided in the *Comprehensive Stormwater Management Plan*).

The *Natural Resource Mitigation Plan* identifies a detailed restoration plan to mitigate these temporary impacts. The plan will involve, as necessary, "tilling or disking of the soils to loosen compacted soils and the addition of soil amendments" to ensure a suitable planting medium.

Obviously, the lifecycles of relatively sedentary or immobile animals using the wetland will be disrupted. Insects and other immobile invertebrates will be likely be killed or displaced. The wetlands are rated low as habitat for amphibians, but if they are present during non-breeding periods they will be disrupted until new habitat is provided. Birds and small mammals are expected to leave the portions of wetlands where temporary construction impacts occur. There are no unique habitat features in these areas, and the wetlands are populated by common species of wildlife that are expected to occur in both upland and wetland habitat throughout the urbanized project area. There is no evidence that these impacts are likely to result in eliminating entire populations of wildlife in the vicinity of the airport.

The delay in providing the replacement functions of the emergent and shrub wetlands is likely to occur in several years to a decade. The delay in providing replacement habitat functions for the early succession alder forests are about 1–2 decades. Groundwater discharge functions will be replaced within 1 years. Water quality functions will largely be replaced upon stabilization of soil surfaces hydro-seeding (up to 1-year), but minor additional increases in this function would occur over a longer time frame as shrub and emergent vegetation matures. Organic matter export functions would be restored over a 2 –10 year time frame as woody vegetation begins to encroach over replacement drainage channels.

20. The commentor's conclusion that it would take more than 50 years for temporary impacts to be restored is unsupportable because the affected wetlands have been subjected to on-going habitat and other disturbances for extended time frames. They therefore do not support the mature plant or animal communities that would require more than 50 years to restore. Where present, alder forest and shrub thickets range from 10 – 30 years of age. The rationale for how remaining portions of Wetlands 18, 37, A12 and R1 will remain functional is discussed above.

All wetland impacts of the project are correctly reported and fully mitigated.

21. Cumulative impacts have been addressed in the project analysis. See General Response #9 that discusses cumulative impacts. The analysis concludes that impacts of the Master Plan Update projects are mitigated through the *Comprehensive Stormwater Management Plan* and the *Natural Resource Mitigation Plan*. Because potential impacts to wetland and stream functions are mitigated, the Master Plan Update does not contribute to cumulative wetland impacts. The analysis further concludes that other projects that may result in filling of wetlands will be required to meet standards of the Clean Water Act, State Environmental Policy Act, National Environmental Policy Act, and local wetland protection ordinances. For approval, the projects will be required to mitigate wetland impacts, so cumulative loss of wetland function is not anticipated.

The Master Plan Update projects impact 18.37 acres of existing degraded wetland.

- In-basin mitigation will provide 25.21 acres of wetland restoration/enhancement and 41.80 acres of upland buffers enhancement.
- Out-of-basin mitigation will provide 29.28 acres of wetland restoration and creation, 19.50 acres of wetland enhancement, and 15.90 acres of upland buffer enhancement.

22. The analysis provided considers that to meet permitting requirements, impacts to wetland area, wetland functions, and beneficial uses of surface waters must be avoided or fully mitigated.

Thus, there are no cumulative impacts to wetlands or surface waters. It is unreasonable to presume that future projects will be able to fill wetlands and not mitigate for this impact, so future projects that involve fill impacts to wetlands will not contribute to cumulative impacts.

23. The *Final Environmental Impact Statement* and *Final Supplemental Environmental Impact Statement* have evaluated upland and wetland wildlife habitat and vegetation. Based on the low quality of most forest, shrub, and grassland habitats altered and the use of this habitat by common wildlife species widely adapted to suburban/urban environments, the *Final Environmental Impact Statement* and *Final Supplemental Environmental Impact Statement* determined that significant impacts to wildlife habitat or populations would not occur. The Master Plan Update projects are not contributing to cumulative impacts on these wildlife species.

24. The Port's analysis demonstrates that watershed dependent wetland functions will be fully mitigated in the impacted watersheds. Potential impacts to Miller, Des Moines, and Walker Creeks are evaluated and fully mitigated. Thus, no cumulative impacts are expected to result from the project. The establishment of avian habitat mitigation in Auburn provides adequate mitigation for bird species that currently use habitat near Seattle-Tacoma International Airport. Also, as recognized in the Norman comment letter, these species are dispersed over the landscape and occur in many urban habitats. The analysis unit for highly mobile bird species adapted to urban habitats should not be small watersheds, but a much broader region.

Project impacts on chinook salmon have been addressed in the *Biological Assessment*.

25. The localized impacts to wetlands and streams have been evaluated in the *Final Environmental Impact Statement* and *Final Supplemental Environmental Impact Statement*, and mitigating these impacts are the subject of the *Natural Resource Mitigation Plan*. The mitigation in basin for filling 18.37 acres of existing degraded wetland includes providing **in-basin,** 25.21 acres of wetland restoration/enhancement and 41.80 acres of upland buffers enhancement. Additional mitigation is provided out of basin. The complete mitigation, designed to replace wetland functions potentially lost by the Master Plan Update projects, will effectively assure that localized and cumulative impacts of the project do not occur.

26. The comment fails to consider data presented in Table 1-3 of the *Wetland Functional Assessment and Impact Analysis* report and the wetland functions that will be replaced through mitigation. See response to comment 24.

27. The commentor's consideration of cumulative impacts fails to include the data provided regarding wetlands in the project area and the benefits that mitigation provides in mitigating for the impacts of the Master Plan Update projects to wetland functions.

28. The Port has avoided and mitigated wetland impacts per Clean Water Act requirements (see Table 4.1-1 and Table 4.1-2) as part of the planning and permitting of the Master Plan Update projects. These actions, coupled with the extensive stormwater management facilities provided to protect stream resources (see the *Comprehensive Stormwater Management Plan)* demonstrate that the Port, and the resource agencies, are taking steps to protect both Miller and Des Moines Creeks.

29. The mitigation proposed by the Port, as discussed above, prevents degradation of the Miller, Walker, and Des Moines Creek watersheds.

The Port's consultants have followed requirements of the Federal Aviation Administration's Record of Decision regarding mitigation of wetland impacts, which requires that the Advisory Circular 150/5200-33, entitled *Hazardous Wildlife Attractants On Or Near Airports* (5/1/97) be followed. In implementing this requirement, the Port, its consultants, and the Federal Aviation Administration have determined the proposed in-basin mitigation is acceptable where existing wildlife hazards are reduced, and where the ability to manage the mitigation areas for wildlife hazards is retained consistent with the procedures outlined in Section 10 of the August 2000 *Wildlife Hazard Management Plan*.

30. The commentor mis-states the conclusions contained in Section 3.4 of the *Wildlife Hazard Management Plan*. The *Wildlife Hazard Management Plan* identifies that a wide variety of avian and non-avian species contribute to wildlife hazards at the Airport. Review of Section 1.2, Table 3.1, Section 3.2, and Section 3.4, Table 2 indicates that wildlife hazards at the Airport are not limited to geese and waterfowl. Table 6-2 of the *Biological Assessment* lists wildlife that has been struck by aircraft near Seattle-Tacoma International Airport runways. The table indicates that several avian species that use a wide variety of wetland and upland communities are of concern at the Airport. The statement that forested wetlands with closed forest canopies "do not cause safety concerns" is not supported by the experiences of wildlife management professionals at Seattle-Tacoma International Airport or other airports around the country. This habitat type can support a wide variety of birds that forage near the Airport Operating Area, including large raptor species.

Wildlife management at Seattle-Tacoma International Airport is complex because of the individual requirements of particular species, interactions between predator and prey species, and the variety of micro-environments necessary to sustain populations of the variety of bird species while foraging or nesting. Thus, effective wildlife management requires more than just removing "preferred habitat," which in many cases may include jurisdictional wetlands and open water habitats that are subject to regulatory protections. Section 10 of the *Wildlife Hazard Management Plan* establishes procedures for minimizing wildlife hazards from the proposed on-site mitigation.

Much of Site 8 is already used for mitigation, as it has been incorporated into the on-site Miller Creek buffer enhancement area. Additional mitigation at Site 12 is not needed because, as discussed above, the on-site wetland, stream, and stormwater mitigation actions mitigate for the loss of wetland functions. Site 12 is located within about 1,800 feet of the proposed new runway, and creating wetlands here would not comply with the Federal Aviation Administration's Advisory Circular 150/5200-33 or the Federal Aviation Administration's Record of Decision for the project.

The bird strike record (Table 6-2 of the *Biological Assessment*) indicates that a wide variety of birds, which use a wide variety of habitats (including forested wetlands), are subject to aircraft collisions at Seattle-Tacoma International Airport. The commentor concludes that bird species using wetlands at Site 12 would not "fly as high as the runway would be in relation to the wetlands"; however, this is not supported by the data.

31. The runway embankment affects the eastern portion of Site 8. Much of the remaining portion of Site 8 is incorporated into the on-site mitigation, in a manner acceptable to the Federal Aviation Administration's concerns regarding wildlife attractants.

32. The Port has used other sites to mitigate, in-basin, for the impacts to wetland functions potentially impacted by the project. This mitigation protects and enhances salmon bearing streams.

33. The Port's mitigation proposal mitigates in-basin for wetland impacts. There are no requirements to mitigate for habitat impacts associated with alteration of low quality upland vegetation. There are no substantial "remnant natural sites" that provide undisturbed high quality habitat in the project area that are not already protected by their wetland status.

34. The potential organic carbon export function was considered in the impact assessment, and mitigation is designed to specifically replace these functions in both the Miller and Des

Moines Creek watersheds. In Miller Creek, converting plowed farmland to shrub wetlands will convert the existing system, where organic matter export to the creek is low (due to annual harvest of crops), to a high-export, shrub wetland linked directly to the creek through its floodplain and through overhanging woody vegetation. Also in the Miller Creek watershed, replacement drainage channels that are lined with overhanging woody vegetation replace roadside ditches. The replacement channels will also convey organic matter to downslope areas and Miller Creek.

In Des Moines creek, mitigation will convert mowed golf course wetlands to shrub-dominated wetlands. This will convert a system where organic matter export to the creek is low (due to periodic mowing of grass and removing residues from the area) to a high export shrub wetland linked directly to the creek through its floodplain and through overhanging woody vegetation.

Further, in both the Miller Creek and Des Moines creek watersheds, enhancement of riparian buffers will increase the density and diversity of vegetation contributing organic matter to the currently sparsely vegetated creek channels.

35. There are no sedge meadows that will be filled by the project, and the emergent wetlands to be filled are typically mowed lawns, golf course areas, or pasture. Organic matter from agricultural operations, lawns and golf courses is typically removed from the site and never reaches wetlands or streams. Replacing these areas with forested and/or dense shrub wetlands will increase organic carbon export compared to existing conditions. Replacing existing non-native wetland vegetation with native wetland/riparian species will also result in increased organic carbon export. Establishment of sedge meadows at Vacca Farm or Tyee Golf Course mitigation sites is not proposed because these sites are not wet enough to support native wetland sedge communities in the long term.

The proposed mitigation will replace and enhance carbon matter inputs to wetlands and streams. The Vacca Farm, Miller Creek riparian wetland enhancement, Miller Creek buffer enhancement, and Tyee wetland mitigation areas will all deliver organic matter to in-basin streams.

36. Organic carbon export functions of wetlands have been considered and fully mitigated by restoration of riparian wetland and buffers. The restoration will increase the export functions of the currently degraded area and replace the functions lost through Master Plan Update project construction. Nitrogen cycling, eutrophication in the shoreline environment, and food web shifts would not occur.

In addition to mitigating for carbon export functions; the project will also remove existing land uses from both watersheds that are likely to contribute nitrogen and other chemicals to the creeks. Proposed mitigation will remove a golf course, septic systems, lawns, gardens, agricultural land, and a plant nursery, all likely sources of nutrient inputs to surface water.

The mitigation will reduce current levels of nutrient inputs to in-basin aquatic systems because of increased sediment and nutrient trapping functions associated with restoration of the Vacca Farm and Tyee Valley Golf Course.

The replacement drainage channels will enhance inputs and transport of organic matter compared to the existing roadside ditches. The drainage channels will have forested/shrub banks that will contribute litter to the channels and ultimately to the wetland and streams.

37. This concern would not occur, because, as explained above, a shift in food webs would not result from the project.

38. Organic carbon inputs would not decrease, as explained above. Therefore the commentor's concerns regarding dissolved organic carbon, metal availability, toxicity to salmon, and stormwater discharges would not occur.

39. The borrow sites are former residential neighborhoods that are covered by a variety of vegetation types, including blackberry, abandoned residential landscaping, and remnant areas of second growth forests. The borrow areas will not be completely cleared of vegetation. For example, in many cases wetlands have been preserved and buffers will be left around the perimeter and adjacent to wetlands.

Upon completion of excavation, the borrow areas will be reclaimed to a stable land surface configuration and revegetated. The base of the borrow areas will be revegetated and will have gently sloping grades, which will locally enhance infiltration. Existing, relatively impermeable glacial till surficial soils, will be removed. Thus, the post-mining condition of the borrow areas will allow for enhanced infiltration rates relative to the pre-mining conditions and are expected to remain high following excavation. The removal of forest vegetation and replacement with herbaceous and/or shrub vegetation will reduce evapotranspiration losses, potentially making more water available to infiltration due to a reduction in evapotranspiration. Without forest vegetation, soil water will be available for infiltration earlier in the fall and later during the spring months than is currently likely, losses of precipitation due to interception by a tree canopy would also decrease, and the overall precipitation contribution to groundwater would likely be increased.

Evapotranspiration from the Borrow Areas will not be "eliminated." Following excavation, the Borrow Areas will be revegetated in accordance with an approved reclamation plan. The groth of this vegetation would result in evapotranspiration.

40. Performance standards reflect that these wetlands are maintained by marginal wetland hydrology that is present during the winter and early spring months. In addition to observation of hydrologic conditions in these wetlands, the vegetation and soil conditions also indicate the wetlands are subjected to early season saturation. The performance standard is thus planned to maintain the existing hydrologic conditions in the wetland.

There are no plans to "extend and prolong the hydroperiod of wetlands that are currently fed by shallow groundwater". Appendix D of the *Wetland Functional Assessment and Impact Analysis* report describes and illustrates contingency measures to convey groundwater to wetlands in Borrow Area 3. Wetland hydrology in Borrow Area 1 is maintained by avoiding excavation in them (thus maintaining the perching soil conditions) and avoiding their upslope watersheds (for Wetlands 48 and B15). For Wetlands B4 and B12, seasonal hydrology will be preserved by avoiding excavation of their perching soil layer and the grading plan, which provides and upslope infiltration and positive drainage.

41. The performance standard will maintain wetland functions because it maintains the existing baseline conditions in these wetlands - i.e., the performance standard reflects the typical duration that these wetlands experience wetland hydrology.

If 'uplands' experienced saturated soils into March or April, they would meet the wetland hydrology criteria, support wetland vegetation, and likely be classified as such. A large percentage of wetlands in the Northwest, and all of the wetlands of concern near the Borrow Areas, lack saturated soils during the late spring and summer months. Performance standards for these wetlands reflect observations that the wetlands lose the wetland hydrology parameter in early to mid spring, once rainfall rates decrease and increased evapotranspiration results in consumption of soil moisture.

42. This performance standard is based on maintaining the existing hydroperiod and hydrology of these wetlands. These wetlands currently begin drying in March when evapotranspiration begins, and do not support species that require water into the middle of June.

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For example, the performance standard for Wetland 30, which does retain saturated soils longer than the other wetlands, the performance standard is standing water from December through May (i.e., the resident amphibian breeding season) in years of normal rainfall.

43. Some aquatic dependent species may require water to be present through the second week in June; however, this is not true for the species that occur in these wetlands, nor is it true of existing conditions in these wetlands.

The proposed mitigation will provide existing water to wetlands; hydroperiods will not be changed, baseflows in Des Moines Creek will be maintained.

Hydrological impacts of excavating borrow areas have been extensively evaluated and are minimal, as documented in the series of studies referenced in the *Wetland Functional Assessment and Impact Analysis* and *Natural Resource Mitigation Plan.*

44. No work has occurred in wetlands.

Work that is occurring in upland areas is being conducted to be protective of nearby wetlands. Wetland protection actions include:

- A minimum 50-foot buffer between all construction activities and wetland boundaries
- Installation of silt fences, straw bales and other best management practices to protect water quality in wetlands
- Installation of security fences around wetlands

Extensive analysis of impacts from fill to hydrology of nearby wetlands has determined that such impacts are minimal and/or beneficial.

Most of the wetlands near construction clearing activities are Class III or IV: (Class III: Wetlands 12, 13, 15, R1, W1, W2, 19; Class IV: 23, 63). These Class III/IV wetlands lack significant habitat for wildlife species so impacts to wildlife from construction would be minimal. Significant clearing has not occurred near Class II wetlands (i.e., 18 and 52) that would result in isolation from other contiguous habitats. For example, although construction is taking place near Wetland 18, this wetland is still contiguous with habitat to the north, south and west.

45. See response above.

46. There are no listed species that occur in these forested habitats in the project area. As explained above, the work has not resulted in significant impacts to biological or physical functions provided by the wetlands. There is no evidence of damage to regulated wetland areas, and the Port has not circumvented any permit processes by engaging in the pre-construction activities.

47. The *Natural Resource Mitigation Plan* identifies how seepage flows will be collected and distributed to wetlands, as explained further below.

48. The collection and diversion of seepage flows to wetlands is shown in the drawings and explained in the *Natural Resource Mitigation Plan* and *Wetland Functional Assessment and Impact Analysis* report. See further comments below in Response 49.

49. Movement of water through the fill and mechanically stabilized earth wall has been evaluated extensively. Several studies and technical memoranda have been prepared detailing how water will flow through embankment fill and mechanically stabilized earth wall maintaining wetland hydrology downslope. Additionally, shallow groundwater will continue to support wetlands and Miller Creek west of the mechanically stabilized earth wall and embankment.

Documents that describe and substantiate that the hydrology of the wetlands located downslope of the embankment and wall are:

- *Sea-Tac Runway Fill Hydrologic Studies Report* (Pacific Groundwater Group) – This report was funded by the Washington State Department of Ecology
- *Geotechnical Report* (Hart Crowser 1999)
- *Wetland Functional Assessment and Impact* report (Parametrix, Inc. 2000)

The *Natural Resource Mitigation Plan* describes and illustrates how water will be discharged to the downslope wetlands. The replacement drainage channels are described in Section 5.2.3 of the *Natural Resource Mitigation Plan.* Design details showing the channel grades, cross sections and flow dispersal trenches are shown in Appendix D (Sheet C8) of the *Natural Resource Mitigation Plan.* Additionally, page 28 in Appendix B of the *Wetland Functional Assessment and Impact Analysis* report (Parametrix, Inc. 2000) describes facilities to maintain water supplies to wetlands located downslope of the embankment and mechanically stabilized earth wall that assure the function of the downslope wetlands and mitigation.

The replacement drainage channels will be located west of the mechanically stabilized earth wall, embankment, and security road. These channels will serve to collect seepage water diverted from the inner collection swale or seeps from the embankment underdrain. The inner collection swale will serve to collect water from the embankment, mechanically stabilized earth wall, and security road. Water from this inner collection swale will be conveyed under the security road to the replacement drainage channels, and ultimately to the wetlands located west of the project area. Water within these channels will be directed to wetlands to maintain hydrology.

The design sheets convey the required information regarding project mitigation. Segment C and Segment D of the replacement drainage channels are north flowing. Segment C conveys water to Wetland 37; Segment D conveys water to Wetland R9 and A13.

Appendices A and B of the *Wetland Functional Assessment and Impact Analysis* report identifies the design and purpose of the temporary erosion and sedimentation control swales and the inner collection swale. The Appendices identifies that portions of the temporary erosion and sedimentation control swale will, following construction, be incorporated into the replacement drainage channels. These swales will serve to collect and direct construction runoff to sedimentation ponds. Water from these ponds will be pumped to stormwater treatment and detention ponds and discharged to Miller Creek at existing outfalls.

The swale shown in Pond D on Sheet C6 is the temporary erosion and sedimentation control swale that will be constructed prior to the construction of stormwater Pond D. This temporary erosion and sedimentation control ditch would be used only during initial construction and construction staging. Prior to completion of the project, Pond D will be constructed in the footprint shown. When this pond is constructed, the portion of the swale within the ultimate boundary of the detention pond will be removed. The finished grading plan for Pond D is shown in Appendix I of the *Wetland Functional Assessment and Impact Analysis* report.

The channel segments identified in the *Natural Resource Mitigation Plan* mitigation are the minimum channel lengths required to replace channel lengths being impacted. The remainder of the channels shown on plan sheets with buffers may also collect seepage water from the embankment or the inner collection swale. The additional lengths of channel provide flexibility in how and where the seepage water is discharged to the wetlands and Miller Creek, if during monitoring and adaptive management, contingency needs are identified.

The grading plans that are part of Appendix D (Sheet C8) of the *Natural Resource Mitigation Plan* show the temporary erosion and sedimentation control ditch to be 2-3 feet deep in upland portions adjacent to Wetland 18 and 37. This ditch is about 1 foot deep where it crosses Wetland 18 and 37. The ditch is designed to be as shallow as possible because the wetland areas it crosses are areas of ground water discharge, and there is no need or desire to collect shallow groundwater from wetlands. By constructing the ditch shallow across wetlands, the amount of groundwater collected in the stormwater ponds during the winter months when it is at the surface will be minimized, as will potential impacts to wetlands.

As described in the *Natural Resource Mitigation Plan*, the temporary ponds will be restored to their pre-construction topography by regrading and backfilling with soil similar to the soils excavated. Shallow groundwater and seeps that feed Wetland 18 and 37 will be maintained through construction of the underdrain, collection swales, and replacement drainage channels.

The 1-foot contours provided on the design drawings show that the replacement drainage channel depths are 0-3 feet in depth. The relationship of the swales to the downslope wetlands can also be determined from the grading plan. Where the swale crosses wetlands, the west side of the swale is shown to be at elevation of the wetland. Thus, water collected by the swale can disperse into the wetland.

Sheet C8 of Appendix D to the *Natural Resource Mitigation Plan* shows flow dispersal trenches. The flow dispersal trenches are not designed for infiltration. They are designed to allow water to disperse over broad areas into wetlands. They are designed to avoid concentrating water in wetlands, and represent an improvement in the existing condition where the culverts beneath 12 Avenue South concentrate water in several localized areas of Wetland 18, 37, and 44.

The potential impact of permanent stormwater detention ponds on the hydrology of downslope wetlands has been analyzed in the *Wetland Functional Assessment and Impact Analysis* report (See Section 4.3.2.12 and Appendix I). Groundwater data for this area, in relation to the ground elevation is shown in Appendix I and discussed in the *Wetland Functional Assessment and Impact Analysis* report. Because of the excavation, a small indirect impact to the uppermost section of Wetland 39 could occur where the pond is excavated below the elevation of the wetland. Because Pond D has been designed to infiltrate water into the soil, and with an additional orifice to discharge treated stormwater to the wetland, the indirect impact may not occur.

50. See response to comments on Letter #7 (GeoSyntec).

There is no reason to suspect that the mechanically stabilized earth wall would be detrimental to forest and shrub wetlands located more than 50 feet away from its base, or Miller Creek located more than 100 feet from its base.

The plants and animals found in the project area are widely distributed across a very broad array of micro and macro-climates over their large geographical ranges. They are expected to occur from lowland areas of Puget Sound, through the Cascade foothills, and typically from northern Oregon into southern British Columbia. Many species, however have even broader geographic ranges, extending into and over the cascade mountains, into warmer and more arid regions of Oregon, or into wetter and cooler regions of British Columbia. Even if minor microclimatic changes were to occur near the wall, they would not be substantial enough to affect species distributions or their biology.

The wall would increase shading of the creek by up to 15 minutes daily. This would not be expected to significantly affect the wetland or creek environment, as a tree and shrub canopy already provides shade to wetlands and the creek. The wetland and riparian area of Wetland 37 may receive amphibian use due to the extended period of soil saturation and shallow (less than 2 inches deep) ponding that occurs on the site. The site conditions would not be expected to support amphibian breeding,

Even if amphibians do breed in the area, and even if the wall were to delay the phenology (i.e. egg development, metamorphosis, etc.) by "a few weeks," impacts to the species would be unlikely. The commentor argues that if eggs were to develop later in the year, they would be at greater risk to drying conditions in the wetlands, yet all hydrologic analysis of groundwater movement into wetlands adjacent to the embankment have found the period of discharge to the wetlands will be extended into the summer months. But even if temperatures were cooler and egg development delayed, the cooler temperatures themselves would promote and extended the wetland hydroperiod because evapotranspiration losses by vegetation in the wetland would be reduced.

The commentor also argues that the wall impacts of "cooler temperatures created by the wall from shading effects" at some point, for unexplained reasons, will shift to "creating higher summer temperatures" that could impact stream temperatures and biota. While the wall could retain heat, the presence of a forest and shrub canopy over wetlands and streams will block transfer of radiant heat to the stream. If warming were to occur, air convection would further limit impacts by promoting warm air to rise up away from the creek and wetlands.

51. As explained in several responses above, the key in-basin mitigation for the project includes:

- stormwater and water quality management to protect the creeks and aquatic systems
- design of the embankment fill to allow groundwater discharge to continue to support downslope wetlands and aquatic systems
- replacement of filled flood-storage volume
- restoration of stream buffers to enhance and restore aquatic habitat
- restoration and enhancement to provide physical and biological functions that replace specific functions affected by fill
- off-site mitigation to fully replace avian habitat function

52. See responses above regarding mitigation for wetland wildlife habitat functions at remote locations to comply with the Federal Aviation Administration Advisory's Circular 150/5200 33 and to minimize the safety risk the traveling public.

As explained in several responses above, the mitigation as a whole will be timed, designed and located in a manner to provide equal or better biological functions than currently exist.

53. The Port is proposing a combination of ponds and vaults to detain stormwater for the project. Stormwater vaults will not attract, trap, or provide habitat to wildlife for several reasons. Where open water is present for short duration, storm water ponds will be netted to prevent use by birds. Vegetation management in stormwater ponds (frequent mowing) will further reduce use by birds and other wildlife. Since stormwater ponds are not "wet ponds" they will lack aquatic habitat that could attract amphibians. Stormwater ponds would not be accessible to fish due to the gradient flow conditions of outfall pipes and will be managed according to the *Wildlife Hazard Management Plan*, which may include the use of netting to prevent use by birds. Vegetation management in stormwater ponds (frequent mowing) will further reduce use by birds

and other wildlife. Since stormwater ponds are not "wet ponds" they will lack aquatic habitat that could attract amphibians. Stormwater ponds would not be accessible to fish due to the gradient flow conditions of outfall pipes.

54. The habitat and ecological value of wetland mitigation at Vacca Farm is explained above. The peat soil at the Vacca Farm site is identified as "Rifle" peat, a fibrous, woody peat. It forms in depressions on glacial outwash soil series such as the Vashon advance outwash (a medium dense sand soil series mapped in the vicinity of the Miller Creek Valley). The characteristics of the peat include moderate permeability (for example, the Soil Conservation Service estimates the permeability of similar peat soils to be on the order of 0.63 to 2 inches per hour). An estimate of field capacity based on the Soil Conservation Service data is 0.4 inches/inch, indicating that a considerable amount of the soil moisture will be retained after gravity drainage from the peat has ceased. In comparison, the underlying dense sand in the outwash material has permeability estimated at less than 1.4 inches per hour, and an available water capacity about 0.1 inches/inch.

The quantity of peat removed that could potentially provide water storage is 10,000 cy, and represents a potential volume of 108,000 cubic feet of water if filled to capacity. Assuming the total porosity of the peat is 0.8, the peat could store 108,000 cubic feet of water [10,000 x 27 x (0.8 - 0.4) = 108,000]. If the rate of release to the creek were uniform over the dry months (May-September), the average daily flow would be on the order of 0.008 cfs [108,000 cubic feet/(160 days x 24 hours x 60 minutes x 60 seconds) = 0.008]. This estimate is high because it neglects the evapotranspiration losses of water to the atmosphere instead of the creek and the timing of release of water from the peat to the stream.

The timing of the release of water stored in the peat is not likely to be uniform throughout the summer – most release would occur during late spring and early summer, prior to minimum stream flows. In fact, the observations of irrigation on the site during the summer months indicated that due to evapotranspiration and a relatively rapid release rate, water storage in surface peats is beneath field capacity by early summer. Thus, the potential impact of peat excavation on low stream flows is likely considerably less than 0.008 cfs, which is immeasurable and insignificant compared to the 1cfs minimum flow of the creek. However, the potential minor losses in lowflow due to peat excavation are mitigated by removal of water withdrawals from Miller Creek.

55. Wetland hydrology at the Vacca Farm site is supported by high groundwater elevations, with minor contributions from overbank flows.

The wetland will not receive water only during extreme storm events (see Chapter 5 of the *Natural Resource Mitigation Plan*). The channel is designed to overtop its banks at flows greater than annual peak flows. In addition, the wetlands are largely maintained by a high ground water table on the site that is present due to groundwater discharge and not flooding by the creek channel.

Micro-topographic features have always been planned as a design feature of the Vacca Farm mitigation as explained in the *Natural Resource Mitigation Plan*. Details showing the construction of micro-topographic features were added to the plan sets of the *Natural Resource Mitigation Plan* in response to the request from Ecology.

The wetland mitigation at Vacca Farm is not designed to convey water and maintenance of wetland functions is not reliant on the wetland 'conveying' water. The wetland is *not* designed to pond water for long duration.

The floodplain is designed to drain water back to the creek channel as flows in it subside and to prevent long-duration ponding on the floodplain that could attract hazard wildlife. The design of the floodplain and swale, in conjunction with the dense forested/shrub wetland vegetation to be planted will allow flood waters to drain off the site without attracting hazard wildlife.

See the responses to Letter #14 (Sheldon) for a full explanation of the channel design, peat soils and geotextile 'liner.'

56. These impacts will be avoided through the use of temporary erosion and sedimentation control measures, fill criteria, or mitigated as described in the *Natural Resource Mitigation Plan*.

57. Indicators such as existing vegetation, soils and hydrology provide the basis for determining if wetland hydrology is sufficient to maintain existing habitat functions post-project.

See response to Letter #14 (Sheldon) on pre-project monitoring.

58. The commentor's remarks regarding fill of perennial seeps are incorrect. The portions of Wetland 44 where fill will occur are located upslope of perennial seeps. The fill would affect a channelized portion of the wetland that, primarily due to stormwater runoff from streets and conveyance through culverts has concentrated to form channelized flow. During winter months, some soil water also seeps into this portion of the channel.

Headwaters are defined under Corps regulations as the *point* on a non-tidal stream above which the average annual flow is less than five cubic feet per second", since the channel in question has flows much less than 5 cubic feet per second, it is above this point, and above the headwaters of Walker Creek.

The two channels discussed are mapped as perennial on Parcel 496, which is located downstream of Parcels 494 and 493. Permanent fill will not extend westward from Parcel 494 or 493 to Parcel 496, and thus will not be placed in channels with perennial flow.

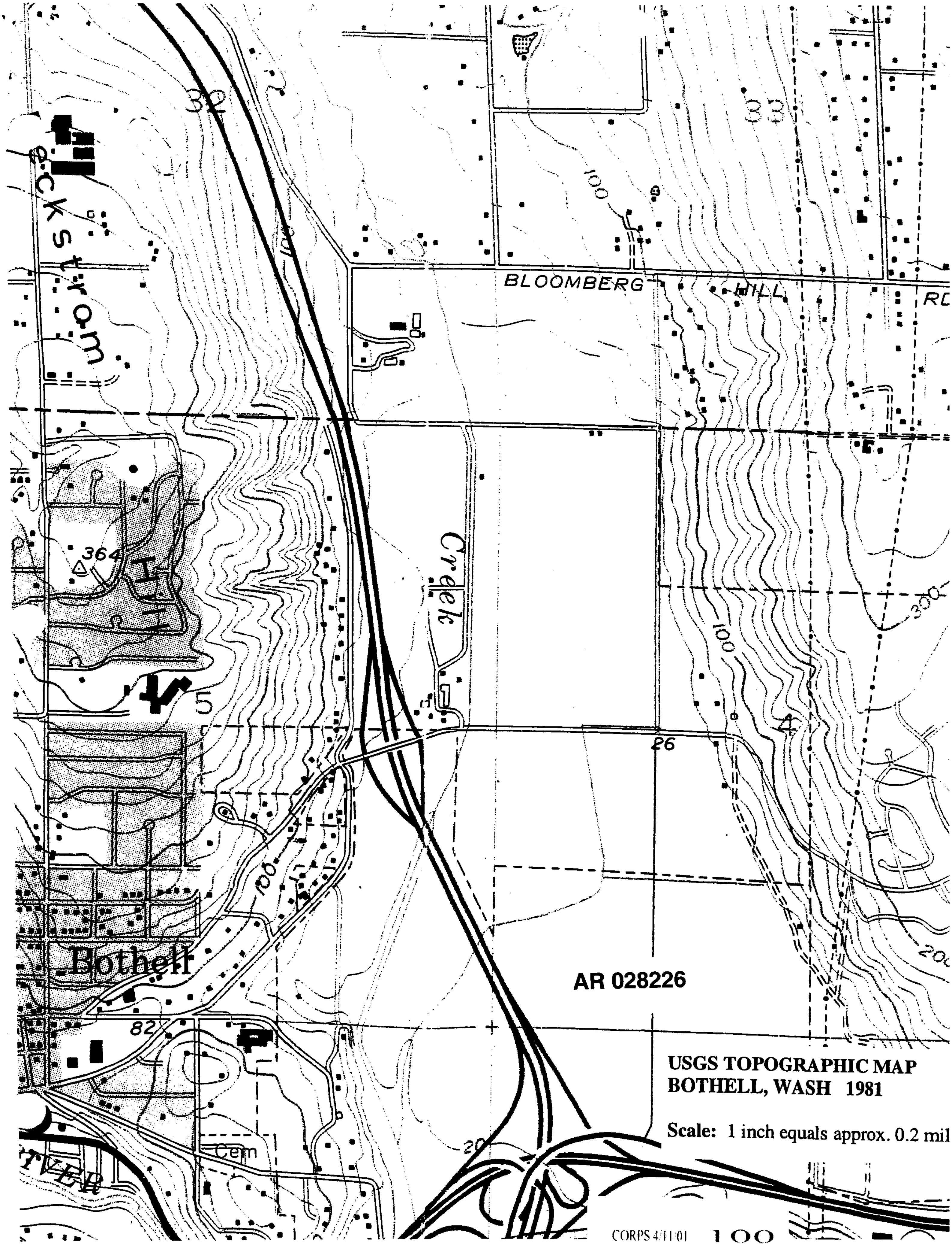
The hydrologic functions of the portions of Wetland 44 that will be filled for the embankment will be maintained by the design of the embankment fill as described in the several hydrologic evaluations of the embankment and previous responses. This design will allow groundwater to infiltrate into the embankment and recharge existing soils, move downslope, eventually discharging to Walker Creek. The project will eliminate channelized storm runoff from 12th Avenue from entering, and the hydrologic properties of the fill could enhance the hydrologic condition of Wetland 44.

59. Mapping of the Walker Creek channel west of highway 509 was removed because the channel location is not known and is discontinuous (there is no channel at Des Moines Memorial Drive). The channel cannot be discerned from existing aerial photographs, and historical photographs suggest the creek was confined to an agricultural ditch.

60. See response to #58 above.

61. The Port has complied with Clean Water Act 404 guidelines to avoid, minimize and mitigate for unavoidable impacts (see Table 4.1-1 of the *Natural Resource Mitigation Plan* and Chapters 3 and 4 of the *Natural Resource Mitigation Plan*).

See responses to comments above.



USGS TOPOGRAPHIC MAP
BOTHELL, WASH 1981

Scale: 1 inch equals approx. 0.2 mil

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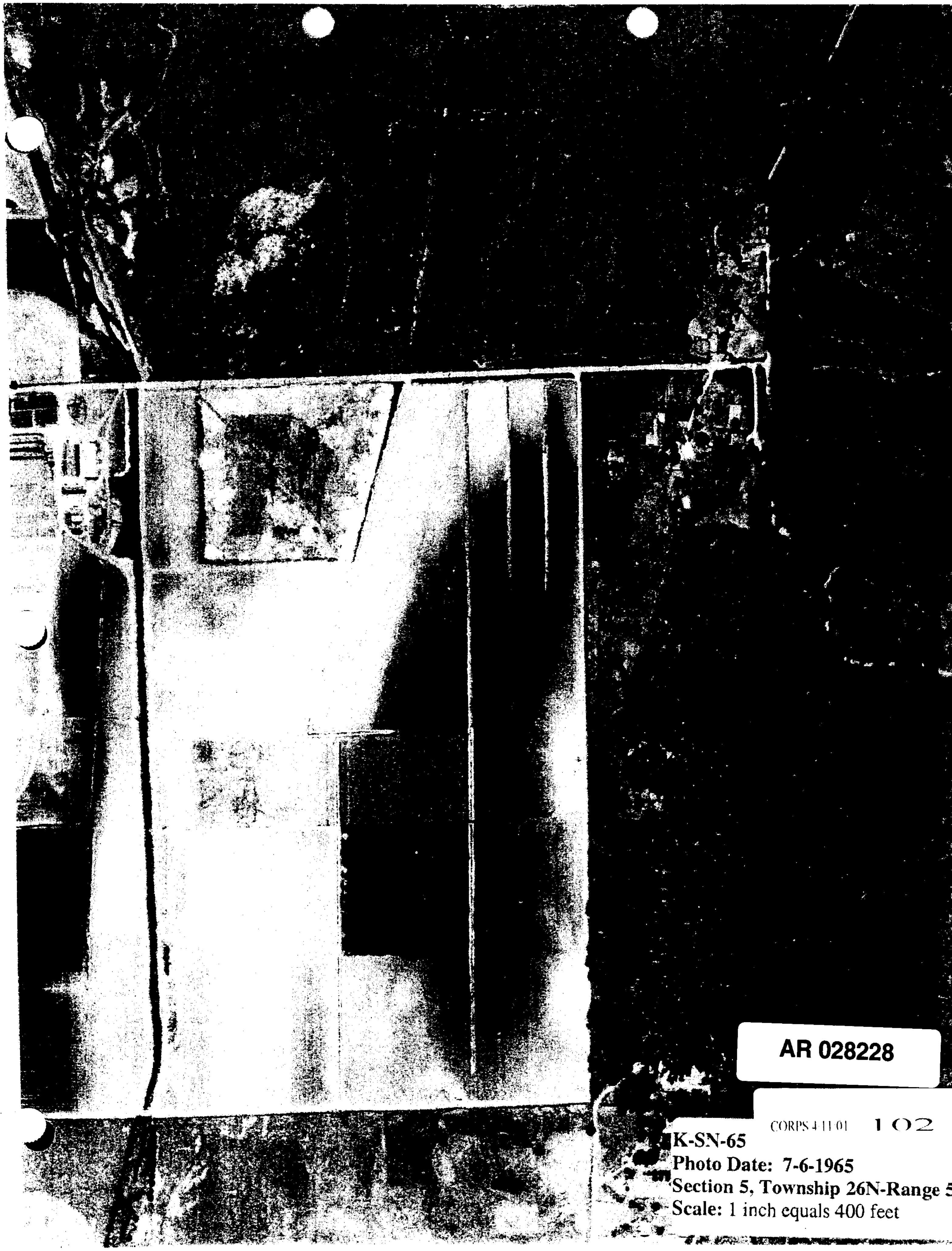

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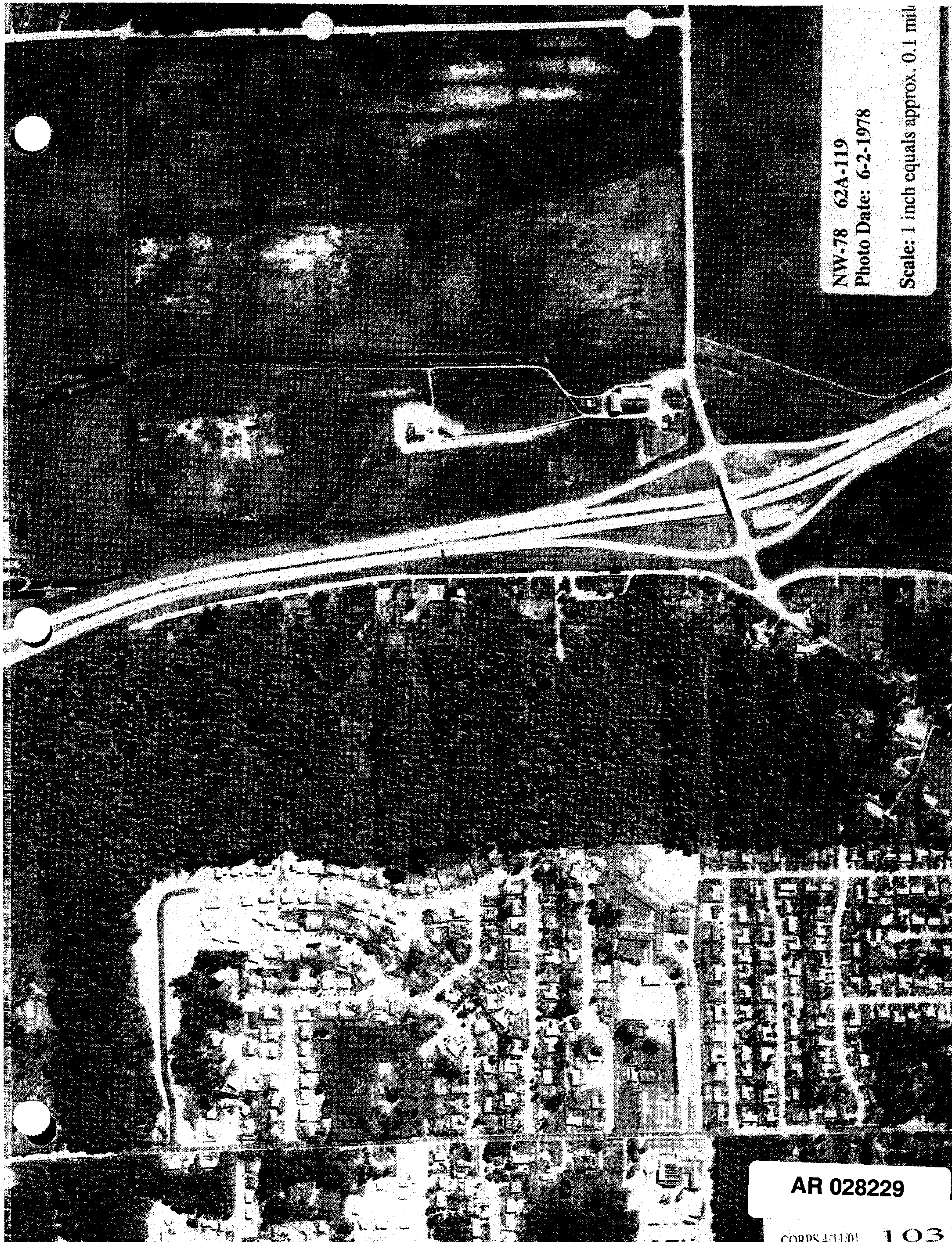
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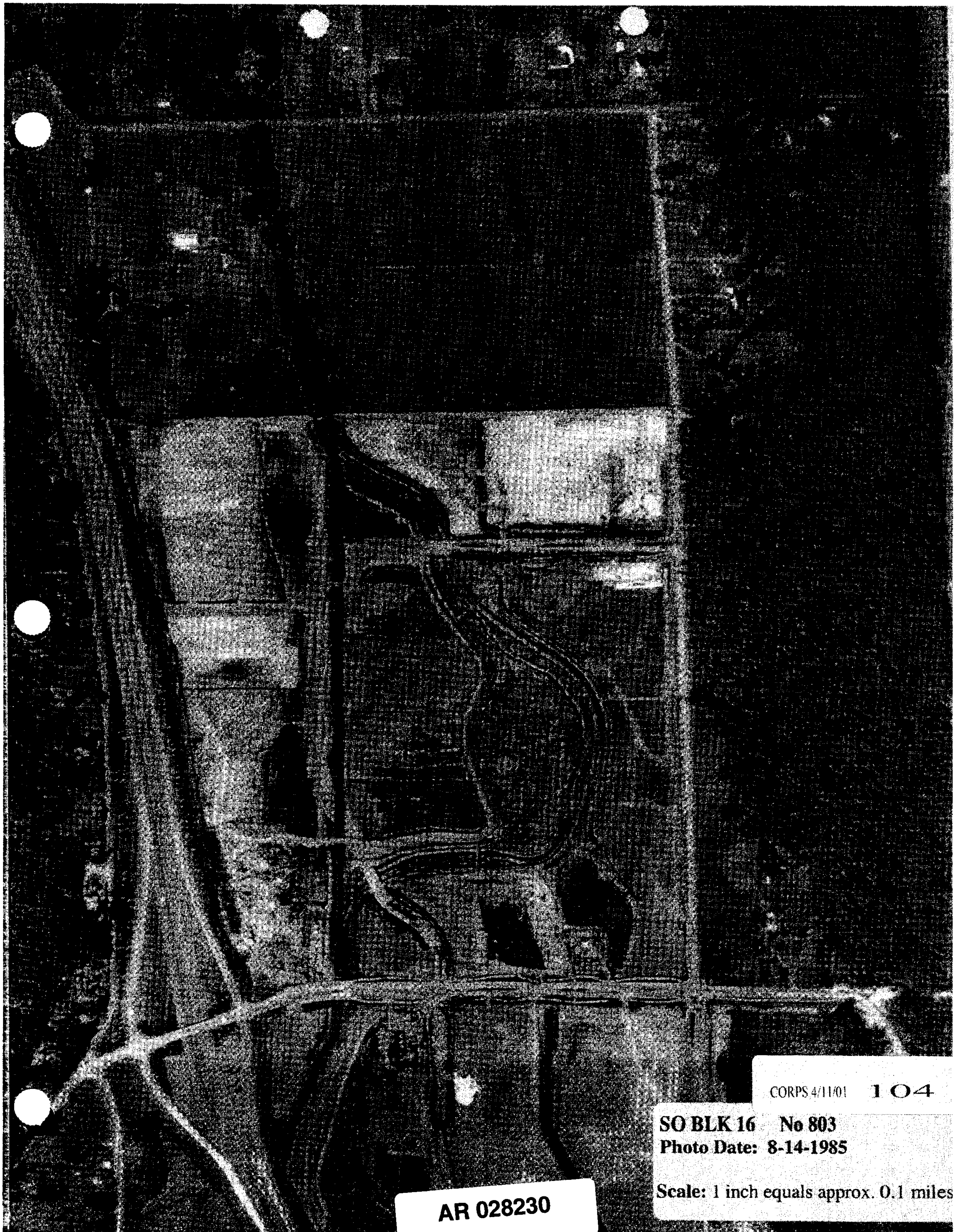

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