Rozeboom

Pre-Filed Testimony of William A. Rozeboom

Submitted on behalf of Appellant
Airport Communities Coalition

PCHB No. 01-160
ACC & CASE v. Dept. of Ecology & Port of Seattle

February 22, 2002

1. My name is William A. Rozeboom. I am over the age of 18, am competent to testify, and have personal knowledge of the facts stated herein.

2. My curriculum vitae is attached as **Exhibit A**. I am a professional civil engineer licensed in the State of Washington. I am employed as a senior engineer with Northwest Hydraulic Consultants, located at Suite 350, 16300 Christensen Road, Seattle, Washington, 98188. I have over 20 years of specialized experience in surface water hydrology and hydraulics, including over 7 years as principal reviewer of all Drainage Plan and Post-Construction Monitoring documents for the 3.2-mile long Snoqualmie Ridge Parkway and the associated 1,300-acre Snoqualmie Ridge mixed use development project under construction since about 1995 in the city of Snoqualmie. The Snoqualmie Ridge project is similar to the 3rd runway project in that it is a large site development which is subject to the requirements of the Washington State Department of Ecology Stormwater Management Manual and the King County Surface Water Design Manual (KCSWDM).

3. Northwest Hydraulic Consultants has been retained since October 1999 on behalf of the Airport Communities Coalition (ACC) to provide technical reviews of stormwater facilities and related streamflow impacts from the proposed 3rd runway and other development at SeaTac airport. I have been responsible for this review work. I have reviewed all stormwater management plans, natural resources mitigation plans, low flow analyses, and related documents which have been prepared by or for the Port of Seattle for airport improvements. My review findings were expressed to Ecology and/or the Corps of Engineers in a series of letters dated

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11/24/1999, 5/3/2000, 7/31/2000, 9/7/2000, 9/21/2000, 9/25/2000, 9/27/2000, 2/15/2001, 4/30/2001, 6/25/2001, 7/23/2001, 8/6/2001, 11/26/2001, 12/18/2001, and 1/30/2002. Internal review and quality assurance for these letters was provided by co-signer Dr. Malcolm Leytham, PE, who is a principal with NHC. I have provided three declarations relating to the ACC's motion for stay of the Section 401 Certification for the SeaTac Airport Third Runway and related projects; those declarations were signed 11 September 2001, 8 October 2001, and 28 November 2001. Also, I was deposed for these proceedings (PCHB No. 01-160) on February 5, 2002.

4. My testimony will address outstanding issues which were raised in previous comment letters and declarations and also new issues found from my in-progress review of the Port's December 2001 versions of the Low Streamflow Analysis and Natural Resources Mitigation Plan. My testimony will identify issues which in my opinion are significant to the identification of project impacts and to the design and implementation of mitigation measures to offset those impacts. In summary, it is my opinion that the streamflow impacts of airport improvements are not adequately identified, and that the project mitigation designs and activities are inadequate as currently proposed. In particular, the project proposal fails to provide reasonable assurance that low streamflow impacts are identified or will be fully mitigated.

5. Many of the issues to which I will testify have been raised in my (NHC's) previous comment letters and declarations. While some issues identified in earlier comment letters have been adequately resolved, many others have not. The following documents are attached to document the status of many of the unresolved issues. **Exhibit B** is NHC's 9-page letter of November 24, 1999 to Ecology and the Corps. **Exhibit C** is pages 227-240 of a March

10, 2000 document from the Port which includes responses to the Exhibit B comments. **Exhibit D** is NHC's 19-page letter dated February 15, 2001 which comments on the Port's December 2000 version of the project Stormwater Management Plan (SMP) and Natural Resource Mitigation Plan (NRMP). **Exhibit E** is the Port's 11-page response dated April 30, 2001 to those comments. **Exhibit F** is NHC's 9-page letter dated June 25, 2001 which provides follow-up comments based on the Port's response. Generally, those issues which we considered to be unresolved and warranting discussion in our June 25, 2001 letter continue to be unresolved at the February 2002 date of this testimony.

6. The Port's latest version of the SMP is dated December 2000 with updated replacement pages dated July 2001. King County, under contract to Ecology, has reviewed this latest version of the SMP and has concluded that it satisfies the technical requirements of the 1998 King County Surface Water Design Manual (KCSWDM). I have two broad concerns with the SMP in its current form. First, the Port has asserted throughout the review process, without any known objection from Ecology, that it is exempt from the "regulatory" provisions of the KCSWDM, including but not limited to mandatory design reviews following specific criteria and requirements. Second, the Port appears to be pursuing construction of stormwater facility alternatives in the Des Moines Creek basin for which no analyses or preliminary designs are provided in the SMP. I will expand on these two points of concern.

7. Airport development projects are subject to the requirements of the KCSWDM because the airport is located in the jurisdiction of the city of SeaTac and because the city of SeaTac has specified in its municipal code at Title 12.10.010 that the KCSWDM is adopted for

surface and storm water management. We first raised the issue of compliance with the regulatory requirements of the KCSWDM as the first and second numbered comments in our letter of November 24, 1999, which is attached as **Exhibit B**. The Port response is attached as **Exhibit C.** The thrust of our comments was that the project should follow the Drainage Review requirements specified by KCSWDM Chapters 1 and 2. The thrust of the Port's response was to claim an exemption from the drainage review requirements. For reference, the introduction & overview page of the 1998 KCSWDM, which provides summary descriptions of KCSWDM Chapters 1 and 2, is attached as **Exhibit G.** KCSWDM Chapter 1, DRAINAGE REVIEW AND REQUIREMENTS is summarized in Exhibit G as: "*Describes the basic drainage requirements that implement King County adopted surface water runoff policies and explains how these requirements are applied to proposed projects through the drainage review process.*" KCSWDM Chapter 2, DRAINAGE PLAN SUBMITTAL is summarized in Exhibit G as: "*Describes the requirements and specifications for submittal of design plans for drainage review, including report and plan formats, and scopes.*"

8. In my view, the drainage review process is a major component of the KCSWDM and is vital to ensuring that stormwater systems are properly designed in compliance with applicable regulations. However, the Port's view of the KCSWDM Drainage Review process is, from **Exhibit C**, that this is "*a procedural process that the Port is not obligated to follow.*" More recently, the Port was non-responsive to our request for technical design information (see Comment 20 on pages 14 to 16 of **Exhibit D**) necessary to review the adequacy of erosion and sediment control facilities being bid for construction. Given the track record of substantial

design errors discovered by us and King County during our reviews of hydrologic modeling and stormwater controls for this project, and the fact that much design work remains to be done, there is a need for this large and complex project to be subject to ongoing, rigorous drainage reviews.

9. My second concern relative to the December 2000 (amended July 2001) SMP is that information in the subsequent December 2001 NRMP suggests that the Port is planning to design and construct Des Moines Creek basin flow control facilities which are different than those designed and approved in the SMP. This concern is described in detail in my letter dated December 18, 2001 to the Corps of Engineers, which addresses Port of Seattle Document Inconsistencies and is attached as **Exhibit H**. The discrepancy of particular concern results from a footnote found on Page 1-10 of the December 2001 NRMP where proposed stormwater facilities are presented. That footnote reads, with emphasis added, "*Des Moines Creek Basin Plan Committee* ***will construct an RDF*** *on the Tyee Golf Course to provide regional flow control. This* ***project will eliminate the need for STIA retrofit facilities described*** *above. As this is a cumulative action subject to future federal action, it is not a Master Plan Update improvement.*" Additional evidence that a Regional Detention Facility (RDF) alternative is being actively pursued is found in NRMP Appendix C Figure C2 which specifies that the Tyee Valley Golf Course Wetland Mitigation site will be protected "DURING CONSTRUCTION OF DES MOINES CREEK REGIONAL DETENTION FACILITY". As pointed out in my Exhibit H letter, there are two significant problems with this approach to stormwater management. First, the SMP does not provide any analyses or designs for airport stormwater facilities which would be required under a Des Moines Creek RDF scenario. Second, there is no certainty that the

proposed RDF will be constructed or on what schedule. The consequence is that there is presently no certainty what stormwater facilities will be constructed to support airport development in the Des Moines Creek basin.

10. Since July 2001, our primary review focus has been on the airport's Low Streamflow Analysis and Mitigation Plan which I will abbreviate as the Low Flow Plan or LFP. Prior to the December 2001 issue of the LFP, the documentation of the Port's low flow analysis and mitigation proposal was extremely poor and resulted in the LFP being the subject of numerous conditions in Ecology's Section 401 Certification for the project. The specific low flow conditions imposed by Ecology are listed on Pages 22 through 25 of the Section 401 Certification and are attached as **Exhibit I.**

11. The December 2001 LFP has numerous flaws, including, but not limited to, being largely unresponsive to concerns we have raised previously. For example, while the report now acknowledges poor upper-gage low flow calibration of the hydrologic models used for the analysis, there does not appear to have been any serious attempt to improve that calibration or to address the resultant uncertainty in the interpretation of model results. Low-flow impacts of Industrial Wastewater System (IWS) improvements and borrow area developments continue to be ignored. The report fails to provide the digital data files (as were provided with previous documents) which would give reviewers the opportunity to independently interpret the Port's simulation results and to assess the significance of apparent modeling errors. Also, there appear to be serious fundamental problems in the methodology and assumptions for the third runway

embankment seepage analyses and in the integration of that seepage analysis with the HSPF modeling used to predict impacts.

12. Each of the three streams considered by the Low Streamflow Analysis—Miller, Walker, and Des Moines Creeks—have different sets of unresolved modeling/analysis issues. For Miller Creek, the main concern is over embankment modeling methods and the way that the embankment model results are integrated with the HSPF hydrologic model. For Walker Creek, the main concern is over how Industrial Wastewater System (IWS) expansion and leak reduction efforts may be causing potentially-large reduction in headwater baseflows. The Low Flow Analysis fails to address the fact that post-1991 recorded streamflow data for the upper Walker Creek gage, compared to the simulated flows, suggest a pronounced (more than 30%) reduction in low flows. For Des Moines Creek, the main concern is an apparent inability to accurately model the low flows and a failure to explore the physical reasons we have identified previously (specifically IWS lagoon seepage and a possible stream losing reach) which might improve the model calibration. The upper-gage calibration results for Des Moines Creek show that actual recorded low flows are on average nearly double (representing a 100% discrepancy) the upper-basin low flows which were simulated with the "calibrated" model.

13. The LFP fails to satisfy Condition I.1.a.iii of Ecology's Section 401 Certification which specifies that the low flow plan "*shall include a specific section discussing the accuracy of the calibration in predicting low flows at upper stream gages, and a statement of adequacy of the calibrations for the purpose of low flow simulation.*" The most relevant text segments we were able to locate in the LFP as responses to this condition are: 1) from LFP Page 2-2, Section

2.2.2, Low Flow Review, "*The overall HSPF model calibration effort did not focus specifically on low flow periods.*" and 2) from LFP Page 2-5, Section 2.2.2.4, Summary, "*calibrated low flows at the upstream gages typically showed lower flows than observed flows. Groundwater conditions in each of the watersheds are somewhat speculative and may account for these discrepancies at the upstream gage locations.*" By these statements, the LFP does discuss the accuracy of the low streamflow calibration, which is poor. However, we are unable to find any statement of adequacy as required by the certification condition. Further discussion of the technical problems with the project's HSPF model calibration and the use of that model to identify and mitigate low streamflow impacts is being provided by Malcolm Leytham in separate testimony.

14. During my deposition, I was asked whether having a well-calibrated model provided assurance that subsequent stormwater plans based on that model would be sufficient to achieve mitigation objectives. The short answer is no. The reason is that successful mitigation designs are based in part on comparing the results of two models: 1) a well-calibrated model of existing conditions which accurately incorporates the important physical features of the system; and 2) a future conditions model which uses best available information to represent future land use conditions and which reflects all known hydrologically-significant changes between the current and future conditions. The HSPF modeling approach being used to assess and mitigate for low streamflow reductions for the airport projects is doubly flawed. In the first instance, the current-conditions model is very poorly calibrated to low flows. In the second instance, the future conditions model fails to represent many of the hydrologically-significant changes which

have already occurred and/or are expected to occur between the current (1994) and future (2006) conditions.

15. My prior letters include numerous comments pertaining to basin hydrologic and land use changes between years 1994 and 2006 which are not adequately reflected in the HSPF models being used for the LFP. The most important omissions are two issues which relate to the Industrial Wastewater System (IWS) and two issues which relate to the mining of runway embankment fill from borrow areas located in what are now forested headwater areas of the Des Moines Creek basin. The two IWS issues involve: 1) leak-reduction improvements to and expansion of the approximately 400 acres of IWS service area collection system; and 2) installation of leak-reduction liners in IWS Lagoons 1, 2, and 3, located near the groundwater divide between Des Moines and Walker Creeks. The two borrow pit issues are: 1) conversion of approximately 155 acres of borrow pit site land area from a currently forested condition to a different, at least partially-developed condition; and 2) the physical excavation and removal of about 6.7 million cubic yards of material and the loss of the flow attenuation and low streamflow benefits currently provided to Des Moines Creek by that material.

16. The IWS has a direct significant impact on seepage and base flows in the Walker and Des Moines Creek systems by its removal of groundwater recharge from large areas of basin (over 400 acres) which would naturally form the headwater recharge areas for those streams. My interest here is not to argue whether IWS improvements should be regulated by Ecology's Section 401 Certification. Instead, it is my intent to point out that one cannot understand (and hence one cannot adequately model or mitigate) low streamflows in Walker and Des Moines

Creeks without understanding and addressing what is going on with the IWS system. For example, if 163 acres of new impervious surface is added to the IWS system, then the base flows to Walker and Des Moines creeks will be reduced by an amount reflecting 163 acres of lost recharge. I use the number of 163 acres in this illustration because of peculiarities in the way that the airport project has reported and modeled IWS acreage.

17. The IWS service area was reported in the 1996 FEIS (Table 3-1 on Page G-23 of FEIS Appendix G by Montgomery Water Group) as being 254 acres under current conditions and 319.7 acres under future conditions. A copy of that table is attached as **Exhibit J.** However, the IWS service area is summarized in the current (December 2000/July 2001) SMP on Table 4-1 (SMP page 4-4) as being modeled as 417 acres for both baseline (1994) and future (2006) conditions. A copy of this SMP table is attached as **Exhibit K.** The discrepancy between the currently-modeled and previously-reported IWS acreages, 417 versus 254, is 163 acres. Our previous comments on the project SMP include objections to the practice apparently used in the SMP and LFP of modeling baseline conditions using basin boundaries which reflect the **future** IWS expansion. For more discussion on this issue, see comment 12f of our February 15, 2001 letter (Exhibit D), the Port's response number 31 from Exhibit E, and our follow-up comment 30 from Exhibit F. The issue has never been satisfactorily resolved, with the probable consequence that streamflow impacts have been and continue to be underestimated.

18. Another issue relating to the IWS collection system is the question of its efficiency in directing runoff into catch basins, and then the question of the leakiness of the IWS conveyance system. Inefficiencies in capturing runoff and leaks in the conveyance system will

allow seepage flow into the ground, recharging groundwater aquifers and helping to maintain stream low flows. The airport's NPDES permit provides information to suggest that Ecology has had concerns with leak issues in the IWS collection system. Condition S1.F.2 on Page 11 of the airport's NPDES Permit No. WA-002465-1, attached as **Exhibit L**, requires a leak assessment to be completed prior to December 31, 2001. I have not seen the results of that assessment.

19. Until recently, the effects of lost (or reduced) infiltration and groundwater recharge from the area of the IWS system collection system have been partially offset by infiltration recharge to groundwater from the three IWS storage lagoons which are located near the groundwater divide between Walker and Des Moines Creeks. The history and status of the IWS system is described in a hydrogeologic study by Associated Earth Sciences, Inc., "Hydrogeologic Study, Industrial Waste System (IWS) Plant and Lagoons, Seattle Tacoma International Airport," prepared for Port of Seattle, June 21, 2000. From that document, Lagoon 1 has been used to store wastewater since 1965. Lagoon 2 was built in 1972 and "*is utilized during times of heavy rainfall events*." Lagoon 3 was constructed in 1979 and "*is used to provide excess storage capacity for industrial wastewater in the event that Lagoons 1 and 2 reach capacity*." The bottoms of the lagoons most regularly in service - Lagoons 1 and 2 - were reportedly "*composed of compacted gravelly sand*" which should have a relatively high infiltration capacity. A program to install leak prevention liners in the lagoons has been underway since 1996: Lagoon 1 was lined in 1996, Lagoon 2 was lined in 1997, and construction documents have been prepared for Lagoon 3 to be lined in the near future. My point is that the unlined IWS lagoons have historically provided the opportunity for water collected from

hundreds of acres of impervious surface collection system to be infiltrated to groundwater. We do not criticize the leak reduction program, but rather the failure to incorporate the impacts of that activity into the low flow modeling. The IWS system leak reduction program in general, and lining of gravel-bottomed Lagoons 1 and 2 in particular, is likely to have some impact on stream low flows. While the lagoons were not constructed or operated with the objective of achieving infiltration to groundwater, the unlined lagoons have nonetheless served to perform an infiltration function. It is my opinion that these effects should be addressed in the assessment of airport impacts to stream low flows.

20. The Port's assessment of land use changes between baseline (1994) and future (2006) conditions has incorrectly assumed no land use change in the area of the borrow pits and fails to address the low flow impacts of additional impervious surface to be constructed at those locations. It is probable that at least two of the three now-forested borrow area sites will be converted to partially-impervious land uses within the Master Plan Update time frame. This land use conversion would be consistent with the regulatory land use zoning for these sites as well as with a recent Port commitment to complete such development.

21. The location and large size of the borrow pit sites relative to other airport features is shown by NRMP Figure 1.3-1, attached as **Exhibit M**. When we previously raised the issue of borrow pit impacts in our (Exhibit D) comments, the Port's April 30, 2001 response (Exhibit E) was that "*The potential hydrologic impacts of the borrow areas were not evaluated in the Comprehensive Stormwater Management Plan because the Port believes that modifications are considered temporary and reversible, as opposed to the construction of permanent new*

impervious areas and airport facilities." That response is however inconsistent with the land use zoning and the more recent document attached as **Exhibit N**: Port of Seattle – Commission Agenda Item No. 8a for Meeting on November 13, 2001; Memorandum dated October 16, 2001 regarding Resolution No. 3469, agreements between the Port of Seattle and the City of SeaTac for use and redevelopment of borrow areas 3 and 4 on Port property within the City. That Port memorandum anticipates impervious surface development of the borrow areas sites within five years. Borrow Areas 3 and 4 are zoned as Aviation Commercial and/or Aviation Operations. The agreement proposed by the Port specifies that "*The Port will prepare and initiate within 6 months of the agreement a marketing plan to promote future redevelopment of the borrow areas after excavation.*" The agreement also "*Provides a Port commitment to in good faith pursue having the redevelopment of the borrow areas completed within 5 years after the date the agreement is signed. . .*" We understand that agreement described in the Port's October 2001 memorandum was formally signed and executed on December 14, 2001. If the Port in good faith pursues and accomplishes site redevelopment as committed to in the agreement, then Borrow Areas 3 and 4 will be fully redeveloped as aviation commercial and operation properties by year 2006, which is the same year adopted in the SMP to represent future conditions. The Port's October 2001 memorandum pertains to agreements with the City of SeaTac and does not address Borrow Area 1, which is located in the City of Des Moines. We have been informed verbally by City of Des Moines staff that Borrow Area 1 is zoned for Business Park development. Borrow Areas 3 and 4 alone have an excavation and development footprint of about 60 acres. Low Flow Impact analyses are unable to assess and mitigate the full impacts of airport Master Plan Update

Improvement projects at year 2006 build-out because they ignore the proposed year 2006 developed condition of the borrow site areas.

22. A second unaddressed hydrologic effect of the borrow pit activities, separate from surface land use changes (conversion from forest to other uses) discussed above, is related to the excavation and removal of 6.7 million cubic yards of material from these borrow pits in the upper Des Moines Creek basin. This material is proposed to be removed from three sites with a combined surface area of about 155 acres and involves excavation to depths as great as 100 feet. Currently, base flows to Des Moines Creek are supported in part by the peak flow attenuation effects of this material. In simple terms, this flow attenuation effect is the time it takes for water to flow through this mass of material, and it is long travel times through the ground that helps winter rainfall show up in the summer as stream base flows. I do not know what magnitude of impact will result from the removal of this borrow pit material. However, in light of the detailed assessments which have been made by the Port to identify low flow timing benefits of embankment construction in the Miller Creek basin, it seems unbalanced that there has been no comparable assessment of potentially-adverse low flow timing impacts resulting from large-scale mining in the upper Des Moines Creek basin to obtain much of these same materials.

23. The next series of comments relate to the embankment modeling performed by Pacific Groundwater Group (PGG) as a consultant first to Ecology and more recently to the Port, and to the integration of that embankment modeling work with the HSPF models used to assess project impacts. The embankment modeling work affects the low streamflow assessments for

Miller and Walker Creeks only. Embankment construction is not proposed in the Des Moines Creek basin.

24. The broad methodology adopted in the latest LFP to identify low streamflow impacts in Miller and Walker Creeks involves an apples-and-oranges mixture of methods which is unlikely to produce meaningful results. The methods at issue involve embankment seepage modeling as discussed on LFP pages 2-6 through 2-8 and in LFP Appendix B. The embankment seepage modeling was performed by Pacific Groundwater Group (PGG) for the Port of Seattle, using groundwater flow calculations which were in some ways similar to calculations performed by PGG in an earlier study for Ecology (Sea-Tac Runway Fill Hydrologic Studies Report, June 19, 2000). The most recent work for the Port is described as "*a more detailed evaluation*" (LFP Appendix B page 1) and as "*building on*" (LFP executive summary) the previous PGG work for Ecology. However a fundamental methodology change occurred between PGG's earlier work for Ecology and the most recent work for the Port. The current PGG study, unlike the original work, examines only a future scenario condition without a comparable examination of current conditions as a necessary baseline for assessing impacts. In the original study for Ecology, PGG developed seepage and groundwater flow models for both current and future conditions and then compared the results to determine impacts. That is a valid methodological approach. However, in the current LFP work for the Port, PGG's scope was "*limited to post-construction conditions, and did not attempt to simulate existing conditions*" (LFP Appendix B, page 1). Impacts were instead addressed by other Port consultants who in effect compared the results of the uncalibrated PGG groundwater flow models for future conditions against poorly calibrated HSPF

model estimates of groundwater flow under current conditions. This mixing of methods—specifically the use of conceptually different methods and models to define current versus future conditions--is inappropriate for evaluating impacts and is unlikely to produce meaningful results.

25. The PGG embankment fill modeling (LFP Appendix B) does not appear to have been updated to incorporate the latest information on embankment construction methods. This comment relates to the expectation that while the bulk fill (vertical flow) aspects of the proposed embankment construction will prolong flow times and will likely benefit stream low flows, the engineered subgrade and drain layer (lateral flow) aspects of the proposed embankment may accelerate groundwater flow velocities and impair stream low flows. The current proposal for embankment construction (Hart Crowser, November 2, 2001, "Geotechnical Summary Report, Third Runway Embankment and MSE Retaining Walls, Seattle-Tacoma International Airport" page 13) is to over-excavate problematic soils (including peat or wetland soils) and replace those soils with densely compacted select fill. By removing the wetland soils which tend to attenuate the water flow, the subgrade improvements will accelerate the drainage and flow of water from those areas. However, Figure 5-1 of the PGG study (LFP Appendix B) shows wetland soils as persisting beneath the embankment fill, suggesting that effects of wetland soil removal have not been addressed.

26. In the LFP analysis of Miller Creek, the volume of airport embankment seepage flow being delivered to Miller Creek at the SR509 point of compliance during the low flow months is about double the flow volume which would actually reach that point based on the findings of PGG's original June 2000 report for Ecology. This causes modeled future

streamflows to be over-estimated. Both of the PGG studies (dated June 2000 for Ecology and November 2001 for the Port) examine vertical seepage through the embankment fill body using a Hydrus model. Also, both of the PGG studies used a "Slice" model to determine the fate of that seepage once it reached the bottom of the fill. The output from the Slice model(s) consists basically of two hydrographs: 1) seepage flow from the constructed drain layer at the base of the embankment plus Qvr (shallow regional aquifer) discharge; and 2) downward flow through the till. PGG spreadsheet data for the hydrographs shown by Figures 5-4 through 5-6 of PGG's November 20001 report show that the volume of "*Downward Flow through Till*" during the low flow months of June through October (for years 1991-1994) is on average about 1.4 times the volume of "*Qvr/Drain Outflow*." PGG's June 2000 report for Ecology (page 24) states, "*[I]n a conceptual sense the till seepage reaches the "Qva" aquifer. This downward seepage is not accounted for further within the cross section.*" That PGG report (again at page 24) further states "*[T]he analysis suggests that base flow consists mostly of local, shallow groundwater flow and that contributions from the Qva aquifer are small in this reach.*" The significance here is that PGG's work for Ecology concluded that the downward flow through the till (these being the flows which recharge the deeper Qva aquifer) do not appear to return to Miller Creek in the vicinity of the runway project. However, in assessing project impacts on Miller Creek low flows at the SR509 point of compliance, other Port consultants direct 67% of this deep aquifer recharge back into the stream above SR509. (In addition, 100% of the Qvr shallow regional aquifer & drain layer flow is directed to the stream.) This assumption that water flowing to deep aquifer recharge will substantially re-emerge to support stream flows in the vicinity of the project is

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conceptually incompatible with the results of the PGG analysis, and causes low streamflow impacts to be under-estimated.

27. Double-counting of groundwater discharges from embankment areas appears to be occurring in the Miller Creek analysis due to an input error in the future-conditions HSPF model for Miller Creek. The apparent intent of the HSPF modelers was to identify areas assessed by PGG with a special "PERLND 80" pervious land segment, and to import the PGG groundwater model results as a lateral groundwater inflow into that land segment within HSPF. However, the input sequence shows that precipitation is incorrectly being applied (with a 1.00 multiplier) to the PERLND 80 land segment in addition to the groundwater inflows being imported from the PGG analysis. This is resulting in a double-application of rainfall to the areas in question and a subsequent double-counting of groundwater flow from those areas. Similar methods were used in the Port's assessment of Walker Creek, but without this input error. The HSPF input sequence for Walker Creek shows that no precipitation (actually precipitation with a 0.00 multiplier) is correctly applied to the PERLND 80 land segment. This problem of double-counting embankment area groundwater discharge appears to be restricted to the Miller Creek model. The consequence is that project impacts to Miller Creek low streamflows are substantially under-estimated.

28. Project impacts to Miller and Walker Creeks are further significantly under-estimated due to infiltration assumptions and model time step issues which over-estimate the volume of rainfall which can reasonably be expected to infiltrate into the embankment. The question at issue here is to identify how much of the runoff from runway and taxiway impervious

surfaces will infiltrate into pervious grassed filter strips adjacent to the runway? The answer to that question can be addressed by comparing the filter strip infiltration capacity to the intensity at which water is applied to the filter strip. In this case, the rate of water being applied is equal to the intensity of the rain falling directly on the filter strip plus the rate of runoff onto the filter strip from runway and taxiway impervious surfaces. When the input intensity (direct rainfall plus runway runoff) is greater than the filter strip soil infiltration capacity, then the excess water flows off as surface runoff and/or shallow subsurface flow and is captured by the storm drain system. Our concern is that the capacity of the embankment to absorb water is being overestimated relative to field observations, and furthermore that the rate of runoff from the runways is being underestimated because of the model time step. Individually and cumulatively, these two factors will cause estimates of embankment recharge and subsequent low flow recharge to the stream to be too high, and will underestimate streamflow impacts and mitigation requirements. Malcolm Leytham will discuss the issues of embankment infiltration in his separate testimony. The model time step issue is discussed below.

29. The Port's LFP analysis of embankment recharge is based on HSPF and seepage modeling with a one-hour time step. One practical consequence of using HSPF hourly modeling to determine runway runoff is that the HSPF model generally (and inaccurately in this context) damps out runoff resulting from short bursts of rainfall. For accuracy, a much shorter time step should be used which is consistent with the short time needed for water to sheet-flow across a 105-foot wide runway half-section. Using the guidance of the 1998 King County Surface Water Design Manual (pg 3-7), "*[T]he quicker a basin responds hydrologically (e.g., due to small size,*

land cover, or lack of detention), the smaller the time step should be." Also (KCSWDM pg 3-23), peak flow analyses should use a maximum time interval of 15-minutes, corresponding to the shortest time step for which continuous data are readily available. Hourly data will fail to provide reliable results. It should be recognized that even the 15-minute data will underestimate peak flows from the runway to the filter strip and hence overestimate the capacity of the filter strip to infiltrate this flow. A continuous duration 15-minute time series data set of SeaTac Airport rainfall for water years 1949 through 1998 was developed by King County and is publicly available from the county's website. We evaluated these 15-minute data to determine the duration of time that rainfall (and pavement runoff) can be reasonably expected to occur. The 15-minute data set consists of 1,753,152 individual data values for the 50 years of record. Non-zero rainfall is reported by 95,345 of these data values, representing about 5% of the full record. In other words, the 15-minute data show that it rains about 5% of the time and that it is not raining about 95% of the time. Allowing for some short time for water to sheet-flow off of the pavement, runoff onto the filter strip would be expected to occur between 5% and 10% of the time. In contrast, the spreadsheet data files for the hourly-time-step PGG model show that in the Port's LFP analysis, water was applied to the runway filter strips for 34% of the 35,064 modeled hours in the October 1990 through September 1994 simulation period. The effect of an hourly time step, combined with HSPF hydrologic routing to produce inflow time series of runoff to the filter strips, has been to greatly exaggerate (by more than 3 times and possibly as much as 6 times) the duration of time that water is applied to the filter strip. The consequence of this exaggerated runoff duration in the Port's analysis is to significantly underestimate the average and peak rates of inflow to the filter strips, to significantly overestimate the volume of water which successfully infiltrates into the embankment, and to underestimate project impacts on low streamflows.

30. Documentation provided with prior versions of the Port's Low Streamflow Analysis was so poor as to make an informed review virtually impossible. With the improved documentation in the current (December 2001) LFP, we now find numerous unsubstantiated statements in the LFP report text, including instances where the LFP report text misrepresents either the methods or the results of the analysis found in the LFP supporting documentation. Two instances of misrepresentation in the report text are: 1) identification of the period of low streamflows, and 2) adoption of a 2-year low flow as a baseline for assessing impacts. These are discussed below.

31. The LFP text misrepresents the period of low streamflows or at least the text is inconsistent with the supporting data. The LFP plan executive summary at Page vi states, "*The Port's proposal to offset impacts to low streamflow is to detain excess stormwater runoff during the winter and release it to the streams during the predicted annual low-streamflow periods.*" The LFP at Page 2-1 states, "*The occurrences of the annual 7-day low-flow periods were plotted and a bar graph showing the distribution of the summer low-flow periods by date was developed for each stream. The summer low-streamflow period for each stream was selected to include all the historical 7-day low-flow occurrences.*" At LFP Page 3-1 (and confirmed at LFP Table 4-2 describing vault operations) 92-day low flow periods are defined as "*the entire annual low-flow period each year for each stream (July 24 through October 24 in Des Moines Creek; August 1 through October 31 in Walker Creek)*" However, these low flow periods presented in the LFP

text are inconsistent with the low flow periods shown by the figures in LFP Appendix I, titled "*Determination of Low Flow Quantity Impacts and Mitigation*". For Des Moines Creek, the historical period with occurrences of annual 7-day low streamflows is shorter than the proposed mitigation period. However, for Walker Creek, the supporting data show that annual low flows occur over a much longer period than the 92 days for which mitigation is proposed. The Port's LFP chart showing 7-day low flow occurrences in Walker Creek is attached as **Exhibit O**. It shows that annual 7-day low flows over the simulation period have occurred during the 152-day period from June 17 through November 16. Notwithstanding the serious model calibration problems which introduce further uncertainty to the mitigation proposal, the current LFP proposed Walker Creek low flow augmentation only for a 92 day period beginning on August 1, and fails to offer any mitigation for much of the period in which Walker Creek low flows are anticipated to occur based on the Port's modeling.

32. The LFP text also misrepresents or is inconsistent with the supporting analyses and data used to determine the low flow impacts and to size mitigation facilities. The LFP at Page 2-2 discusses the methods used to determine low flow impacts as follows: "*The 7-day low flow with a 2-year (50 percent) recurrence interval was selected as the streamflow target in each stream. The 2-year, 7-day low flow was selected because the magnitude of the estimated impact to 7-day low flows generally decreases with greater recurrence interval (i.e., the estimated reduction in the 7-day, 2-year-frequency low-flow rate is greater than that for the 7-day 10-year-frequency low-flow rate). Therefore, providing mitigation equivalent to the 7-day, 2-year-frequency impact will provide mitigation sufficient to mitigate the more extreme summer low-*

streamflow events." The LFP does not provide any data to substantiate the claim that the 2-year, 7-day low flow is an appropriate target. Regardless, close inspection of the LFP Appendix I data shows that the impact assessments for both Walker and Miller Creeks are actually based on approximately a 7-day, **4-year**-frequency impact. The issue does not affect the analysis of Des Moines Creek impacts, which were based on the full 47 years of simulation record. The LFP supporting calculations show that low flow impacts for Miller and Walker Creeks are based on a statistical analysis of years 1991 through 1994, corresponding to "*a representative dry period*" (LFP Page 2-11 paragraph 3) for which embankment seepage modeling was conducted by PGG and integrated with the HSPF model. The statistical analysis of the four data points for years 1991 through 1994 fails to recognize that these dry years are not representative of longer-period conditions. Other tables in LFP Appendix I show that for Walker Creek, for example, these years ranked as the first, fifth, tenth, and 25th driest years in a 47-year period of simulation record. The dryness of these four years is such that a 50% exceedance (2-year return period) low flow value computed from these years is actually more representative of about a 25% exceedence (4-year return period) in the context of the longer 47-year record. A similar conclusion is found in the 4-year versus 47-year record for Miller Creek. Because of the LFP statistical manipulation, it is misleading for the LFP text to state that that low flow impacts for Miller and Walker Creeks are based on a 2-year return period. Furthermore, if the statements made in the LFP to support selection of a 2-year-frequency impact are correct, then the actual use of a 4-year-frequency impact will underestimate impacts for 2-year and more frequently-occurring events.

33. One of the technical design challenges confronting the LFP is to develop constant-release outlet controls which function according to the LFP design assumptions. The Port has conceptually proposed a floating orifice system and has provided an outlet schematic for such a system as the last page of LFP Appendix F, attached here as **Exhibit P**. Note that the Port's outlet schematic is not to scale and that if the 1-foot height of the orifice box was to be used as a scale, then the depth of the vault would fill the 11-inch height of the page. As I stated in my deposition, the outlet as shown will not function as planned or intended. An initial problem is that the head (labeled as H on the exhibit) is incorrectly shown. The actual hydraulic head (H) on the orifice is from the pond water surface to the highest water surface downstream from the orifice as the water enters the discharge pipe. The schematic incorrectly shows the head to be measured to the invert of the outlet connector; the needed correction is to instead measure to the highest downstream water surface at the intended design flow. A serious related problem is that the discharge pipe appears to be buoyant, even in the schematic, and will cause the outlet head to be highly variable. In the extreme, if the discharge pipe floats (flexes) to the surface, zero outflow will occur. Furthermore, the hydraulic control which regulates system outflow may result from circular channel flow in the discharge pipe, instead of critical flow through the orifice. Continuing with easily-identifiable problems, no venting is shown and pressure (suction) flow will result if the outlet pipe fills with water. There are numerous opportunities for the currently-proposed outlet to fail to perform as intended. When I stated in my deposition that I believed I could solve these problems, my statement was in the context of being able to properly identify the hydraulic controls at the floating orifice device. I do not know how feasible or practical it is to solve the remaining design challenges facing the proposed floating orifice

system. For example, it may not be possible to procure negatively-buoyant (when air-filled) flexible pipe as specified by the outlet schematic, or to provide necessary maintenance access to a floating head orifice located within a water-filled vault buried under more than 12 feet of fill (See Exhibit C141 in LFP Appendix F). The Port has in my opinion failed to provide information sufficient to demonstrate the feasibility of a constant-release outlet as required for LFP mitigation of low streamflow impacts.

34. Ecology's Certification Condition I.a.ix (see attached Exhibit I) requires that "*The Port shall develop a pilot program to test one reserve stormwater vault for performance.*" In response, the LFP at Page 3-11 proposes to modify existing stormwater detention vault SDS3A as the pilot program for the Flow Impact Offset Facility. I have two concerns with the current proposal. First, no details or conceptual drawings are provided to demonstrate what modifications are proposed or, in other words, what vault configuration would be tested or how well the test configuration represents the proposed actual facilities. It is impossible to comment further on this issue without at least a conceptual level of detail (reserve storage volume and depth, location of controls, release rates, outlet point, etc.) of the test facility. Second, the proposal reads as though the existing detention facility SDS3A peak flow controls will temporarily be taken off-line, allowing undetained stormwater flows from the airport to discharge directly to Des Moines Creek, resulting in increased peak flows and possible erosion damage to the stream channel for the one-year duration of the pilot program.

35. At my deposition, in response to questioning by an Ecology attorney, I stated that I was aware that the Section 401 Certification requires monitoring of the streams in June and

July and requires mitigation if any impacts are found. I also stated that it was my opinion that those conditions were not very useful. I would like to elaborate on that statement. The Certification conditions relating to monitoring requirements are specified on page 25 of the certification (see attached Exhibit I). The first required element of the monitoring protocols is specified as: "*i) Collection of stream gage data and an evaluation/correlation to expected flow rates established by the model.*" The main reason I consider this requirement to be not useful is that the expected flow rates established by the model are too low and do not reflect appropriate real-world flow targets. In the instance of Des Moines Creek, for example, the upper-basin low flows established by the calibrated model are approximately one half the amount of the observed low flows. More generally, the LFP acknowledges (Page 2-5) that "*calibrated low flows at the upstream gages typically showed lower flows than observed flows.*" Despite this known problem, the inaccurately-low modeled flows are identified by LFP Section 2.1.3 (Page 2-2) as "*target streamflows*" for the streams. In practical terms, this approach to monitoring means that there is a built-in cushion for up to a 50% reduction in low streamflows before the monitoring protocols would recognize that low flow reductions are occurring.

36. A broad concern I have with the proposed monitoring protocols is that they establish the status quo (degraded stream) as a target condition for addressing impacts and do not provide any basis for identifying the causes of adverse impacts or failure to improve the overall health of the streams. Considerable effort is being put to: 1) improving the effectiveness of the IWS system and retrofitting the airport stormwater controls so as to prevent the discharge of industrial process water (contaminated with aviation fuels, glycols, etc.) to the receiving streams;

2) retrofitting the storm drain system with water quality facilities so as to improve the quality of stormwater runoff; and 3) retrofitting the storm drain system peak flow controls so that the duration of erosive flows from the developed airport mimics as close as possible the flows from a mostly-forested basin. The underlying reason for these Ecology-imposed retrofit requirements is presumably to improve the health of the streams. However, the Certification conditions imposed by Ecology would only require implementation of low flow contingency measures if the low flow impacts are so severe as to surpass the combined benefits of the retrofit activities described above. In my opinion, this is a futile approach to monitoring for low streamflow impacts.

On behalf of the ACC, I thank you for your consideration of these concerns.

DATED this 22 day of February, 2002, at Seattle, Washington.

William A. Rozeboom, P.E.

AR 014623

Pre-Filed Testimony
of
W. A. Rozeboom, M.B.A., P.E.

INDEX TO EXHIBITS

A. Curriculum Vitae of W. A. Rozeboom

B. Letter dated November 24, 1999 from Northwest Hydraulic Consultants, Inc. commenting on the stormwater management plan for the proposed 3rd runway

C. Title page and pp. 227 – 240 of the Port of Seattle's March 10, 2000 responses to public comments. The enclosed pages respond to the comments in Exhibit B.

D. Letter dated February 15, 2001 from Northwest Hydraulic Consultants, Inc. to the U.S. Army Corps of Engineers, with comments on stormwater, hydrology and hydraulic aspects of the 3rd runway proposal

E. Title page and pages III-74 – 84 of Port's responses to the letter from February 15, 2001, listed above as Exhibit D

F. Letter dated June 25, 2001, from Northwest Hydraulic Consultants, Inc. to the U.S. Army Corps of Engineers, with follow-up comments on the stormwater, hydrology, and hydraulic aspects of the 3rd runway proposal

G. Introduction and overview pages from the 1998 *King County Surface Water Design Manual*

H. Letter dated December 18, 2001, from Northwest Hydraulic Consultants, Inc. to U.S. Army Corps of Engineers, which outlines inconsistencies in the Port of Seattle Documents

I. Page 1 and pages 22 – 25 of the Section 401 Certification issued on September 21, 2001.

J. Cover pages and Table 3-1 on page G-23 of the 1996 FEIS Appendix G by Montgomery Water Group, a summary of land use changes in SeaTac Subbasins assumed for proposal

K. Title page and Table 4-1, page 4-4 of the December 2000 Comprehensive Stormwater Management Plan illustrated baseline 1994 and projected 2006 changes in drainage areaa of Miller, Walker and Des Moines Creeks

L. Cover page and page 11, Condition S1.F.2 of the airport's NPDES Permit No. WA-002465-1

M. Title page and Figure 1.3-1 of the NRMP titled, "Master Plan Update Improvements at STIA"

N. Port of Seattle – Commission Agenda Item No. 8a for meeting held on November 13, 2001, a memorandum dated October 16, 2001 regarding Resolution No. 3469, agreements between the Port of Seattle and the City of SeaTac for use and redevelopment of borrow areas 3 and 4 on Port property within the City

O. Low Flow Plan Appendix I (determination of Low Flow Quantity Impacts), bar chart showing 7-day low flow occurrences in Walker Creek

A

W.A. ROZEBOOM, M.B.A., P.E.

EDUCATION

B.Sc.. in Civil Engineering (with Distinction), University of Alberta, 1978.

M.B.A., University of Alberta, 1986.

GENERAL

Mr. Rozeboom has 20 years experience in water resources management and water resources engineering. He has broad technical expertise in surface water hydrology and hydraulics, developed through substantive experience in the areas of streamflow gaging and sediment sampling, data processing, assessments of data reliability, physical hydraulic model studies, regional and site-specific hydrologic analyses, and hydraulic modeling and design. Mr. Rozeboom also has broad expertise in the regulatory aspects of water rights administration in Washington and Hawaii and of Puget Sound stormwater quantity and quality controls and best management practices. While employed by the Hawaii Water Commission, Mr. Rozeboom helped establish the institutional framework for implementing the 1987 Hawaii Water Code. He is an active member of the Washington Department of Ecology Water Resources Advisory Committee and served on Ecology's 2000-01 Water Use Measurement Technical Advisory Group.

CHRONOLOGICAL EXPERIENCE

November 1992 - Present: Hydrologist and senior engineer with Northwest Hydraulic Consultants, Seattle office.

June 1988 - November 1992: Hydrologist with the State of Hawaii Commission on Water Resource Management. Responsible for implementing new programs for water rights certification and dispute resolution under the 1987 State Water Code.

September 1986 - May 1988: Self-employed. Provided engineering and management consultant services for various projects, including two water supply development assignments in the West Indies.

September 1984 - August 1986: Full-time MBA student and graduate assistant. During summer employment with Alberta Environment Hydrology Branch, conducted field and office research studies of carriage losses from natural channels.

January 1979 - May 1984: Project engineer with Northwest Hydraulic Consultants, Edmonton office. Responsible for managing and conducting projects involving field inspections, river surveys, scale model design, construction, and testing, hydrologic and river engineering assessments, and development of computer models.

Summers, 1976 - 1977: Water survey technologist with Alberta Environment Water Survey Section. Responsibilities included flow meter measurements of river discharges by bridge and wading methods, integrated depth sampling of suspended sediments, data reduction, development of rating curves, and servicing of hydrometric gaging stations.

SELECTED PROJECT EXPERIENCE

Seattle South Park Storm/Tide Design Events: Developed and evaluated a 48-year continuous simulation sequence of urban runoff and tidally-influenced flooding of the Seattle South Park area which drains to the Duwamish River. Performed future-conditions hydrologic runoff computations with HSPF and developed FORTRAN computer code to perform continuous simulation hydraulic routing of inflow, storage, and tidally-restricted outflow. Identified historic events for use as 2-year through 100-year storm/tide events for designing flood control alternatives.

SeaTac Airport Plan Review: Reviewed technical and regulatory elements of the stormwater management plan and related documents submitted for Section 401 State Water Quality Certification for the SeaTac airport third runway project. Identified significant errors in the hydrologic modeling and analyses. Concerns were corroborated by third-party reviews and led to substantial overhauls of the stormwater plan modeling and facility designs.

Kent Third Avenue Storm System Modeling: Performed hydrologic modeling with HSPF and storm drain network modeling with EPANET of the storm drain improvements proposed for the collection system to a new pump station under design. Confirmed pipe sizes necessary to satisfy drainage requirements.

Mitigation Wetland Design: Performed site inspection and hydrologic modeling services for a mitigation wetland proposed for a gravel mine in Snohomish County. Evaluated watershed conditions and basin hydrology for the proposed impact and mitigation sites, and identified the wetland depth-duration inundation characteristics which would result under alternative mitigation and basin restoration design alternatives.

Snoqualmie Tree Farm Park Floodway Certification: Performed a hydraulic assessment of water level impacts which would result from development of a large municipal park in the federally-regulated floodway of the Snoqualmie River. Reviewed findings with FEMA officials and provided the engineering "no-rise" certification for this park development.

Ledger Lake Wetland Impact Assessment: Performed hydrologic modeling and data analyses to evaluate potential impacts of city of Mount Vernon stormwater discharges to the Ledger Lake wetland complex. Modified a daily water balance simulation model of the area to accurately reflect the design characteristics of a proposed pump station at the lake outlet, and to assess near-term future water level conditions for comparison with existing and simulated long-term future conditions. Extracted wetland water level (stage) data from the simulation output and presented the results as a series of tables summarizing the wetland hydroperiod stage-duration data. Reviewed the data in the context of available regulatory

guidelines for allowable wetland water level fluctuations.
Snoqualmie Ridge Post-Construction Monitoring Program: Provided comprehensive technical review and regulatory oversight, on behalf of the city of Snoqualmie, for the planning and implementation of a post-construction monitoring program for the 1,300-acre Snoqualmie Ridge Mixed Use Development. The development, which drains to numerous wetlands and fish-bearing streams, is one of the first projects in King County to implement the requirements of the 1998 King County Surface Water Design Manual. The project employs a number of unique mitigation measures including sand blankets to preserve interflow conveyance across roadways, enclosed-storage water quality sand filters for golf course runoff, and flow splitting systems to divert undetained peak flows to large-capacity bypass pipelines. The multi-disciplinary monitoring plan was developed to: 1) assess the performance of the stormwater facilities; 2) determine if impacts to measurable physical and biological characteristics of wetlands and streams were within the tolerances predicted by the project EIS, and 3) take remedial measures as necessary. The work is ongoing.

Snoqualmie River HEC-RAS Modeling: Managed the updating of an existing HEC-RAS hydraulic model of the Snoqualmie River at Snoqualmie to assess impacts of proposed modifications to the dam crest at the Snoqualmie Falls Hydroelectric Project. Work included a field survey, verification of model calibration to observed summer water level data, and hydraulic analyses to identify project water level impacts affecting summer river access and recreational opportunities.

Mill Creek Salem Hydrologic and Hydraulic Modeling: Developed, calibrated, and applied hydrologic and hydraulic models to assess flood control alternatives for Mill Creek at Salem, Oregon. HEC-1 and HEC-HMS models were developed of the 104-square mile upper basin, calibrated to the record flood of February 1996, and applied to compute design flow hydrographs for current conditions and future scenarios with regional detention facilities. Developed and calibrated an unsteady flow branched network hydraulic model, UNET, for 15 network reaches describing Mill Creek and its distributaries which flow through the city of Salem. The UNET model was calibrated to high water mark data and very limited hydrograph data from the record flood of February 1996, and updated to incorporate flood reduction works which had been constructed after flood event.

February 1996 Postflood Report: Managed preparation of a postflood report for the Portland District Corps of Engineers (COE) providing comprehensive qualitative and quantitative documentation of the major storm which struck the Pacific Northwest in February 1996, causing record or near-record flooding in many basins. Archived and summarized more than 1,200 hydrometeorological data sets from USGS, NOAA, COE, and NRCS sites, developed storm isopluvial maps, determined storm intensity and flood discharge return periods, assessed flood control operations at 13 COE flood control reservoirs and 4 Section 7 flood control projects, and described COE flood fight activities.

Thunder Ridge Erosion Control: Provided expert advice, on behalf of a downstream landowner, as to the adequacy of site erosion control measures at the 50-acre Thunder Ridge Estates Subdivision development in Snohomish County. Following a site inspection, prepared a legal declaration describing the development's substantial lack of compliance with required erosion control Best Management Practices, which led to a stop work order.

Mount Vernon Riverbend Stormwater Alternative: Determined the hydraulic effects of discharging stormwater from 230 acres of the City of Mount Vernon to lowlying fields outside the City limits, and identified mitigation alternatives. The fields are located in a diked meander loop of the Skagit River, and interact with the river by seepage flows and a flap-gated culvert. Developed a daily water balance model of the area and calibrated seepage functions and soil specific yields to reproduce historic conditions. Determined design parameters for alternative pump station and culvert improvements to mitigate impacts of the proposed stormwater discharge.

Lake Chelan Hydroelectric Project PMF Study: Developed and calibrated a HEC-1 model of the Lake Chelan basin to determine PMF rain-on-snow lake inflow and outflow hydrographs for the Lake Chelan Hydroelectric Project. The basin consists mostly of rugged mountain terrain with very steep precipitation and temperature gradients which greatly affecting local snowpack and precipitation amounts. Calibration was made to historic flood events, and PMF simulations evaluating alternative reservoir operational scenarios were made in accordance with National Weather Service and Federal Energy Regulatory Commission guidelines.

Snoqualmie Ridge Golf Course Drainage Reviews: Provided technical reviews of stormwater management plans and permanent utility plans and specifications for the Snoqualmie Ridge Golf Course on the Lake Alice Plateau above Snoqualmie Falls. Reviews were made for technical accuracy and compliance with City ordinances and MDP and EIS documents. The work required analyses of numerous requests to depart from the approved MDP and standard facility designs for purposes of golf course aesthetics and to construct a large lake combining functions of water quality treatment and storage of recycled water. Results were expressed by detailed review memoranda, meetings with the City and applicant, and participation at meetings of the City Planning Commission.

Wenatchee Alluvial Fan Flood Hazard Review: Reviewed flood hydrology and flood hazard mapping for alluvial fan streams in the City of Wenatchee to address a 20-year old dispute over the extent of 100-year flood hazard. Evaluated methodologies and assumptions used by previous studies, and developed updated flood hydrology estimates analyses based on HEC-1 modeling, regional analysis, and a 90-year archival record of flooding from local newspaper reports. Performed hydraulic analyses with the Federal Emergency Management Agency's FAN alluvial fan model. Study results led to an 80% reduction of the regulatory flood hazard zone, relieving more than 500 property owners from the need to purchase federal flood insurance.

North Fork Issaquah Creek Floodplain Mapping: Updated an existing HSPF hydrologic simulation model of the North Fork basin to determine flood quantiles for current land use conditions, and developed a HEC-2 hydraulic model to determine floodplain boundaries for 1.2 miles of channel ending at the confluence with the main stem Issaquah Creek. Flood flows and floodplain boundaries in the lower portion of the study reach were determined to be influenced significantly by inter-basin flood flows originating from the main stem channel and which overtop a ridge between the basins during major floods.

Nevada Flood Insurance Hydrology Studies: Updated hydrology studies and determined design flows for FEMA floodplain mapping of three mountain streams in Washoe County near Reno, and the North Las Vegas Wash Flood Control Project near North Las Vegas, Nevada. Design flows for the Washoe County streams were determined from a regional analysis to be governed by a population of relatively rare (about 50-year and higher return periods) cloudburst events accompanied by high sediment and debris loads. Existing HEC-1 models for the North Las Vegas Wash were reviewed and updated to more accurately predict 500-year flows. Methodologies used in the previous North Las Vegas Wash analyses were found to have substantially underestimated 500-year flows by overlooking the loss of peak flow control which will result when the 100-year design capacity of a major flood control detention facility is exceeded.

Watershed Assessments: Conducted surface water assessments of the Deschutes, Snohomish, and Walla Walla Water Resource Inventory Areas under a statewide program of initial watershed assessments for the Washington State Department of Ecology (DOE). The purpose of this work was to characterize the "health" of the surface water resources in each watershed to facilitate decision-making by DOE on water rights applications. Examined available flow data in relation to established instream flow regulations, and conducted time-series assessments of streamflow and precipitation data to determine whether there were indications of declining minimum or average annual flows unrelated to natural climatic fluctuations.

Cowlitz River Flood Analysis: Reviewed the controlled flow releases from the Cowlitz River Mossyrock Dam during flood events in November 1995 for compliance with FERC license requirements. Assessed alternative reservoir operating scenarios to determine the extent to which operating practices contributed to downstream flood damages.

Snoqualmie Ridge Parkway Plan Reviews: Reviewed Stormwater Management Plans, Temporary Erosion and Sediment Control Plans, and related construction drawings for stormwater aspects of the 3.2-mile long Snoqualmie Ridge Parkway. Principal stormwater facilities include water quality/detention ponds, biofiltration swales, and a large-diameter high-flow bypass pipeline. The high-flow bypass pipeline is sized to convey excess flow from the Parkway and the adjoining Snoqualmie Ridge and Falls Crossing sites for direct discharge into the Snoqualmie River. Plans and drawings were reviewed for technical accuracy and for compliance with the King County Surface Water Design Manual, City of Snoqualmie ordinances, and project MDP and EIS documents. Coordinated subconsultant reviews of water quality and wetlands issues and facilities.

Mount Pinatubo Regional Hydrologic Analysis: Conducted a regional analysis of rainfall and streamflow data for the Mount Pinatubo region, assessed data reliability, prepared isopluvial maps of 2- through 500-year rainfall amounts for 24-hour through 5-day durations and, through HEC-1 modeling, developed flow duration and flood frequency curves for 39 potential sediment and flood control project sites on major streams affected by the 1991 eruption of Mount Pinatubo. Study results were published in COE Technical Report GL-94-16, Post Eruption Hydrology and Hydraulics of Mount Pinatubo, The Philippines.

Mount Vernon Regional Drainage Analyses: Used HSPF simulation models of current and future land use conditions in the City of Mount Vernon to identify drainage problems along main stem channels throughout the city. Developed designs and costs for proposed alternative solutions including pump stations, regional detention pond facilities, and culvert replacements.

Falls Crossing Master Drainage Plan (MDP) Review: Reviewed Draft MDP hydrologic analyses and flood impact analyses submitted to the City of Snoqualmie for approval of a development partially located within the Snoqualmie River floodplain. Coordinated reviews of water quality and wetlands issues by subconsultants.

Clarewood Development Review: Assessed drainage patterns and flood risk for properties located downstream of the proposed Clarewood development in Pierce County. Provided expert testimony at a development hearing on the uncertain performance of infiltration facilities to be constructed immediately upslope of an area with past flooding problems, and the downstream flood impact risk associated with the development as proposed.

Cedar Hills Gaging Services and Data Processing: Responsible for operation of a six-station gaging network at the Cedar Hills landfill for a period of one year to identify and eliminate persistent data discrepancy problems. Conducted field tests and theoretical reviews which positively identified two principal problems: control elevations which had been incorrectly reported on "as-built" drawings, and inaccuracies in the technical manual used to derive theoretical rating curves for multiple-orifice outlet structures. Developed revised stage-discharge relationships which eliminated the data discrepancies, and provided training to client staff in data processing and reporting practices.

Snoqualmie Ridge Master Drainage Plan (MDP) Review: Reviewed Draft MDP hydrologic analyses and conceptual facility designs submitted to the City of Snoqualmie for mixed use development approval. Reviewed hydrologic analyses for adequacy of HSPF model calibration and measures proposed to deal with uncertainty in the analyses. Reviewed conceptual facility designs for feasibility and compliance with applicable development standards. Coordinated reviews of water quality and wetlands issues by subconsultants.

Myrtle Creek Flood Study Review: Reviewed flood hydraulics and floodplain mapping studies for the Town of Myrtle Creek located at the confluence of Myrtle Creek and the South Umpqua River. The work was undertaken on behalf of the Federal Emergency Management Agency to resolve a 4-foot discrepancy in the 100-year flood elevation as reported by two other federal agencies. The discrepancy was resolved by identification of an error in one of the earlier analyses.

Snoqualmie Parkway EIS and SMP Reviews: Managed a multidisciplinary review of water quantity, water quality, and wetlands elements of Environmental Impact Statement materials and supporting documents submitted to the City of Snoqualmie for the proposed Snoqualmie Ridge Parkway. Subsequently reviewed the Stormwater Management Plans (SMP) and construction drawings for compliance with applicable standards and representations made in the environmental impact process. The work was undertaken for the City of Snoqualmie under the direction of the Director of Community Development.

Evans Creek HSPF Model Calibration: Calibrated the EPA's Hydrologic Simulation Program - Fortran (HSPF) to streamflow and wetland water level data collected at four sites in the Evans Creek West catchment of the proposed Northridge/Redmond Ridge Urban Planned Development in King County.

Water Use Inventory: Implemented Hawaii State Water Code legislation requiring registration of all wells and stream diversions statewide, declaration of water use, and monthly reporting of water use. Gave public workshops on water code requirements, developed systems, procedures, and databases to analyze and manage the contents of 7,300 declarations of water use, acted on all declarations, and coordinated field survey activities for verification of water facilities and uses.

Bank Protection Research: Conducted a comprehensive review of alternative methods of streambank protection, seeking those that might provide cost-effective alternatives to conventional riprap protection for highway bridges in Alberta. Computed present value project life costs of promising alternatives, considering allowable velocities, maintenance costs, local availability of materials, and transportation costs.

Database Development: Developed computer databases to track processing of Hawaii well and stream diversion works construction permits, to inventory wells, stream diversions, and water uses statewide, and to target specific groups by geographic area and/or activity for mailings of notices and informational materials.

Water Rights and Dispute Resolution: Administered the first contested case hearing before the Hawaii Commission on Water Resource Management, including mediating discussions between opposing expert witnesses, preparing the Findings of Fact, and drafting the Commission's Decision and Order. Prepared the Findings of Fact report which led to the designation of the Island of Molokai as a Water Management Area. Prepared Departmental testimony to the Legislature on proposed amendments to the State Water Code.

Satellite-Linked Water Resources Data Collection: Initiated and developed a pilot program for collecting real-time precipitation and other water resources data via satellite from remote areas in Hawaii.

Water Utility Privatization Study: Determined rate structures and impact on consumers which would result from the privatization of water and sewerage facilities for small municipalities.

Montserrat, W.I., Integrated Resource Development Project: Provided specialist water resources input on a five-person multidisciplinary mission in Montserrat, W.I. for the Canadian International Development Agency. Determined design and construction specifics and costs for small dam and irrigation projects to facilitate agricultural self-sufficiency.

Cedar Hills Hydrologic Data Review: Reviewed the accuracy of rain and flow data being collected at the Cedar Hills landfill to determine downstream impacts and for future calibration of a hydrologic model. Identified erroneous records through double-mass analysis, reviewed implications of stage measurement and theoretical rating curve errors, and recommended measures for improving data accuracy.

Supermall Downstream Impact Assessment: Developed current and future land use HSPF simulation models for the proposed Supermall of the Great Northwest to identify downstream impacts. Linked hourly HSPF simulation results to a finite difference unsteady flow model, FEQ, and assessed water level impacts through a complex system of wetlands, ditches, and culverts leading to the downstream receiving channel.

City of Yellowknife Municipal Financial Assessment: Assessed the impact of the City's 5-year capital improvements plan on financial stability and tax rates.

Jasper Park Lodge Water System Analysis: Conducted computer analysis of recirculating water system for Jasper Park Lodge; identified causes and recommended solutions to problems of low water pressure and fluctuating water temperatures.

St. Lucia W.I. Roseau River Carriage Loss Assessment: Determined water losses which would result from using a natural channel to transmit water from a proposed water storage reservoir to downstream agricultural users.

St. Lucia W.I. Roseau Basin Water Development Program: Provided hydrologic input towards site selection for a water supply reservoir in St. Lucia, W.I. Reviewed reliability of available hydrometric data and extended streamflow records using rainfall records and computer modeling techniques. Estimated low-flow sequences to determine reservoir storage needs, and design floods for spillway sizing. Conducted on-the-job training with local personnel for computer use and hydrologic techniques.

School Financial Planning Model: Refined a prototype computer model to project finances over a 5-year horizon, based on scenarios of economic and demographic growth, required facilities, debt structure, salary rates, and programs of government financing.

Ross Creek Basin Surface Water Supply: Developed a computer simulation model which accounted for varying precipitation, evaporation, runoff and water consumption within the Ross Creek Basin in southern Alberta. The model was used to develop a 50-year sequence of natural runoff conditions and to assess alternative water supply management proposals.

Peace River Basin Surface Water Supply: Determined surface water supply characteristics from limited streamflow records based on regional correlations and frequency analyses, and computed reliable water supplies for 22 communities in northwest Alberta based on intake characteristics, current and projected water consumption, and existing reservoir facilities.

Pipeline River Crossings: Conducted field surveys and determined hydraulic design parameters of scour, bank erosion and 1:100 year high water levels at 32 river crossings of the Alaska Highway Gas Pipeline and 7 river crossings of the Alberta Deep Basin Pipeline.

Gull Lake Regulation Study: Developed and calibrated a computer simulation model to determine causes of historical declines in lake levels and assessed the effectiveness of alternative lake management scenarios on the basis of historical hydrological conditions.

Carriage Loss Investigations: Designed and coordinated a field research study to monitor carriage losses over 60 km of natural channel in Southern Alberta; analyzed field data to determine the magnitude, uniformity, and causes of losses. Reviewed and evaluated all previous studies conducted to assess carriage losses in natural channels in Alberta and Saskatchewan, and developed techniques to predict carriage losses which affect reservoir release flows into natural channels.

Isle Lake - Lac Ste. Anne Stabilization: Developed and implemented a computer simulation model to examine proposals to stabilize lake water levels.

Alaska Highway Gas Pipeline Route Hydrology: Six-month in-house assignment with the Yukon Pipeline Design Joint Venture design team; provided hydrotechnical input on small basin hydrology, and for development of drainage and erosion control criteria.

Berry Creek Channel Losses: Determined channel losses affecting reservoir release flows over 12 km of natural channel in southern Alberta.

Willow Creek Water Supply: Determined causes of winter water supply shortage at communities drawing water from Willow Creek below Chain Lakes Reservoir in southern Alberta.

Little Bow Basin Water Supply: Assessed basin water supplies as affected by internal runoff and inter-basin water diversions.

Whitford Lake Basin Management: Developed a comprehensive study program to establish an engineering data base and methodologies to evaluate drainage and flood control projects in the Whitford Lake Basin in central Alberta.

Buffalo Bay - Horse Lakes Management Program: Developed a computer simulation model to assess water levels and discharges in the Buffalo Bay - Horse Lakes complex in north-central Alberta under alternative management schemes.

Rat Creek Bridge Crossings: Conducted field surveys, determined hydraulic design parameters, and designed abutment armoring for two single-span bridge crossings in central Alberta.

McLeod River Bank Stabilization: Conducted field surveys and designed rip-rap armoring for bank stabilization at a railway bridge in central Alberta.

Channel Ice Surveys: Conducted winter ice and breakup surveys at 52 river crossings encountered along the British Columbia segment of the proposed Alaska Highway Gas Pipeline.

Red Deer River Floodplain Development: Determined open water and ice jam design flood levels and developed measures for floodplain development in Red Deer, Alberta.

St. Mary Canal Sedimentation: Conducted field sedimentation studies to assess sources and mechanisms of canal sedimentation in southern Alberta.

Dickson Dam Diversion Tunnel Model Study: Constructed a 1:54 scale physical model of dual 5.5 m diameter diversion tunnels: assessed and optimized intake and outlet flow patterns, minimized transition losses, and assessed outlet scour. Supervised construction of a 1:70 scale model of the 60 m wide, 190 m long service spillway for the dam project.

Port McNeill Harbour Breakwater Model Study: Constructed a 1:100 scale physical model of the Port McNeill harbour region in British Columbia. Developed a breakwater design to shelter a proposed harbour expansion from ocean waves.

Elbow River Channel Improvement: Conducted field surveys and designed channel improvements to increase side-channel flows in the City of Calgary, Alberta.

Harvey Creek Channelization Model Study: Constructed 1:15 and 1:25 scale physical models of a steep 12 degree channel in British Columbia. Determined the stability of 1.0 m boulders under flood conditions, and assessed flow patterns through transitions and curves in a channelized reach of channel.

Cooling Pond Circulation Model Studies: Constructed and tested physical scale models of cooling ponds formed in natural topography for three thermal generating stations in central Alberta: the Calgary Power Ltd. Keephills Thermal Plant, the Edmonton Power Genesee Power Project, and the Alberta Power Ltd. Sheerness Generating Station. Assessed alternative dike arrangements to optimize circulation patterns under conditions including thermally stratified flow and adverse wind shear.

Sundance Helper Cooling System Model Study: Developed 1:12 scale model of a 20 m long sump bay with a 2.1 m diameter, 100,000 GPM pump intake: designed baffles to produce smooth intake flow conditions, and determined intake energy losses.

Field Surveys: Conducted hydrometric surveys over two summers of more than 100 rivers and lakes throughout the Province of Alberta. Responsibilities included surveying of seasonal lake level elevations, streamflow gaging by wading and bridge crane methods, sampling of suspended sediment at bridge and cableway sites, hydrographic soundings and mapping of lake bottom contours, field servicing and repair of strip-chart water level recorders, and assisting in the construction and installation of housings and equipment for stream gage stations.

PROFESSIONAL REGISTRATION

Washington
Alberta

ASSOCIATIONS

American Water Resources Association
Washington State Water Resources Advisory Committee
Washington State Water Use Measurement Technical Advisory Group

AWARDS

National Science and Engineering Research Council Postgraduate Scholarship, 1978.

RELEVANT PUBLICATIONS

"Use of a Scale Model to Improve Pond Circulation," Proceedings of the Specialty Conference on Computer and Physical Modeling in Hydraulic Engineering; Chicago, Illinois; August, 1980.

"Carriage Losses in Natural Channels in Southern Alberta," with S.J. Figliuzzi. Proceedings of The 1986 Canadian Hydrology Symposium on Drought: The Impending Crisis?; Regina, Saskatchewan, June 1986.

B

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November 24, 1999

U.S. Army Corps of Engineers
Regulatory Branch
Post Office Box 3755
Seattle, Washington 98124-2255
ATTN: Jonathan Freedman, Project Manager

Washington State Department of Ecology
Permit and Coordination Unit
Post Office Box 47600
Olympia, Washington 98504-7001
ATTN: Tom R. Luster, Environmental Specialist

Subject: Comments on stormwater management plan for proposed 3rd runway development actions at Seattle-Tacoma International Airport.

Northwest Hydraulic Consultants (nhc) has been retained on behalf of the Airport Communities Coalition to provide a technical review of stormwater facilities and related streamflow impacts from the proposed 3rd runway development at SeaTac airport. The purpose of this letter is to record our comments from a technical review of the following documents:

- "Hydrologic Modeling Study for SeaTac Airport Master Plan Update EIS" dated April 7, 1995 (revised November 16, 1995) by Montgomery Water Group.

- Revised Draft "Natural Resource Mitigation Plan; Master Plan Update Improvements; Seattle-Tacoma International Airport" dated August 1999 by Parametrix.

- Review draft, "Preliminary Comprehensive Stormwater Management Plan; Master Plan Update Improvements; Seattle-Tacoma International Airport" dated November 1999 by Parametrix. Also reviewed were the separately-bound documents containing the November 1999 revision of: 1) technical appendix A; and 2) technical appendices B through H of the Stormwater Management Plan (SMP). Technical Appendix A was the last of the documents made available for public review (it was not available prior to November 18, 1999). It has an outside cover dated November 1999 but an inside cover and inside contents dated December 28, 1998.

AR 014639

We are highly qualified to perform this review. Mr. Rozeboom has over 20 years of specialized experience in surface water hydrology and hydraulics, including over 5 years as principal reviewer of all Master Drainage Plan, Stormwater Management Plan, and Storm Drainage Technical Information Report documents for the 1,300-acre Snoqualmie Ridge project currently under construction in the city of Snoqualmie. The Snoqualmie Ridge project is similar to the 3rd runway project in that it is a large site development which is subject to the requirements of the Washington State Department of Ecology Stormwater Management Manual and the King County Surface Water Design Manual (KCSWDM). Dr. Leytham has over 20 years of specialized experience in surface water hydrology and hydraulics, including serving as technical advisor to King County on flow control aspects of the 1990 and 1998 versions of the KCSWDM. Dr. Leytham was also responsible in 1990 for the original development of the Miller Creek basin HSPF simulation model which has since been modified by others for purposes of 3rd runway impact assessments and facility designs. Vitae for Mr. Rozeboom and Dr. Leytham are attached for reference.

Our review of the above documents has found major deficiencies in the analysis which may result in significant adverse impacts to the natural stream systems if the current version of the Preliminary Comprehensive Stormwater Management Plan (SMP) is approved and implemented as a basis for mitigation of project impacts. The greatest problems are: the failure to follow the regulatory and procedural requirements of the King County Surface Water Design Manual and Washington State Department of Ecology Stormwater Management Manual; the failure to establish the feasibility and performance of proposed stormwater facilities; and the establishment of target flows which may be much too high and could worsen existing problems along the downstream creek systems.

Our specific comments follow.

Comment Group I

Failure to follow the regulatory and procedural requirements of the King County Surface Water Design Manual and Ecology Guidelines.

1. The SMP does not satisfy applicable regulatory requirements of the 1998 King County Surface Water Design Manual (KCSWDM). Applicability of the KCSWDM is established from Chapter 12.10.010 of the municipal code for the city of SeaTac, which adopts the 1998 KCSWDM for surface and storm water management. Also, the SMP (pg 1-2) states that its goals include meeting all local and state stormwater regulatory requirements for stormwater management, including those described in the King County Surface Water Design Manual (KCSWDM, 1998). However, the SMP fails to identify or comply with the basic KCSWDM requirements. Specific deficiencies are identified in the points below.

2. KCSWDM Section 1.1.2 defines thresholds for types of drainage reviews. It requires a "large site drainage review" for projects such as the proposed 3rd runway which will result in more than 50 acres of new impervious surface. (The proposed development will add about 200 acres of new impervious surface according to the 1995 hydrologic modeling.) There are two requirements for a large site drainage review. From KCSWDM pg 1-14, the applicant must: 1) prepare a master drainage plan (MDP) in accordance with the process and requirements described in the MDP guidelines "Master Drainage Planning for Large or Complex Site Developments"; and 2) demonstrate that the proposed project complies with all the core and special requirements in Sections 1.2 and 1.3 of the KCSWDM. The present SMP is

substantially incomplete because it does not address or satisfy either of these two basic requirements for a large site drainage review.

3. The present SMP does not come close to satisfying the requirements of an MDP. The SMP might at best provide partial satisfaction of the Preliminary Draft MDP level of effort from the Master Drainage Plan process guidelines. The major missing technical element is a drainage plan which includes actual proposed facility locations, service areas, and discharge points and which resolves major questions/conflicts such as a desire to provide detention ponds without standing open water and to allow infiltration into the embankment fill without compromising the structural integrity of the fill. The major missing procedural element is the opportunity for review and comment--the MDP process involves four stages/opportunities for review and comment on the sufficiency of stormwater facilities: 1) Preliminary Draft MDP; 2) Draft MDP; 3) Recommended MDP; and 4) Hearing Examiner Process.

4. KCSWDM Core Requirement 1: Discharge at the Natural Location. (Similar to Ecology's Minimum Requirement #2) The objective of this requirement is to protect downstream properties from increased or reduced flows due to changes in basin area. The SMP does not address this requirement, and provides insufficient basin mapping to understand how sub-basin divides will be affected by the development. There are several areas of probable non-compliance. For example, peak flow control in the Miller Creek and Des Moines Creek basins is proposed to be provided in part by diverting a total of 45.7 acres (SMP Table 4-5) of new impervious area to the Industrial Wastewater System (IWS). Significant basin area reductions will reduce erosive peak flows but will also reduce the middle-range and low flows which support habitat functions. Actual impacts in the Miller, Walker, and Des Moines Creeks are not known because the core requirement for discharge at the natural location has not been addressed in the SMP.

5. KCSWDM Core Requirement 2: Offsite Analysis. (Similar to Ecology's Minimum Requirement #8.) The objective of this requirement is to identify existing problems and establish appropriate performance targets for future site development or redevelopment. Given that the Miller and Des Moines Creek systems are known to have existing problems, the main question from a regulatory perspective is whether any of those problems would be described as "Severe Erosion" or "Severe Flooding" problems as defined by the KCSWDM under this core requirement. That question is not addressed in the SMP.

6. KCSWDM Core Requirement 3: Flow Control. (Similar to Ecology's Minimum Requirement #5.) The objective of this requirement is to establish appropriate performance targets for the design of stormwater facilities. For urbanized areas such as in the city of SeaTac, the KCSWDM normally requires a "Level 1" control as correctly described in the SMP pg 2-3. However, if a "Severe Erosion" or "Severe Flooding" problem exists as determined under Core Requirement 2, then the KCSWDM (Table 1.2.3.A, pg 1-26) requires that relatively-restrictive Level 2 or Level 3 flow controls be applied. For the 3rd runway project it cannot be concluded which flow control performance targets are required under the KCSWDM because the necessary offsite analysis has not been conducted.

7. Ecology Minimum Requirement 5, Streambank Erosion Control. The 1992 Ecology minimum requirement is that "stormwater discharges to streams shall control streambank erosion by

limiting the peak rate of runoff from individual development sites to 50 percent of the existing condition 2-year, 24-hour design storm while maintaining the existing condition peak runoff rate for the 10-year, 24-hour and 100-year, 24-hour design storms." This requirement is more restrictive than the KCSWDM "Level 1" peak flow control which only requires that there be no increase in 2- and 10-year peak flows determined by continuous simulation methods. The actual effect of the Ecology vs King County requirements on stormwater facility sizes is however difficult to predict because of the different hydrologic methods (storm event vs continuous simulation) which are prescribed.

From the perspective of providing environmental protection, it is far more important to provide control to 50% of the (frequently-occurring) existing condition 2-year storm than to provide control of the (rarely-occurring) 100-year storm. The relative unimportance of 100-year control is confirmed by Ecology having eliminated the requirement for 100-year control from its 1999 draft revised regulations. It is also noteworthy that Ecology's 1999 draft revised regulations (Vol I, pg 42) specify flow duration control "from 50% of the 2-year peak flow up to the full 50-year peak flow" and also (Vol III, pg 1) that "for purposes of designing runoff flow control BMPs, a calibrated continuous simulation model must be used for estimating runoff in western Washington." The Port's "Enhanced Level 1" standard targeting control of 2-, 10, and 100-year peak flows does not protect against increases in the duration of erosive flows, and will do little to prevent increases in stream bed and bank erosion (also see Comment 13). The SMP (pg 2-3) mis-states the text of the present (1992) Ecology minimum requirement, and fails to adopt or comply with the Ecology minimum requirement for control to 50 percent of the existing condition 2-year storm.

8. KCSWDM Core Requirement 4: Conveyance System. (Equivalent Ecology requirement not found.) The objective of this requirement is to ensure that the conveyance system is sufficient to capture uncontrolled peak runoff from development areas and to safely deliver or convey this water to detention facilities. Conveyance system issues are not addressed in the SMP. Specially-engineered facilities may be needed for conveyance and energy dissipation of runoff collected from runway areas (about elevation 390 feet) and dropped more than 120 feet vertical elevation to detention ponds (SMP Figure D-1) proposed to be located below the toe of the runway fill.

9. KCSWDM Core Requirement 7: Financial Guarantees and Liability. (Similar to Ecology's Minimum Requirement #11.) The objective of this requirement is to ensure that development projects have adequate financial resources to fully implement the stormwater management plan and that liability is not unduly incurred by local governments. The present SMP does not address costs for either the optimistic "best case" scenario assumed for preliminary planning or for contingency "worse case" scenario conditions. Critical assumptions for the "best case" scenario are: 1) that waterfowl attraction constraints do not prevent construction or expansion of open-water detention facilities and thereby force construction of expensive enclosed vault systems; and 2) (SMP pg 4-7) that local governments provide funding for 60% of the cost of the Des Moines Creek Regional Detention Facility. The likelihood of local government funding for the regional facility is uncertain. The SMP does not provide cost or financial viability information for either the best or worst case scenarios, and does not satisfy this minimum requirement common to both state and local regulations.

Comment Group II

Failure to establish the feasibility and performance of proposed stormwater facilities.

10. The SMP recognizes standing open water as a waterfowl attractant which is incompatible with airport safety requirements. The issue is addressed in SMP pages 2-7 through 2-10 which provides a superficial analysis of a hypothetical pond. The methods and conclusions of this analysis are seriously flawed because of the analysis assumption (pg 2-9) that "*it can be assumed that the precipitation event ends when the pond reaches the peak storage volume. Therefore, the duration of open water is calculated as the time it takes for the pond to drain.*" This assumption is inconsistent with actual precipitation conditions in the Puget Sound region. Complex precipitation patterns in the Pacific Northwest are one reason why HSPF continuous simulation methods are prescribed by King County for the design of stormwater detention facilities. The methodology described and used in the SMP will seriously underestimate the duration of open water conditions in airport stormwater facilities. A more accurate continuous simulation HSPF analysis may conclude that standing water constraints make it difficult or impossible to provide the necessary levels of flow control using open water facilities adjacent to the airport.

11. The SMP does not address whether open water durations have been analysed for any of the facilities proposed in the SMP. On page 2-10, the SMP concludes that "*Individual pond designs would have to be analyzed.*" The SMP provides no text or documentation to show that any of the proposed ponds have been so analyzed or are feasible in light of the open water duration constraint. When the analyses are made, it is critical that this be done with HSPF continuous simulation modeling, not the simplified method presented on SMP page 2-9. The feasibility of the Miller Creek Detention Facility expansion is particularly uncertain given its location in natural topography where it may be difficult or impossible to satisfy the detention pond design guidelines summarized on SMP pages 2-10 and 2-11. Those recommendations include using steep side slopes and deep pond depths, and eliminating wetland vegetation by lining the pond with riprap or quarry spalls.

12. The design performance of individual facilities is not substantiated in the SMP. It is impossible from the information provided in the SMP to determine or verify what performance standards are being applied, the point(s) of compliance, and whether the facilities achieve the required level of flow control.

We will use the proposed Walker Creek facility as an example of the lack of basic information to verify facility feasibility and performance. SMP Table 4-6, "Summary of stormwater detention required for Master Plan Update Improvements," (pg 4-17) indicates that a 6.6 acre-ft Third runway middle vault or pond is required to provide Level 2 flow control in the Walker Creek watershed. We are unable to find any information in the SMP which gives the facility's proposed physical location, the facility design tributary area, the facility discharge point, the acreage of Walker Creek basin which will be affected by the airport expansion, the land use changes which the airport expansion will cause in the Walker Creek basin, the target (existing conditions) peak flows and flow durations for runoff from the affected area of the Walker Creek, or simulated post-development peak flows and flow durations downstream of the proposed Walker Creek detention facility. A detailed review of the subbasin parameter tables (SMP Appendix B) found that the SMP has assumed future land use conditions in the headwater area of Walker Creek, subbasin 20, which are identical to existing conditions even though a portion of this subbasin will be converted from forest to runway under the proposed development. This lack of basic information in the SMP makes it impossible to assess or confirm facility adequacy.

Comment Group III
Establishment of target flows which may be much too high and would worsen existing problems along the Miller and Des Moines creek systems.

13. The SMP (pg 2-3) adopts an "Enhanced Level 1 flow control standard" which ignores the Ecology Minimum Requirement for limiting the peak rate of runoff from individual development sites to 50 percent of the existing condition 2-year, 24-hour design storm. Control is instead provided to a lesser standard of control to 100% of the 2-year, 10-year, and 100-year storms. This lesser standard allows for significant increases in peak discharges for events which occur more frequently than once in two years, on average, and provides no control over increases in the duration of erosive flows. A peak flow of about 50% of the 2-year peak flows is important to providing environmental protection because under undisturbed (forested) basin conditions this generally reflects a threshold flow at which channel erosion begins to occur. The point here is that failure to comply with the Ecology flow control minimum requirement (to 50% of 2-year flow) is likely to cause increases in erosive streamflows.

14. The SMP (pg 2-5) states that *"Re-introducing streams to pre-developed flow regimes may have serious consequences. . .unstable channel conditions may again result that may require years for the streams to adapt to."* This argument is used in the SMP (pg 2-6) to support that "for the purposes of establishing a target pre-developed flow regime for the Level 2 standard retrofit scenario, a uniform watershed imperviousness of 10 percent is assumed." There are two serious problems here:

    First, the argument that restoring "natural" flows will have serious consequences manifested as unstable channel conditions for years to come is speculative and unsubstantiated and provides a weak excuse for establishing elevated discharge rates as the performance target for stormwater facility design. Adoption of elevated discharge rates as performance targets will reduce the size and cost of stormwater detention facilities but is inconsistent with efforts to restore the natural conditions of these streams.

    Second, application of this methodology has resulted in target peak flows in the Miller Creek basin which are significantly **higher** than the current-conditions peak flows. Something is seriously wrong with this: all other studies indicate that the streams are degraded because the flows are already too high. We are unable to determine why the SMP is showing target pre-development flows substantially higher than current conditions flows because the SMP documentation is incomplete and the models used to determine the target and existing conditions flows are not provided. The discrepancies/problems with the target peak flows can be found in the Natural Resource Mitigation Plan Document, Table 6.1-2. If these targets were to be accepted and applied, then the SMP would appear to be recommending that the 2-year flow at the Miller Creek Detention Facility should be increased by 24% above current conditions and that the 100-year flow should be increased by 92% above current conditions.

SMP Figure 4-5 shows that the proposed target flows for Miller Creek are significantly higher than under current conditions for nearly all discharges. Application of these target flows would expedite the design and construction of economical stormwater facilities, but would most certainly worsen erosion and flooding along Miller Creek.

15. The SMP does not state whether the same uniform 10% effective imperviousness is also used for establishing Level 2 flow control targets for areas of new development, and does not provide sufficient documentation to describe what exactly was done. Lack of adequate analysis and design documentation in the SMP is problematic. If the same assumption of uniform 10% imperviousness has been used to establish flow targets for areas of new development, the resultant facility designs will fail to meet King County and Ecology minimum requirements and will cause unacceptable increases in erosive streamflows.

16. The SMP does not provide any information to describe the results of calibration of the Miller Creek HSPF model. SMP page 3-11 states that the HSPF model for Miller Creek was calibrated at two locations and implies that runoff data from several major runoff events in late 1995 and early 1996 were used as the basis for calibration. (This and other text implies that the current model is different from the 1995 Montgomery Water Group model which was based on calibration to events in 1990 and 1991.) The SMP does not provide any text or discussion on how the model was calibrated or the success of the model in reproducing recorded streamflows. SMP page 3-11 states only that "Plots of the HSPF calibration for Miller and Des Moines creeks. . .are shown in Figure B-3." However, calibration plots for Miller Creek were not provided in our copy of Figure B-3 or elsewhere in our copy of the SMP document or its appendices. Without this information, we have no way of assessing whether the HSPF-determined target flows for existing conditions are reasonable or if they are too high and would worsen problems of channel erosion. We suspect that problems with model calibration of the Miller Creek model may be responsible for the highly-questionable SMP target flows identified in comment 14 above.

17. The report for the 1995 Montgomery Water Group HSPF model for the Miller Creek is presented as FEIS Appendix G; it is not known how similar the SMP "final" model is to this 1995 version. The Miller Creek HSPF hydrologic model described in FEIS Appendix G is poorly calibrated and not well suited for establishing accurate target flow characteristics for the design of site stormwater facilities. The "red flag" for concern is raised with calibration results for Miller Creek below Lake Reba, for which (pg G-17) "the simulated flow volumes were only 60 percent of the recorded flow volumes", and for which basin "impervious areas had to be significantly reduced to achieve a good match of peak flows." The modeled upper basin area tributary to Lake Reba is 1,999 acres, which comprises about 43% of the total basin area for Miller Creek at the mouth.

The FEIS states (pg G-16) that good calibration results were achieved at the lower Miller Creek gage for both peak flows (89% match) and flow volumes (99% match). However, since upper-basin flow volumes to Lake Reba were undersimulated by 60%, a good volume match at the lower gage could only have been achieved by significant overestimation of flow volumes in the 2,639-acre incremental tributary area between Lake Reba and the downstream gage. The data indicate that flow volumes from lower basin areas are overestimated by about 45% above "true" flow values if the gage data are considered to be reliable. The proposed 3rd runway and airport expansion areas are all located in the lower basin areas. This means that the target flows (at least as indicated by flow volumes) may be significantly too high relative to actual existing conditions. In a similar vein, under-simulation of runoff volumes into Lake Reba (or the co-located Miller Creek RDF) will result in over-estimates of the level of flow control produced by detention in that facility.

18. It is unclear how stormwater runoff from areas tributary to the Industrial Wastewater System (IWS) has been handled in the modeling and what effect this has had on model calibration and target flows. Significant land areas are involved: the IWS handles runoff from about 254 acres under existing (1995) conditions and will be expanded to handle runoff from about 320 acres in the future. According to the report for the 1995 Montgomery Water Group (MWG) HSPF model, areas tributary to the IWS were not included in the HSPF model. However, these areas may in fact influence streamflows. The MWG report (pg G-8) indicates that the IWS has a hydraulic capacity of between the 10- and 25-year storm events and that overflow during more extreme events will overflow to the stormwater system. SMP Table 3-5 (pg 3-9) lists IWS areas totaling 78 acres which depend on pump systems with a capacity of only 6-month or 2-year events, after which runoff will overflow to the stormwater system. If the HSPF modeling and detention facility designs have ignored runoff contributions from the IWS areas, as seems to have occurred in the 1995 MWG study, the detention facilities will be undersized and not meet performance objectives for events which exceed the IWS system capacities. SMP pg 3-9 states that the most recent hydraulic models have incorporated appropriate flow splits between the IWS and stormwater systems. There appears to be an inconsistency in that the old (1995) model which excluded all IWS areas identified a need for 92.0 acre-feet of detention storage whereas the current SMP (pg 4-15) which is supposed to include stormwater overflows from the IWS is indicating a lesser requirement of 76.6 acre-feet of storage.

Comment Group IV
Miscellaneous Comments.

19. The SMP does not adequately assess or incorporate the use of infiltration facilities. SMP pg 5-2 acknowledges that *"infiltration is the highest priority for stormwater control"* according to Ecology, but does not commit to providing any infiltration of stormwater. Instead, the SMP states (pg 5-4) that *"the proposed stormwater facility locations would be investigated for feasibility as infiltration facilities"* and concludes with *"because expected base flow impacts are minimal, reduced infiltration would not adversely affect the success of the proposed mitigation."* Infiltration is given a very low priority in the SMP, inconsistent with King County and Ecology guidelines.

20. The SMP does not adequately assess the opportunity for creating artificial aquifer storage, which was one of the conditions identified in the Governor's Certificate for the project. The SMP concludes (pg 2-14) that *"a man-made aquifer within the runway embankment is not a viable option"* This conclusion is however inconsistent with SMP pg 5-2 which states that *"additional recharge from the new fill embankment"* is expected to be a significant base flow input. In order to satisfy this condition from the Governor's Condition, an analysis needs to be performed which examines the feasibility of infiltrating runoff from stormwater vaults constructed in the fill for the 3rd runway. The geotechnical analysis should focus not so much

on constructing some sort of underground swimming pool but rather on the viability of safely collecting the infiltrated water (after it percolates through over 100 vertical feet of fill) so that the stability of the fill body is not in any way compromised. The fill soils are projected to have hydrologic characteristics somewhere between till and outwash, and will have significant infiltration capacity to soak up most of the rainfall which falls on unpaved areas of the runway. Subdrain systems in the fill body are expected to be an essential element of the geotechnical design to deal with this seepage flow. The missing part of the analysis is to determine how much additional additional water (from paved areas of the airport) can be safely introduced into the fill body and collected by the engineered subdrain systems.

21. Some of the conclusions in SMP Appendix A are incorrect and are based on a questionable interpretation of the hydrologic modeling results. The conclusions in Appendix A Table 1 that discharge rates from the North SDN basins are lower in 1998 and 1999-2000 than in 1994 are not entirely correct. The supporting data presented as HEC-FFA frequency curve plots show that this is true for most return periods, but not for 100-year conditions. The Appendix A plots are annotated to indicate that the HEC-FFA results have been ignored for 100-year conditions and that the study conclusions are based on a nonstandard and highly questionable method of flow frequency analysis which produces results opposite to those which would have resulted from a conventional analysis.

In summary, there appear to be major deficiencies in the analysis which may result in significant adverse impacts to the natural stream systems if the current version of the Preliminary Comprehensive Stormwater Management Plan (SMP) is approved and implemented as a basis for mitigation of project impacts. We request on behalf of the Airport Communities Coalition that, prior to regulatory certification or approval of the proposed 3rd runway project, the applicant be required to respond to the SMP issues we have raised in this letter, and that we be granted the opportunity to provide followup review and comment on that response.

Sincerely,

NORTHWEST HYDRAULIC CONSULTANTS, INC.

William A. Rozeboom, P.E.
Senior Engineer

K. Malcolm Leytham, Ph.D, P.E.
Principal

Enclosures: vitae.

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C

Response to Comments on Permit Reference No. 1996-4-02325

Master Plan Update Development Actions at Seattle-Tacoma International Airport

March 2000

20. See response to 4G-10A (18, 19).

21. See response to 4G-10A (3, 17).

4G-10B Northwest Hydraulic Consultants, Inc.

1. On September 4, 1997, the Port and the City of SeaTac entered into an Interlocal Agreement (ILA) that established the standards and requirements for surface water management. This agreement provides, in material part, that the Port shall follow:

> ...the standards and requirements for surface water management as contained in the King County Surface Water Design Manual and King County Code Chapters 9.04 & 9.08 as existing on the date of the agreement, except (a) specific County permitting procedures (e.g. KCC 9.04.09) and (b) to the extent FAA or other federal requirements take precedence over local surface water requirements.

(ILA, p B-4, para. 4, see also attachment B-4.)

These stormwater management requirements are met through the Port's Stormwater Management Plan (SMP). The SMP uses the King County Design Manual (the Manual), the Stormwater Management Manual for the Puget Sound Basin (the Ecology Manual), and the Governor's Certificate (as it applies to stormwater management) as the basis for stormwater management for its Master Plan Update projects. In addition, stormwater requirements identified by the resource agencies that are unique to the Master Plan project are also used. The SMP demonstrates compliance with applicable performance standards. The manual process is required of applicants seeking approval from King County. The SMP addresses all of the relevant standards required by the Manual, in addition to meeting the performance goals and objectives of stormwater management described in the referenced design manuals.

2. This comment refers to a procedural process that the Port is not obligated to follow. The Port's SMP meets the intent of the process described in the Manual. In addition, the information provided in the SMP is substantially the same information required for this process and would likely satisfy this requirement if it were applicable.

3. The Port is not required to meet the procedures or process of a Master Drainage Plan (MDP). The SMP includes key plan elements, including the proposed facility locations (Figure 4-4), service areas (Tables 4-3 and 4-6; Figure 4-3), and discharge points (Appendix D). The standards for open water facilities are included in section 2.4.2. An analysis of the embankment infiltration was provided in Appendix B of the *Revised Draft Wetlands Functional Assessment and Impact Analysis* report.

4. The SMP provides sufficient basin mapping, as shown in Table 4-3 and Figures 3-2, 4-2, and 4-3. The SMP also demonstrates how basin areas are unchanged (see sections 2.4.1, 4.3.3, and 4.3.4).

The Industrial Wastewater System (IWS) diversions are compliant with the Manual standards. This diversion is equivalent to the King County approach to allow direct discharges to large water bodies and is similar to high-flow bypass pipes that are used to control peak stream flows and stream erosion. In addition, the IWS reduces water quality impacts. Post project flow duration curves demonstrate that proposed "middle-flow" values of one-half the two-year flow are equivalent to existing flows.

5. The Port's SMP demonstrates that Level 2 flow controls are applied to all Master Plan projects, which is the flow control standard required when a "Severe Erosion Problem" has been determined by the off-site analysis. Thus, off-site analysis is unnecessary to determine the applicable standard, since the flow standard for a "Severe Erosion Problem" is applied.

6. The Port's SMP demonstrates that Level 2 flow controls are applied to all Master Plan Update projects regardless of whether "severe erosion" problems exist (the comment notes that Level 1 is what is normally required for urbanized areas such as SeaTac). See page 2-4 for peak flow control standards and Comment (5) above.

7. This comment applies only to Des Moines Creek facilities because the Miller Creek facilities are already designed to meet the Level 2 flow standard. In the Des Moines Creek basin, the Des Moines Creek Basin Committee proposes construction and operation the Des Moines Creek Regional Detention Facility (RDF). The purpose of the RDF is to mitigate existing flow impacts and moderate peak flow impacts from long duration peak flows (the intent of the Level 2 standard). Therefore, additional Level 2 peak flow controls for the Master Plan projects are not needed for the Des Moines Creek basin. It would be of no significant ecological benefit to "over-detain" stormwater by meeting the Level 2 standard in both the on-site Port facilities and the RDF. However, in the event that the RDF is not constructed by the Basin Committee, the SMP (see page 2-4) indicates a contingency plan to build additional facilities to meet Level 2 detention.

   As indicated in the comment, Ecology has proposed new language that requires continuous flow simulation to design flow controls. The SMP used continuous flow simulation modeling and therefore, the intent of the Ecology Manual has been met.

8. Stormwater conveyance standards are described by FAA Advisory Circular AC150/5320-5B-Airport Drainage. The Port is required to comply with those standards.

9. See response to Commonly Asked Question I.

10. Review of section 2.4.2 (pg. 2-7) of the SMP demonstrates that the standards and methods described to calculate probable open water duration and wildlife controls are valid and adequate to meet the Port's wildlife control standard. "This duration of standing water in stormwater ponds is measured starting at the end of the precipitation event. For purposes of this analysis, it can be assumed that the precipitation event ends when the pond reaches the peak storage volume. Therefore, the duration of open water is calculated as the time it takes for the pond to drain, starting at the maximum storage of the 2-year design storm event." In other words, the open water duration standard is measured from the end of the storm, but assumes that the pond is at the 2-year flood stage when the storm ends and the pond starts to drain. This is a conservative assumption, since the pond would begin draining from

its peak stage immediately after it reaches peak stage, but the duration measurement would not begin until the storm had stopped.

Section 2.4.2.4 lists several detention design requirements to minimize wildlife attraction, including covering the entire facility. The Port has demonstrated the ability to construct large underground detention facilities, and has successfully reduced wildlife use of other large impoundments with netting. Figure D-1 in the SMP technical appendices shows proposed detention ponds with a "double-cell" design where the smaller, second cell is the area where more frequent standing water may be present. This smaller area could be readily covered to reduce wildlife attraction.

11. The SMP addresses open water durations (see Table 2-1) for two typical stormwater facilities under enhanced Level 1 and Level 2 standards. The results show that even under Level 2 flow controls and the conservative draining assumption described in the response to the previous comment, the ponds would drain the 2-year storm within 48 hours. During final design, the actual pond performance will be tested. The ponds would be tested using applicable input from the HSPF model.

The Miller Creek Detention Facility (MCDF) expansion would be constructed in a non-wetland area (see section 4.2.3.1, pg. 4-7). Grading plans are shown on Figure D-3, indicating the proposed pond slopes. No deep ponds would be constructed for expansion. The expansion area would be graded to be free-draining to prevent wetland establishment. The proposed bottom elevation of the expansion is elevation 270. The minimum pool elevation of the MCDF is elevation 264, which means that the expansion area would not be frequently flooded. The wildlife control guidelines will be met in the MCDF expansion.

12. Performance standards (section 2, Table 4-6), proposed facility locations (Figure 4-4), service areas (Table 4-3 and Figure 4-3), discharge points (Appendix D), points of compliance (Table 4-7) and results of the analysis (Table 4-7) are all provided in the SMP.

13. The Port's enhanced Level 1 flow control is proposed for the Des Moines Creek facilities only. The Miller Creek facilities are designed to meet the Level 2 flow standard; accordingly, this comment does not apply to those facilities. The purpose of the Ecology Manual 50 percent flow reduction standard is primarily to account for the inability of event models to sufficiently characterize hydrologic and climatic conditions in the Puget Sound region. While event models are adequate for analyzing small development sites, continuous simulation hydrologic models are more appropriate for large-scale projects that have more significant watershed effects. Ecology has proposed new language that requires continuous flow simulation to design flow controls (which has been used for the SMP). The Port detention facilities are designed to meet the flow standards using a continuous flow model, which is consistent with the intent of existing and proposed Ecology standards. The construction and operation of the Des Moines Creek Regional Detention Facility (RDF) will mitigate existing flow impacts and moderate peak flow impacts from long duration peak flows as intended by the Ecology Manual. In the event that the RDF is not constructed by the Basin Committee, the SMP (see page 2-4) indicates a contingency plan for additional Level 2 detention. The intent of the existing Ecology Manual and proposed Ecology Manual standards has been met

through the proposed SMP standards and analysis. The statement in the comment that the proposed Master Plan Update projects are likely to cause erosive stream flows is incorrect considering that the application of Level 2 standards are specifically intended to control areas with extreme erosion hazard.

14. The proposed stormwater plan will not increase peak flow rates above existing peak flows. Target flows are calculated to determine the flow regime that would not exceed a stream's ability to maintain equilibrium between erosion and aggradation. Both Des Moines and Miller creek watersheds have been developed for many years, the creeks have changed somewhat in response to their modified developed hydrology. In the Des Moines Creek Basin, the target flow regime was determined in a study by the University of Washington (see Des Moines Creek Basin Plan Regional Detention Facility Engineering Report 1999). The flow regime determined for Des Moines Creek was compared to a target flow regime modeled for a watershed with 10 percent effective impervious area, rather than its actual effective impervious area. The results of both analyses compared very closely, as shown in Figure 4-5 of the SMP.

There appears to be some confusion regarding the relationship of the Level 2 flow standard to the target flow regime. The purpose of the target flow analysis is to establish a flow regime for existing conditions that is protective of fish habitat and will not exceed a streams ability to maintain equilibrium between erosion and aggradation. In other words, what should the flows in the creeks be without considering the Master Plan projects or the Miller Creek Detention Facility? The target flow rate assumes that the runoff effects of existing basin imperviousness would be reduced from the current effective impervious areas to 10 percent impervious. The Level 2 benefits of the existing Miller Creek Detention Facility are then considered. Figure 4-5 of the SMP demonstrates that the target flow is in fact below the existing flows resulting from more frequent small storms. Once the target flow is established, impervious area from the Master Plan Update projects is added and additional detention that is specifically needed for Master Plan Update projects is determined. The performance standard requires that there be no increase in the established target flow. Figure 4-5 of the SMP demonstrates that the flow duration curve for the proposed condition is lower than existing flow duration curves for all flow frequencies.

15. The SMP describes existing conditions for establishing Level 2 flow controls (see section 2.3.3, 2.3.4.1, and 4.3.2). Peak flow magnitude and duration would not increase, as demonstrated on Figure 4-5 of the SMP. The 10 percent impervious area assumption is used to determine retrofitting standards for the STIA areas that drain to existing or proposed detention areas. What this means is that assumed existing flows are modeled assuming that the basin is reduced to10 percent impervious, which would lower allowable peak flows. For areas of new Master Plan development, primarily the west side development where the third runway is proposed, impervious area existing in 1994 is assumed. It is very unlikely that the Master Plan projects could increase erosion and peak flow magnitude and duration in the creeks with proposed target flows that reduce existing condition flows and additionally mitigate peak flows from the airport project to the Level 2 erosion protection standard.

16. Miller Creek model calibration is not related to the selection and results of target flow analysis in the Miller Creek basin. See response to comment 4G-10B (14).

Calibration of the HSPF model for Miller Creek has been periodically refined since 1990 as additional monitoring data and research results become available. The most recent revisions (1999) were directed at achieving a closer match between recorded and simulated peak flow and runoff.

Of the 16 essential parameter values that were used to calibrate the 1995 and 1999 model versions, three parameters (DEEPFR, INTFW, and IRC) were adjusted in 1999 to better match local conditions. All but the three adjusted parameters are similar to the regional parameters developed by the U.S. Geological Survey for Western King County (Dinicola 1990). The effects of the adjusted parameters, a comparison to the regional values for these parameters, and the effect on modeled output are evaluated in Table 1.

Table 1. Comparison of HSPF calibration parameter values for 1995 and 1999

Parameter – Definition	Change From 1995-1999 Model of Existing Miller Creek Basin Condition		Comparison to 1990 Regional Calibration Parameter Values (Dinicola 1990)	
	Change	Effect	Difference	If Regional Value Were Used
DEEPFR – fraction of groundwater that does not discharge to surface water within modeled area	Decreased from 0.8 to 0.3 in till covered area of modeled basins	Less subsurface water is lost to the deep aquifer; results in greater discharge to stream	Not provided in 1990 study; however subsequent study estimates this to be less up to 0.17 in till covered areas [1]	
INTFW –index of the amount of water that infiltrates and flows as shallow subsurface flow (i.e. interflow)	Increased index from 1.7 to 6.0 in till covered areas	Results in greater amounts of interflow and rapid discharge to stream in till areas	Increase from regional value of 3.0	Greater runoff from till covered areas will increase flow volume
	Decreased index from 1.7 to 0.0 in outwash areas with forest cover	Reduces runoff from these areas	No difference	
IRC –Interflow recession parameter that governs the rate at which interflow drains from pervious surfaces	Increased from 0.12 to 0.5 in till covered areas, and to 0.7 in outwash covered areas	Decreases discharge rates of interflow from till and outwash area to Miller Creek.	For till areas, the modeled value is less than the regional value of 0.5	Longer interflow response increases recession limb of storm hydrographs

Note: [1] In Bauer and Mastin. 1997. *Recharge from precipitation in three small glacial-till mantled catchments in the Puget Sound Lowland, Washington*. U.S. Geological Survey. Water Resources Investigations Report 96-4219.

The effects of the changes from the 1995 to the 1999 model shown above are (1) an increased base flow, (2) an increase in interflow, with corresponding reduction in peak flow (but preservation of runoff volume), and (3) a reduction in the rate of interflow discharges into the stream. The changes improve the correlation between recorded and simulated runoff volume, and better match the simulated peak flow rates relative to the recorded flow peak rates.

The adjustments in the parameters between 1995 and 1999 model versions resulted in values that were closer to regional parameters developed by U.S. Geological Survey (Bauer and Mastin 1997). These studies report the fraction of precipitation that is lost to deep groundwater in till-covered areas averaged 4.0, 13.9 and 16.7 percent of precipitation. The studies used two methods to determine the water budget and both methods provided in similar results. In general, changing the INTFW and IRC parameters to the regional values will increase the base flow estimate and reduce the peak flow of the model.

The changes in these values are warranted because they are consistent with the parameter values found in the regional studies. Use of the values result in a closer match of monitored to simulated runoff volumes, as is shown below.

Miller Creek HSPF Model Calibration

The HSPF model is accurately calibrated and suitable for characterizing target flow conditions in the project-related watersheds. This is further demonstrated in the next section.

Table 2 compares recorded average monthly and peak hourly-recorded flow to simulated flow values for the period from 1993 through 1996. The Miller Creek Detention Facility (MCDF) was constructed in 1992; however, there were changes made in 1995 to the outlet gate setting that affect the hydraulic routing through the detention pond. The last two years of the record (1995-1996) are the best suited to evaluation of the HSPF model calibration.

Table 2. Relative percent difference between recorded and simulated flow for 1995-1996 period of record

Gauge Location	Average Monthly Flow Difference, %	Peak Hourly Flow Difference, %
MCDF	11	26
Miller Creek Mouth	3	17

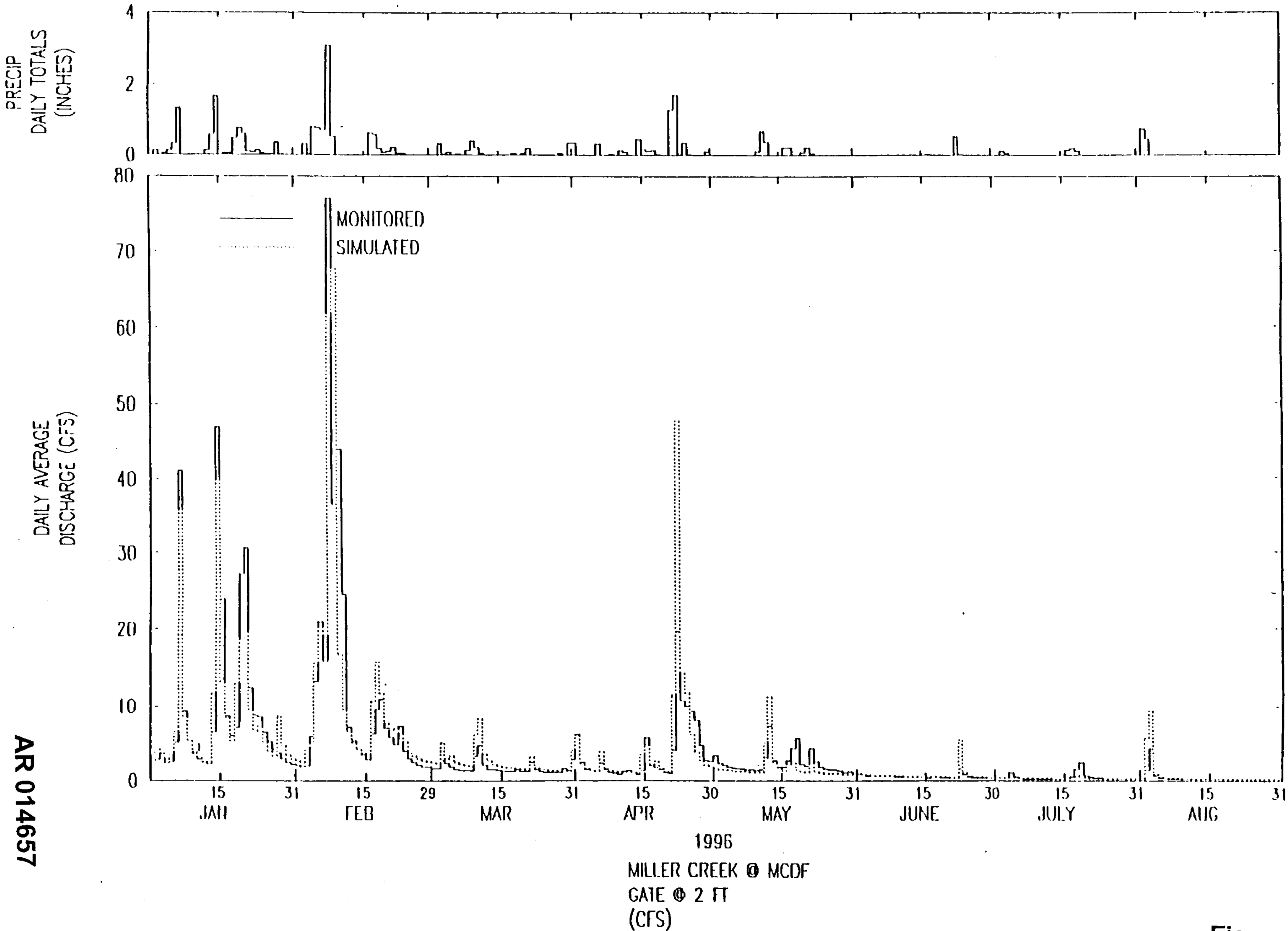
As shown in the table, the model average results are approximately 11 percent greater than the recorded volume and 26 percent greater than the recorded peak flow for the recent monitoring period between 1995-1996 at the MCDF. At the mouth of Miller Creek, the model results average approximately three percent greater than the recorded volume and 17 percent greater than the recorded peak flow. These results are close to the stated goals in the FEIS (pp. G-12: G-13), particularly with respect to achieving a good match of flow volumes to within plus or minus 10 percent (on average). In comparison to the 1995 model results for Miller Creek, the 1999 model results are an improvement because runoff volume is a closer match to recorded flow at the MCDF and peak flows are not underestimated at the mouth.

As noted in the FEIS, emphasis was placed on calibrating the model to accurately simulate the peak flow events in the record in order to accurately estimate the peak flood flow frequency curve. Figures 4 and 5 included in this response show a comparison between the monitored and simulated results at the MCDF and the mouth of Miller Creek for 1995 through August 1996. These figures show the close correlation between the recorded values and simulated flow frequencies.

The goal of the calibration process is to obtain a set of parameters so that the model will respond to the full set of physical events that it represents and thereby serve as a useful decision tool. The model will not simulate every event exactly because of the model's abstractions of the physical processes, the variability in the precipitation patterns (such as rainfall spatial and temporal distribution), and the variability in the geophysical parameters that affect soil conditions and subsurface flow. The model is used to determine how measures such as detention facilities affect relative differences between two conditions. Therefore, if peak flow volume is slightly overestimated for the base condition, the same factors apply toward overestimation in the future condition. Elimination of the last ten percent error does not improve the utility of the model for decision-making purposes.

Flow Volume and Target Flow Verification Discussion

The hydrogeologic characteristics of Miller Creek are significantly different as indicated by the following charts of soil and impervious cover. Note that the soil is predominately till in the basins above SR 518 (Lake Reba outlet) and predominately outwash below this location. The runoff responses are greatly different and explain the increase in volume generation in the intervening tributary are between Lake Reba and the mouth of Miller Creek estimated by the HSPF model.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JAN
FEB
MAR
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JULY
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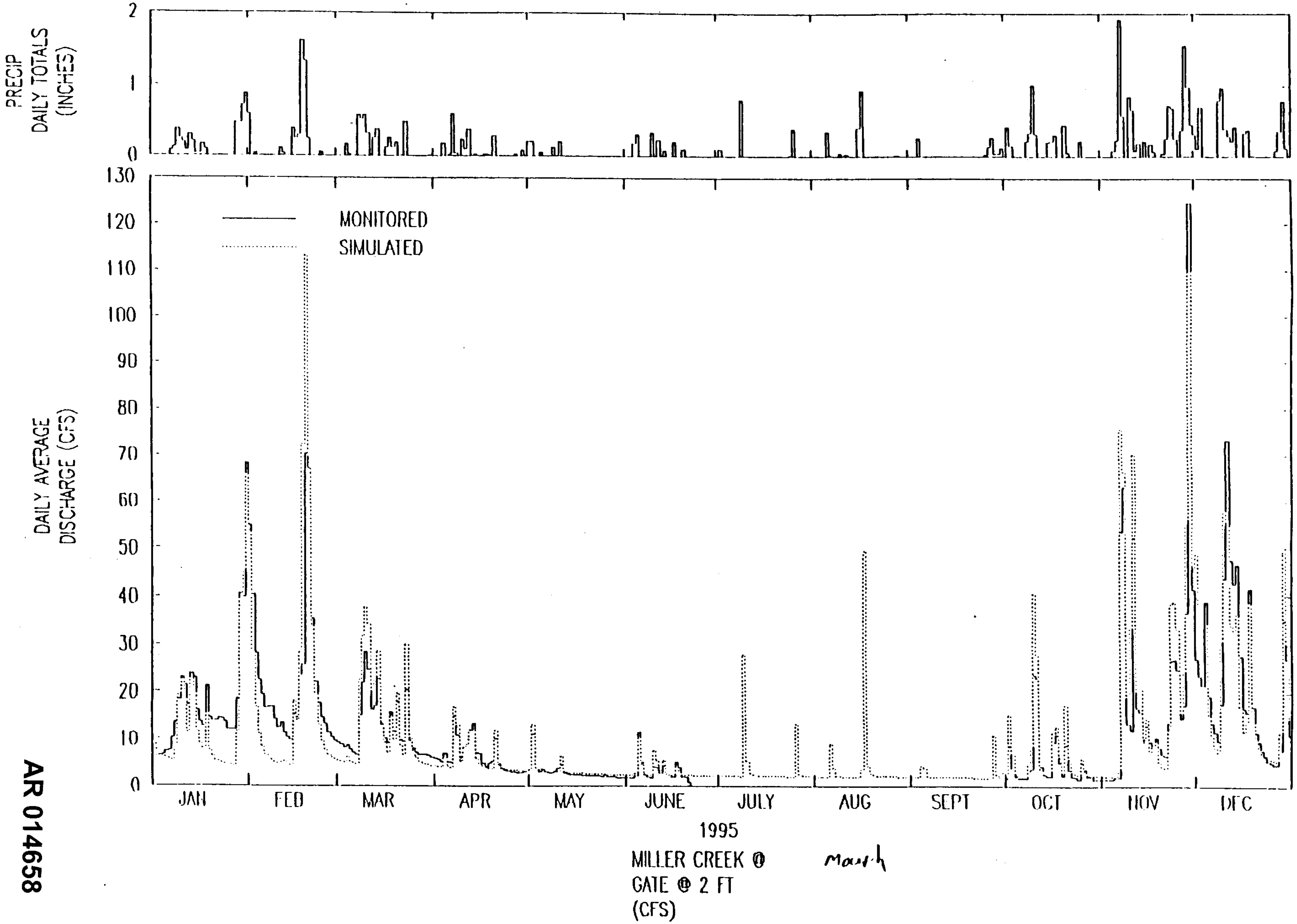
1996
MILLER CREEK @ MCDF
GATE @ 2 FT
(CFS)

Figure 4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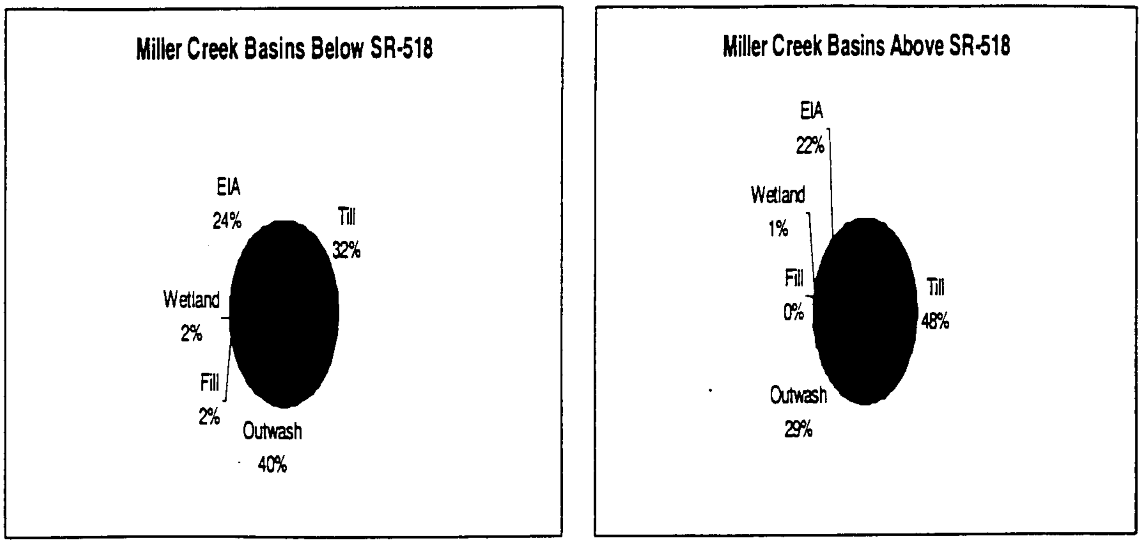
MILLER CREEK @
GATE @ 2 FT
(CFS)

Figure 5

Figure 6. Land use and soil conditions in the Miller Creek Basins

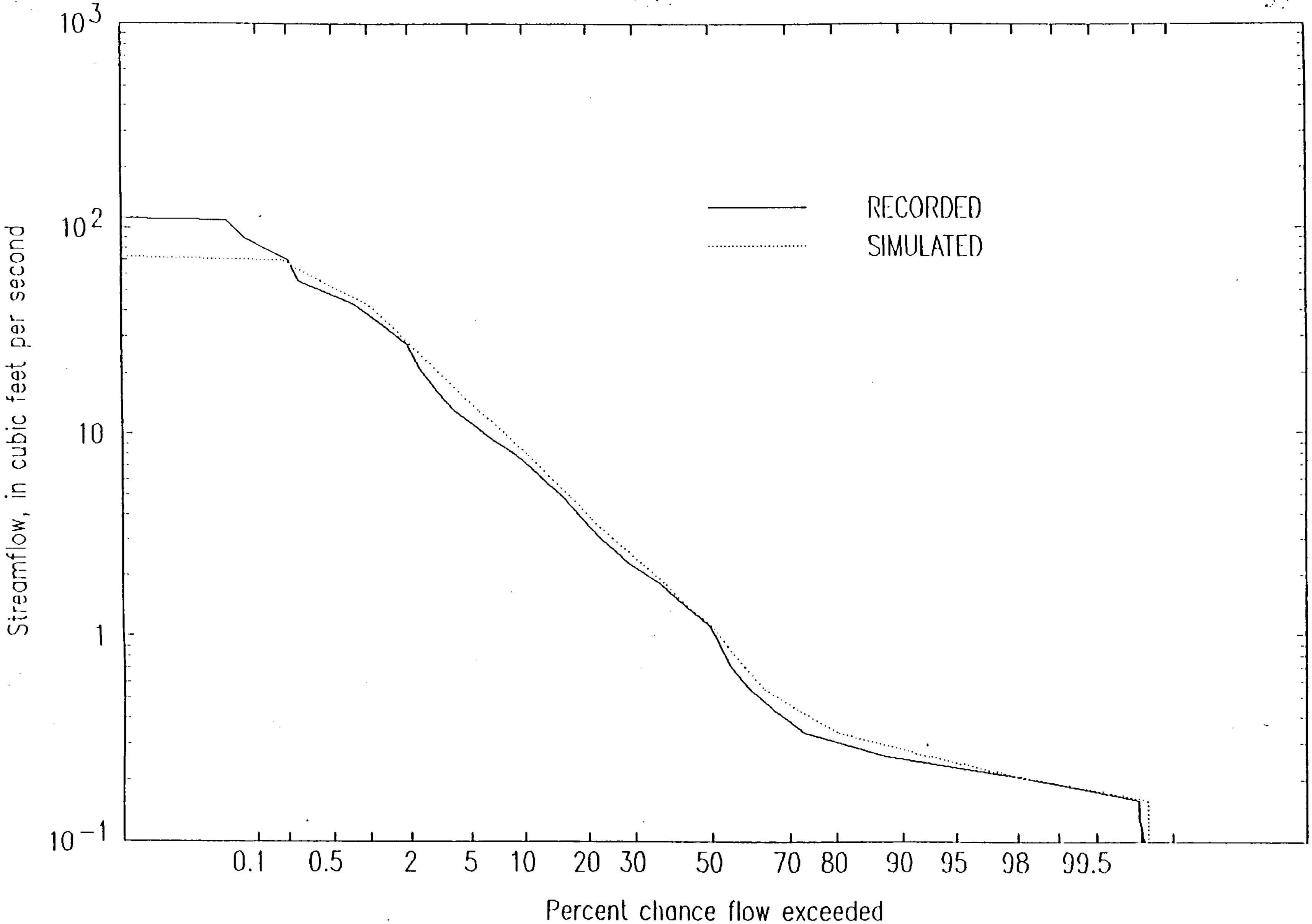


The amount of precipitation that returns to the creek from groundwater recharge for each soil type is compared in Table F-1 from the SMP for various land cover types. The average direct runoff (sum of surface runoff, interflow, and groundwater discharge) response from till (forest and grass) is 64 percent of rainfall versus 68 percent from outwash (forest and grass).

Considering that the area downstream of SR 518 is 2.2 times the area upstream, it is possible for there to be increased direct runoff difference between the two areas. Therefore, it is expected that there will be differences between the direct runoff volume from area upstream and downstream of Lake Reba because of hydrogeologic characteristics. The reviewer's assumption that underestimation of runoff volume above SR 518 can only be compensated (to calibrate the model at the mouth) by overestimating the runoff volume downstream of SR 518 is erroneous. Runoff volume is a function of soils, hydrogeologic conditions, as well as drainage area.

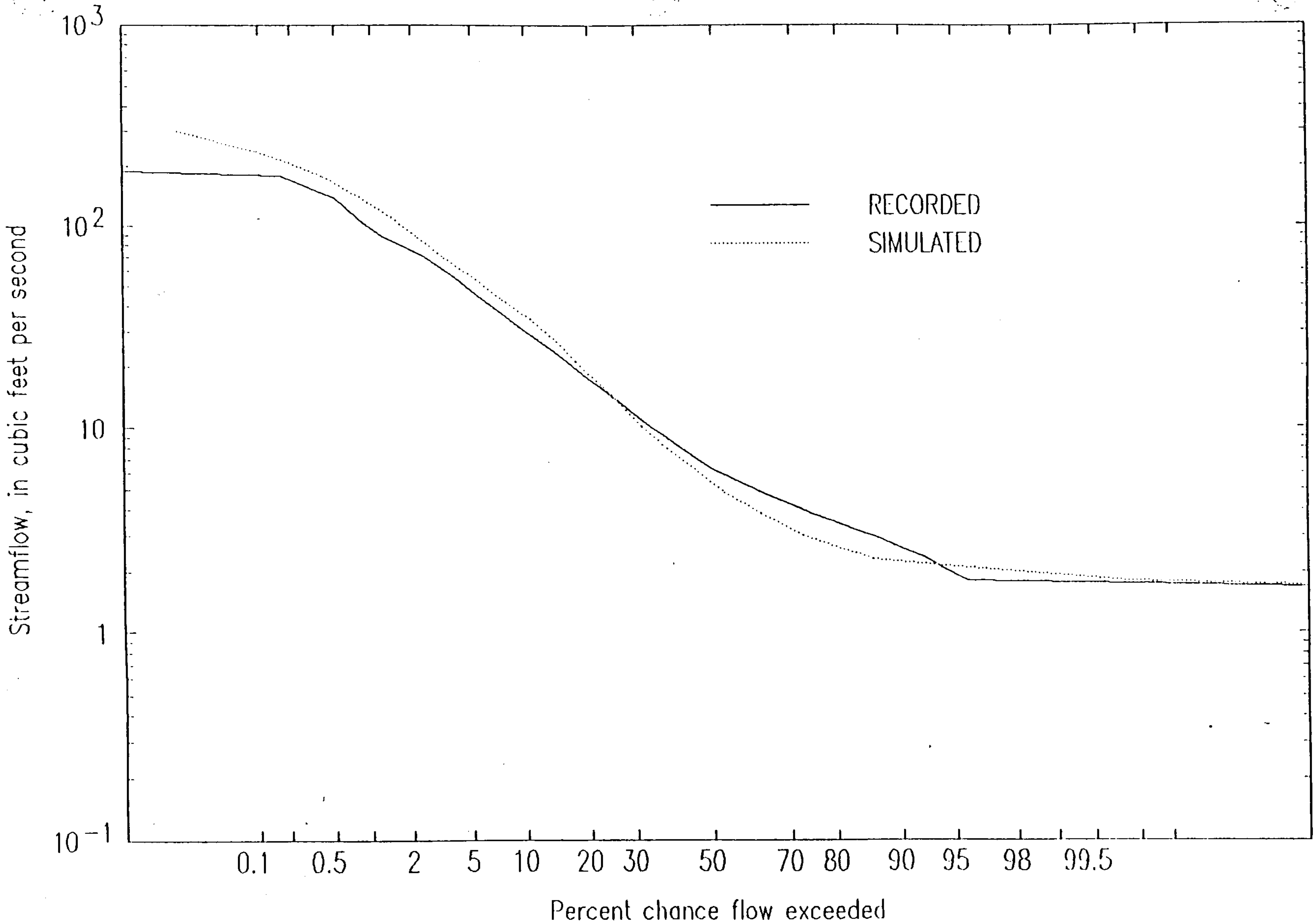
Further information to show that the model reproduces the monitored runoff volumes is presented in Figures 7 and 8. These figures show flow duration curves for recorded data versus simulated data for periods between 1995 to 1996. Note that there is a close match between the recorded and simulated percent chance that flow is exceeded. There are reasons to suspect that gate operation or flow recording problems may have altered the peak outflow at the MCDF for at least two significant runoff events in this time period which may explain differences between recorded and simulated flows during extreme events.

However, the percent of time the differences on Figures 7 and 8 occur are approximately 0.1 percent or about 12 hours or less during the period of record shown in the figures. The intermediate locations between MCDF and the mouth, such as at SR 509, will have less difference between monitored and simulated conditions since the peak flow shown in the figures is underestimated for a short time period upstream at MCDF and overestimated for a similar time period downstream at



FLOW DURATION COMPARISON @ MCDF 2/95-8/96

Figure 7



FLOW DURATION COMPARISON @ MOUTH 10/95–7/96

Figure 8

the mouth. The HSPF model is sufficiently accurate to establish the target flow regime. (Dinicola 1990, Bauer and Mastin 1997)

17. See response to Comment 16 above.

18. The IWS flows have been included in the hydrologic models. Section 3.2.2, pg. 3-9, final paragraph indicates that the hydrologic model considers flow diversions from IWS areas.

19. Infiltration is a high priority stormwater management technique when appropriate site conditions are present. Section 5.1.2 describes the analyses and conditions under which infiltration will be used. To demonstrate that the Port could adequately provide the required stormwater detention, infiltration was assumed to not be available, which means that infiltration would provide additional stormwater control, if feasible. The Port would provide infiltration facilities if feasible, considering the potentially positive wildlife control benefits. The reviewer omitted a key phrase when quoting the SMP. The complete quote (with the omission in italic), "The proposed stormwater facility locations would be investigated for feasibility as infiltration facilities *as part of the stormwater management design report for the proposed facilities. Proposed facilities would be designed and constructed as if no infiltration would occur; therefore they would be large enough to reduce peak flow as required.* Because expected base flow impacts are minimal, reduced infiltration would not adversely affect the success of the proposed mitigation." The reviewer's assertion that infiltration is given a very low priority in the SMP is incorrect.

20. Section 2.4.5 of the SMP describes the unfeasibility of creating an *enhanced* artificial aquifer (emphasis added). Considering other geotechnical considerations, this is a prudent decision. However, the Port has identified the potential for "natural" recharge into the proposed embankment (Appendix B of the *Revised Draft Wetland Functional Assessment and Impact Analysis* report (Parametrix 1999)). The potential flow benefits of the embankment have been left out when calculating base flow, which means that future base flow from the embankment has likely been underestimated. The Port has not described this as potential mitigation because the primary objective of the design must be stability; including the potential flow benefits. Base flow mitigation from the embankment cannot be committed to in the event that the embankment cannot contribute to base flow without compromising stability. As described in the SMP, base flow impacts are mitigated, and flow from the embankment need not be quantified.

The Governor's Certificate does not require that stormwater be infiltrated from the stormwater vaults. This would be infeasible for the same reasons described above.

21. The flood frequency curves for the 1998 and 1999-2000 conditions for the Miller Creek stormwater drainage system subbasins, which comprise the basins located at the north end of the airfield, show a flood peak for the 100-year event based on the expected probability curve that is estimated to be greater than the 1994 condition. The 2- and 10-year flood magnitudes are, however, less than the 1994 condition. The purpose of these curves is to determine the interim flood probability and performance of the Miller Creek Detention Facility during the time between the report date and construction of the Miller Creek expansion. In other words, what is the probability (and predicted flow) of a flood to occur that will exceed the target flows in the

MCDF before the facility is complete, and what is the relative magnitude of impact. The increase in the 100-year flood peak flow rate for the two conditions is shown below:

	1994 Q	1998 Q	1999-2000Q
Flow (cfs)	62	67	66
Change from 1994 (cfs)		5	4

The increased discharge volume of the above differences is approximately 0.3 and 0.4 acre-ft. This amount of additional storage is approximately two percent of the proposed expansion to the Miller Creek Detention Facility which is required for the 154th/156th St Relocation scheduled for construction in year 2000.

4G-10C Mark C. Rutsick

1. The *Revised Draft Biological Assessment* (BA) (Parametrix 1999) describes the potential for chinook salmon to use the project area. Potential impacts to chinook were not discussed in previous documents because chinook are not documented in any of the streams within the project area. Chinook salmon are found within Puget Sound and likely use the near-shore and estuarine habitat at the mouths of Miller and Des Moines creeks; however, no impacts to these habitats will occur as a result of the construction of the Master Plan Update improvements. The ESA determination for chinook salmon as described in the biological assessment is "may affect, not likely to adversely affect." See response to 4G-10A(20).

2. See response to 4G-10A (18).

3. The presence of coho salmon within Miller and Des Moines creeks has been described in various documents including the DEIS (1995), the FEIS (1996), and referenced in various appendices to the FSEIS (1997) (i.e., *Revised Draft Natural Resource Mitigation Plan* and Appendix F). The DEIS (Landrum and Brown 1995) and the FEIS (1996) identify that both Miller and Des Moines creeks historically supported large runs of coho salmon and small runs of chum salmon. These reports also state that currently, both creeks continue to support reduced runs of coho, which are largely maintained by annual releases of hatchery-reared fingerlings raised by the Des Moines Salmon Chapter of Trout Unlimited. In addition to anadromous fish, these reports describe other fish species that use the creek systems. For instance sea-run cutthroat and pumpkinseed sunfish are found in both creeks, whereas resident rainbow trout, bluegill, black bullhead, and largemouth bass are primarily found in Des Moines Creek.

4. Even though the chinook salmon, Puget Sound ESU, and bull trout were listed as threatened species after issuance of the FEIS and FSEIS, those listings do not require the preparation of another SEIS. As documented in the BA, the Port's Master Plan Update development activities are not likely to have an adverse impact on the fish or their habitat. The mere listing or proposed listing of an ESA candidate species is not significant new information that requires a supplemental EIS. The BA accurately reports on the expected biological impacts of the project to these species. NEPA permits the Corps to rely upon supplementary documentation that was not included in an environmental impact statement when, as in the present case, that documentation has been made accessible and available to the public. See response to 4G-6(2).

D

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Shorelands and Environmental Assistance Program
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ATTN: Ann Kenny, Environmental Specialist

Subject: Comments on stormwater, hydrology, and hydraulics aspects of proposed 3rd runway and related development actions at Seattle-Tacoma International Airport, Corps Reference No. 1996-4-02325.

Northwest Hydraulic Consultants has been retained on behalf of the Airport Communities Coalition to provide technical reviews of stormwater, hydrology, and hydraulics elements of proposed development actions at SeaTac airport. Our comments on the November 1999 version of the project stormwater management plan and related environmental documents were submitted to Ecology and the Corps in a series of three letters dated 11/24/99, 5/3/2000, and 7/31/2000. Our comments on the August 2000 version of the stormwater management plan were submitted to Ecology (but not the Corps) in a series of four letters dated 9/7/2000, 9/21/2000, 9/25/2000, and 9/27/2000. The purpose of this letter is to record our review comments on the December 2000 version of the documents listed below.

- "Comprehensive Stormwater Management Plan; Seattle-Tacoma International Airport Master Plan Update Improvements" dated December 2000 by Parametrix, Inc. Also reviewed were the separately-bound (as Volumes 2 through 4) Comprehensive Stormwater Management Plan Appendices A through Z dated December 2000. (SMP)

- "Natural Resource Mitigation Plan; Seattle-Tacoma International Airport; Master Plan Update Improvements" dated December 2000 by Parametrix, Inc. Also reviewed were the separately-bound Natural Resource Mitigation Plan Appendices A-E Design Drawings dated December 2000. (NRMP)

AR 014665

- "Wetland Functional Assessment and Impact Analysis; Master Plan Update Improvements; Seattle-Tacoma International Airport" dated December 2000 by Parametrix, Inc. (WFA)

Our qualifications to perform this review were described in our letter of November 24, 1999, and are repeated here. Mr. Rozeboom has over 20 years of specialized experience in surface water hydrology and hydraulics, including over 6 years as principal reviewer of all Master Drainage Plan, Stormwater Management Plan, and Storm Drainage Technical Information Report documents for the 1,300-acre Snoqualmie Ridge project currently under construction in the city of Snoqualmie. The Snoqualmie Ridge project is similar to the 3rd runway project in that it is a large site development which is subject to the requirements of the Washington State Department of Ecology Stormwater Management Manual and the King County Surface Water Design Manual (KCSWDM). Dr. Leytham has over 20 years of specialized experience in surface water hydrology and hydraulics, including serving as technical advisor to King County on flow control aspects of the 1990 and 1998 versions of the KCSWDM. Dr. Leytham was also responsible in 1990 for the original development of the Miller Creek basin HSPF simulation model which has since been modified by others for purposes of 3rd runway impact assessments and facility designs. Vitae for Mr. Rozeboom and Dr. Leytham are attached for reference.

Our review of the current Stormwater Management Plan and related documents has identified numerous technical deficiencies in the analyses and preliminary designs which present a risk of significant adverse impacts to the natural stream and wetland systems if the current documents are approved as a basis for mitigation of project impacts. The risk of adverse impacts is heightened by uncertainty over what performance standards will be eventually negotiated and applied for the final design of stormwater facilities, and the absence of a process for regulatory review of final drainage design plans for this large and complex project.

Our comments follow.

1. There is no clear and consistent definition of stormwater control standards to which the Port has committed to adhere. Although the SMP describes storm water control standards and target flow regimes at some length in Chapter 2 of the SMP, the standards discussed appear to still be under negotiation with Ecology. Ecology's current proposal to modify the NPDES permit[1] for SeaTac International Airport would extend permit coverage to stormwater discharges associated with the Third Runway and Master Plan Update projects. However, in the draft of the modified permit, project stormwater detention requirements are specified in Special Condition S14 as, "*All construction actions taken by the Permittee shall provide sufficient detention and/or shall use existing available detention capacity, in accordance with the Stormwater Management Manual for the Puget Sound Basin or its approved equivalent, to prevent an increase in the peak flow rate or flooding frequency of Miller Creek and Des Moines Creek.*" The problem with this language in the draft permit is that it specifies (requires?) a stormwater standard for the Third Runway and Master Plan Update projects which is less stringent than the SMP "updated" detention standards (SMP section

[1]Ecology held a February 12, 2001 public hearing on the proposed modification to NPDES Permit No. WA-002465-1. The deadline for written comments on the proposed modification is February 26, 2001, which is 10 days after the deadline for public comments on the Section 404 Permit application for the same project.

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2.1.4) sought by others at Ecology as a condition of Section 401 Certification for those same projects. The December 2000 SMP (page 6-3) indicates that "*the hydraulic design of the facilities will be reevaluated and detention volumes adjusted as appropriate to ensure that the Port's stormwater management standards are met.*" However, the "Port's stormwater standards" appear to be defined by the SMP (page 2-1) as being "in the King County and Ecology Manuals" and those manuals do not describe or require the "updated" detention requirements found in SMP Section 2.1.4. These inconsistencies in proposed standards are of concern and lead us to question whether the Port will implement designs per the updated standards cited in the current SMP or is anticipating future negotiations which will allow the facilities to be reevaluated and detention volumes to be reduced per the less stringent standards in the King County Manual or as required by the NPDES permit.

2. The lack of detailed stormwater plans, plus the lack of a clearly-defined review process for this very complex project, makes it likely that post-SMP detailed engineering and revisions to stormwater facility designs will fail to meet Ecology and King County performance expectations. The recent history for this project, particularly the major flaws in both the November 1999 and August 2000 versions of the project SMP, highlights the need for an independent design review to supplement the Port's quality assurance and review processes. Lack of an established review process is a very major concern given that the current SMP does not establish exactly what facilities and hydraulic controls will be constructed.

   Stormwater drainage regulations for the project site are defined by the King County Surface Water Design Manual (KCSWDM) as adopted by the city of SeaTac. The KCSWDM begins (Chapter 1) by describing the drainage review procedures necessary to implement the King County surface water policies and to ensure compliance with the manual's technical requirements. However, the Port has consistently claimed to be exempt from the KCSWDM drainage review requirements as well as all other KCSWDM "procedural" requirements[2]. The proposed project will have a long timeline and there will likely be a need for design adjustments to address unanticipated conditions which arise in the future. Without explicit descriptions in the SMP of the facilities and hydraulic controls to be constructed, plus certainty of ongoing, independent, competent review, there can be no reasonable assurance of project compliance with either King County surface water policies or Ecology conditions of approval for Section 401 Certification.

3. KCSWDM Core Requirement 7: Financial Guarantees and Liability. (Similar to Ecology's Minimum Requirement #11.) The objective of this "procedural" core requirement is to ensure that development projects have adequate financial resources to fully implement the stormwater management plan and that liability is not unduly incurred by local governments. The present SMP does not address the costs of the proposed improvements or offer any financial guarantees. Using costs presented in SMP Appendix M, a single 12.6 acre-foot vault

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[2]Procedural issues were previously raised in our comment letter dated November 24, 1999. The Port's response to those comments, in a "Response to 401/404 comments" document dated March 10, 2000, stated that the Port's Interlocal Agreement with the City of SeaTac includes an exemption from "specific County permitting procedures." In the same document, the Port response to our comment on drainage review requirements begins with the statement, "This comment refers to a procedural process that the Port is not obligated to follow."

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for water quality treatment would cost $7,258,675 or about $13 per cubic foot. SMP page 6-5 shows that a total of 207.2 acre-feet of stormwater vaults are proposed. At $13/cubic foot, the proposed stormwater vaults alone would cost over $117,000,000. The SMP does not address or satisfy the applicable King County and Ecology requirements for financial guarantees, and provides no assurance of sufficient funding to construct the facilities being proposed.

The importance of costs and financing is also cited in a letter report dated November 10, 1999 to the US Army Corps of Engineers by Keith Macdonald, Ph.D., of CH2M Hill, who was hired by the Port to "prepare an objective, independent, peer review of the natural resources mitigation program" for the proposed Master Plan Update Improvements. Dr. Macdonald states that "Obviously, the success of the mitigation depends on the effectiveness of implementation and monitoring. . .It is critical that sufficient guaranteed funding be available. . ."

4. Sizing of stormwater facilities has relied on unsupported assumptions regarding future Industrial Wastewater System (IWS) capacity for processing airport runoff without overflows to the natural creek systems. If these assumptions are not achieved, the stormwater facilities proposed in the SMP may be undersized. The core questions are whether the IWS storage lagoons can be significantly expanded as has been proposed[3], and what future processing rate can be achieved. SMP page 7-15 indicates a requirement for AKART (all known available and reasonable methods of treatment) recommendations for handling of IWS flows to be fully implemented by June 2004, and that the recommended alternative is for IWS treated effluent to be discharged to a King County DNR facility at Renton. An important implication of this AKART requirement is that the current IWS configuration and capacity discussed in the SMP (Section 4.2.2.2) may be largely irrelevant to the future IWS configuration and capacity. According to the SMP, negotiations are ongoing for determining (future) IWS pre-treatment standards, flow limits and timing and other issues. The Storm Drain System (SDS) is being sized to accommodate year 2006 conditions and therefore needs to be compatible with the year 2006 IWS system which meets AKART requirements.

<u>Proposed lagoon expansion is incompatible with safe airport operations</u>. The FAA has published guidelines in Advisory Circular 150/5200-33 dated 5/1/97, titled "Hazardous Wildlife Attractants on or Near Airports." The proposed expansion of IWS Lagoon 3 falls under the Advisory Circular's definition of a wastewater treatment facility (definitions are given by SMP page 4-7). Section 2 of the Advisory Circular, "Land Uses that are Incompatible with Safe Airport Operations" recommends that any new wastewater treatment facilities or associated settling ponds be sited no closer than 10,000 feet from turbine aircraft movement areas. The existing third lagoon is located within 2,000 feet of the runway, and the proposed new expansion area is within 3,000 feet of the runway. The proposed expansion of the lagoon facilities, as assumed for purposes of SMP facility design, appears to be in direct conflict with these FAA guidelines which have been applied elsewhere in the project to preclude on-site mitigation for loss of wetlands.

[3]SMP Table 4-5 shows that the proposed expansion of IWS Lagoon 3 will add about 145 acre-feet of total storage. This significant volume is equal to about 45% of all other new stormwater storage volume proposed per SMP Table 6-2.

Feasibility of proposed IWS discharge rate is not established. The future processing rate to be achieved by the IWS system is a variable which has yet to be designed and/or negotiated. Based on system performance predictions in the latest IWS design report[4], it is clear that consideration is being given to a processing rate which is substantially less than the 2.4 to 4 MGD treatment rates examined in the SMP (Table 4-2).

The IWS storage volumes which are assumed in the SMP presume that Lagoon 3 will be expanded from its current volume of 26 MG to a future volume of 72 MG. That future volume is not proposed or described in the IWS design report. Instead, the design report (page D-1) indicates that the required lagoon size is dependent on the available release rate--a 47 MG lagoon would be required for a release rate of 4 MGD while a larger 67 MG lagoon would be required for a release rate of 2 MGD. The report does not indicate what release rate would be associated with a 72 MG lagoon. The proposed expansion to 72 MG is understood to have been established as simply "the maximum possible capacity within the available area[5]."

The IWS design report provides information to suggest that there are benefits to having a lower processing rate. The report (page 4-4, Alternative A3) cites a major cost incentive for having a reduced IWS processing rate of 1 MGD in that effluent "can be metered to KCDNR at a controlled rate during off-peak hours, which is an operating benefit to KCDNR and a cost savings to the Port. . . the annual operating costs are approximately half of Alternative A1[6]: $2.9 million versus $5.8 million." The IWS design report however does not identify what size of lagoon would be required, for a 1 MGD processing rate, to prevent overflows into the SDS or directly into Des Moines Creek.

Due to an apparent conflict with FAA guidelines, it is uncertain whether the IWS lagoon capacity can be significantly expanded as has been assumed. Because of the unknown outcome of future negotiations between the Port and King County DNR, it is uncertain what future IWS release rates will be permitted, and whether any emergency/flood-event restrictions might be imposed on IWS releases[7]. These uncertainties are problematic for ensuring the adequacy of the proposed stormwater system because IWS capacity has a direct impact on the size of required stormwater facilities, yet the IWS system is being designed and permitted through processes which appear to be largely independent of the design and review

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[4] "Addendum to IWS Engineering Report" dated April 1998 by Kennedy/Jenks Consultants.

[5] Information provided by email from Ecology (Chung Yee), with reference to a letter dated November 10, 1999, from Michael D. Feldman of the Port to Kevin Fitzpatrick of Ecology.

[6] Alternative A1 involves enlarging Lagoon 3 to 47 MG and discharging 4 MGD to King County. Disadvantages to Alternative A1 include :"Very high annual operating costs for the first 20 years. . ." and "A new pretreatment permit with KCDNR must be obtained and complied with."

[7] Other documents obtained for review purposes (not part of the SMP) included sizing calculations for Lagoon #3 dated February 2000 by Kennedy/Jenks Consultants. That document discussed several "additional considerations" to support construction of a lagoon with more storage volume, including: "Downstream system owners may prohibit IWS flows from being released during high-flow events."

processes for stormwater system planning. In the presence of these uncertainties, there can be no reasonable assurance that water quality standards will be met.

5. Problems similar to those resulting from SDS-IWS interdependence above are also found in a need for coordination between SDS facilities and low flow augmentation facilities. Specifically, a new proposal for reserve storage to augment low streamflows appears to have been added at the SMP at the last minute. SMP page 6-6 references "managed release of stormwater from reserved storage" but the summaries of stormwater facility volumes (SMP Table 6-2 and equivalent tables in other documents) do not contain any allowance for "reserved storage." The SMP is internally inconsistent in that the SMP page 6-6 list of factors which would mitigate low flow impacts fails to include the proposal from SMP page 6-10 that water for low flow augmentation will come from a well within the Tyee Valley Golf Course. Significant problems with SMP underestimation of low flow impacts and overestimation of mitigating factors are identified in other comments later in this letter. This comment focuses mostly on the unaddressed practical challenges of adding reserve storage capabilities to already-large stormwater facilities.

Under the current proposal for streamflow augmentation (from the Low Streamflow Analysis, pg 15), the Port will construct "additional storage volume in the base of selected detention facilities" to store winter season runoff until needed to support low flows during the dry season. The Low Streamflow Analysis (pg 20) further indicates that about 16.0 acre-feet of reserve storage would be required to mitigate for estimated low flow impacts. (In other comments we describe why low flow impacts have been underestimated.) Several of the proposed detention facility exhibits presented in SMP Appendix D do have some "dead storage" capacity for reserve storm water release, but the total storage (based on spot checks) appears to fall short of the target amounts. There is no tabulation on the exhibits or elsewhere of how much stormwater reserve is to be provided in total or at each facility: our spot checks required estimation of volumes from facility dimensions. A check of Vault G1 (Exhibit C151) found that the design detention volume (9.2 acre-feet) would not be available given the facility dimensions and the depth of water being allocated to dead storage. Operation of these facilities may be impractical as now configured. For example, a valve box to control reserve releases from Vault G1 would need to be either buried at about 35 feet depth (hard to operate) for runway-grade access or, for a more reasonable shallow depth, the valve box would need to be accessed and operated from a difficult-access ledge on the embankment terrace. The deepening of the vaults to provide reserve storage has caused some vaults to exceed King County maximum cover requirements and will necessitate special designs to ensure structural integrity. The reserve (dead) storage layer at the base of the detention facilities function will accumulate and concentrate settleable solids and particulate-based pollutants from the airport stormwater runoff; that "dead storage" water would later be released under very low-flow conditions with little or no opportunity for dilution of any concentrated pollutants. There is also a potential for development of anaerobic conditions in the dead storage zone which would further worsen the quality of the "reserved" water. Our point is that the "reserve stormwater" plans are new to the SMP design/review process. They are at a highly preliminary stage of development and require significant further work prior to a detailed design review which could offer any assurance that the plans are feasible or capable of providing useful low-flow mitigation.

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6. While it appears that many of the gross inconsistencies in previous HSPF models have been resolved, we remain surprised by the lack of checks on the hydrologic simulation results and lack of effort to explore apparent data irregularities. This comment focuses on calibration deficiencies for Des Moines Creek.

The hydrologic model calibration report for Des Moines Creek indicates (SMP pages B1-13 and B1-14) that model results under-simulate recorded base flows at both of the upper-basin gages used for model calibration. The justification offered for under-simulation of inflows at Tyee Pond is a speculative "*it seems unlikely that enough rainfall can get into groundwater to support 0.35 base flow*" and a presumption that the stream should be gaining water in its lower reaches. The explanation offered for under-simulation of flows at the SDS3 outfall is that "*it is unknown what phenomenon could produce this base flow. One explanation is that the flow monitoring device will not register zero flow.*" In our opinion, further efforts should be made to evaluate the reliability of the available data. In the case of the SDS3 gage, we are unaware of any flow monitoring devices which, properly installed and maintained, would fail to register zero flow. Failure to register zero flow, if true, could reflect a problem with the gage and should be explored to determine if there are also problems with the high-flow data being reported from the gage. Given the questions over low flow calibration for both the East Branch (Tyee Pond) and West Branch (SDS3) tributaries to Des Moines Creek, the model results should be checked against the low flow data which are available for King County Gage 11F, Tyee Weir, below the confluence of these headwater streams. The calibration report does include one plot of peak daily flows at a "Golf Weir" but we could not locate any discussion of those results.

There are inconsistencies and problems with the Des Moines Creek model treatment of area groundwater conditions represented by Figure B1-3. The calibration report text (pg B1-10) indicates inflow of groundwater from 1,240 acres of area which is noncontiguous with the surface watershed; this is inconsistent with the model input sequence which has only 512 acres. Also, our independent measurement of the Des Moines Creek noncontiguous area (per Figure B1-3) yielded about 850 acres of total area. Another groundwater-related problem with calibration is that it has overlooked possible stream losses to groundwater in the lower part of the basin. Figure B1-3 groundwater mapping shows that the Des Moines Creek below about elevation 200 feet does not intersect the regional groundwater table. This transition area corresponds roughly to the location of a knickpoint described in SMP page P-2 where the Des Moines Creek channel gradient increases and where bed sediments change from fine grained materials to relatively coarse materials with boulders, cobbles, gravel, and fine sand. Considering the evidence of the streamflow data, it seems likely that the lower part of Des Moines Creek includes a "losing reach" which has cut through the perching layer which supports the regional shallow groundwater table. The physical condition of a losing reach would be consistent with streamflow data at the mouth which show unexpectedly low flow peaks and volumes relative to streamflow data for the headwater areas. It is possible that the "poor calibration" problems described by SMP page B1-13, and the difficulty in reconciling measured flows at the upper and lower gages, could be rectified if the presence of a losing reach were confirmed.

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We recognize that model calibration is a challenging process and that data reliability is often an issue. However, because the purpose of this work is to address and mitigate conditions in the upper basin (airport) areas of the watershed, calibration efforts should place more emphasis on matching upper basin flows unless those data are confirmed to be unreliable. The current calibration effort is deficient because it has placed too much emphasis on matching conditions at the lower gage, and has prematurely discounted the more-important upper basin data.

7. In our letter of Sept 21, 2000, we pointed out that the modeling had not made any use of King County stream gage 42C which measures flows in Tributary 0371A (a.k.a. Walker Creek) near 281 S 171st Place, a short distance downstream from the Walker Creek wetland. That gage provides direct information on flows in the headwater reach of this stream below the area of the proposed 3rd runway, and is more meaningful than the lower gage near the mouth for calibrating a streamflow model which is intended to examine streamflow effects of the 3rd runway. However, in the December 2000 SMP, there is again no mention or use of the available stream gage data for upper Walker Creek. The calibration is deficient for its failure to use this readily available streamflow data.

8. The Walker Creek calibration for low flows was achieved with a model adjustment which appears to be inconsistent with actual basin characteristics. In order to simulate flow volumes (and low flows), the Walker Creek model (SMP page B2-51) has included groundwater flows from 630 acres of till grass lands located in the (surface topography) Des Moines Creek basin, based on groundwater mapping shown by SMP Figure B2-23. However, our review of the same groundwater mapping does not show support for this acreage. We have measured the identified "Noncontiguous Walker Creek groundwater area" to be only about 690 acres in total, before adjustment for impervious surfaces. From Figure 2-1 and aerial photos, probably about one half of that total area consists of impervious surfaces which should be collected in either the IWS or other piped storm drain system and should not be available for groundwater recharge. These data checks indicate that the groundwater recharge area required (630 acres) to balance the measured Walker Creek flows is much greater than the available groundwater recharge area (about 350 acres) indicated by the available mapping. We do not know if the difficulty in simulating sufficient flow volume in Walker Creek is related to apparently similar problems in reproducing recorded flow volumes in the upper Des Moines Creek basin.

It is possible that base flows in the model calibration period have been supported in part by leakage from the IWS conveyance system and by seepage from unlined IWS lagoons. It is also possible, although more speculative, that irrigation runoff from the golf course may be influencing the base flows. It is difficult to provide any reasonable assurance of appropriate mitigation for airport impacts on stream base flows, or seepage flows to wetlands, when the source of those flows is so poorly understood.

9. The SMP model calibration of airport fill parameters appears to be biased towards parameters which understate the hydrologic flashiness of the fill which is being placed. Airport fill calibration is described in SMP (Appendix) page A-16; calibration results are plotted on page 4 of Attachment B to that appendix. The calibration data show that the model does a good job of representing average flows, but does not cover the full range of flows which were

measured during the calibration period.[8]. Peak flows are consistently (in 5 out of 6 events) underestimated, and low flows are consistently overestimated (by about 0.03 cfs from the 20-acre fill site being assessed). One consequence of these calibration results is that stormwater detention facilities might be slightly undersized. A second consequence of these calibration results is that any assessment of runway fill impacts on base flows, using HSPF modeling with these calibration parameters, might underestimate actual base flow impacts.

10. The SMP and related documents fail to consider the impacts to low flows in Des Moines Creek and Walker Creek which will result from recent lagoon lining improvements to the IWS system. The IWS has a direct significant impact on seepage and base flows in the Walker and Des Moines Creek systems by its removal of large areas of basin which would naturally form the headwater recharge areas for those streams. Until recently, the effects of these diversions have been partially offset by infiltration recharge to groundwater from the three IWS storage lagoons which are located near the groundwater divide between Walker and Des Moines Creeks.

    Our source of information on the history and status of the IWS system is a recent hydrogeologic study by Associated Earth Sciences, Inc., "Hydrogeologic Study, Industrial Waste System (IWS) Plant and Lagoons, Seattle Tacoma International Airport," prepared for Port of Seattle, June 21, 2000. Lagoon 1 has been used to store wastewater since 1965. Lagoon 2 was built in 1972 and "is utilized during times of heavy rainfall events." Lagoon 3 was constructed in 1979 and "is used to provide excess storage capacity for industrial wastewater in the event that Lagoons 1 and 2 reach capacity." The bottoms of the lagoons most regularly in service - Lagoons 1 and 2 - were reportedly "composed of compacted gravelly sand" which should have a relatively high infiltration capacity. A program to install leak prevention liner systems in the lagoons has been underway since 1996: Lagoon 1 was lined in 1996, Lagoon 2 was lined in 1997, and construction documents have been prepared for Lagoon 3 to be lined in the near future. The flow augmentation recommendations in the 1997 Des Moines Creek Basin Plan were likely based on data which did not reflect impacts of the lagoon linings. Our point is that airport impacts to stream base flows, as well as mitigation needs, have likely been underestimated because they have not considered the effect of lining these lagoons.

11. The SMP and related documents fail to consider the additional adverse impacts to streamflows in Des Moines Creek which will result from the proposed development of Borrow Areas 1, 3, and 4 as a source of 6.7 million cubic yards of fill for the 3rd runway. Information on the proposed borrow area development is found in the Appendices C and D of the Port's December 2000 Wetland Functional Assessment and Impact Analysis,[9] and in Ecology's June 2000 Sea-Tac Runway Hydrologic Studies Report by Pacific Groundwater

[8]Calibration period was for 25 days in February 1999. According to NOAA-published rainfall data, SeaTac airport recorded approximately 5.6 inches during this period.

[9]Appendix C is a Hart Crowser memorandum dated December 8, 2000 regarding "Third Runway Project; Borrow Areas 1, 3, and 4; Projected Impacts to Wetlands." Appendix D is a Hart Crowser memorandum dated October 20, 2000 regarding "Sea-Tac Third Runway - Borrow Area 3 Preservation of Wetlands."

Group (PGG). The three borrow area sites have a combined area of approximately 217 acres and are proposed to be mined to depths as great as 100 feet below existing grade. The material to be excavated is described as glacially-deposited, slightly silty to silty sands and gravels (outwash soils).

Airphotos of the airport vicinity show that the existing land use at the borrow areas is primarily forest. Land use for these areas (a.k.a. South Borrow Area, Onsite Borrow Source Areas 1-4) is further described in the project 1996 FEIS Appendix M, pages M-2 and M-3 as "Both upland and wetland second-growth deciduous forest are prevalent components of the South Borrow Area" and "Upland coniferous forest is found in the northwest corner of the South Borrow Area."

Development (excavation) of the borrow areas will eliminate most of the remaining forest[10] in the headwater areas of Des Moines Creek. There will be several impacts to streamflows in Des Moines Creek as a result of physical impacts of the excavation work. First, the cutting of the forest and stripping the land of forest duff and organic soils will produced increased runoff volumes as well as increased peak flows. Second, depending on the eventual site grading and soils, infiltration and groundwater recharge may be reduced relative to the current forested condition. Third, summer base flows in Des Moines Creek can be expected to be impaired due to lost flow attenuation capacity, just as summer base flows impacts in Miller Creek are expected to be moderated somewhat by flow attenuation effects in the embankment fill. Finally, base flow contributions to Des Moines Creek from the borrow areas could be significantly affected if the excavations should strip away outwash materials to leave a surface exposure of till soils or if excavations should penetrate any groundwater perching horizons.

PGG Figure 4-2 shows a cross section for Borrow Area 1. Surface geology consists of a 5- to 25-foot depth of (permeable) recessional soils overlying a (relatively impermeable) till layer which is typically about 30 feet thick. Under current conditions, very little surface runoff would be expected. Precipitation in excess of the amount consumed by forest evaporation and transpiration would infiltrate through the recessional soils, encounter the till perching layer, and gradually seep laterally to provide seepage/base flow to Des Moines Creek. Grading and excavation will cause both the forest and the recessional soils to be removed from this area. The remaining (newly-exposed) surface geology will instead consist of till which will generate relatively large surface discharges (high peak flows) and relatively little seepage or base flow. Long term impacts will also be influenced by undetermined site restoration activities or conversion to non-forest land use.

PGG Figure 4-3 shows a cross section for Borrow Areas 3&4. Surface geology is variable. In the area of Borrow Area 3, which is closest to Des Moines Creek, the surface geology consists of a typically 10-foot depth of (permeable) recessional soils overlying a quite thin (less than 10 feet) lens of relatively impermeable perching layer. The current hydrologic response for the area of Borrow Area 3 would be similar to that described above for Borrow Area 1. In the area of Borrow Area 4, the surface geology consists of a thick (up to 100 feet)

[10] Additional forested basin will be lost by development of the SASA element of the Master Plan Update Improvements.

depth of advance outwash soils overlying a perching horizon. The perching horizon beneath Borrow Area 4 connects with the perching layer beneath Borrow Area 3, such that the seepage flows from both areas eventually merge and flow (seep) together en route to Des Moines Creek. The current hydrologic response for the area of Borrow Area 4 would be generally similar to that for Borrow Areas 1 and 3 except that there would be even greater flow attenuation due to the thickness of the outwash deposit and the greater distance from Borrow Area 4 to Des Moines Creek.

The proposed excavation of Borrow Areas 3 and 4, as proposed, may leave a surface exposure of deep advance outwash soils. This soil exposure (assuming no conversion to land use with impervious surfaces) should not cause any increase in surface flows and the elimination of the forest cover will promote increased groundwater recharge. However, the proposed grading will penetrate and remove a perching layer which may currently be conveying borrow area seepage flow to the headwaters of Des Moines Creek. As a result, the base flow from these borrow areas to the upper reaches of Des Moines Creek may be significantly diminished.

In summary, the proposed development of the borrow areas is likely to result in adverse permanent impacts to Des Moines Creek, including increased peak flows and reduced base flows, which have not been assessed and for which no mitigation has been proposed.

12. There are numerous shortcomings in the evaluation of the potential low stream flow impacts described by SMP pages 6-5 and 6-6. Our comments below reference the source of that analyses which is the December 2000 Earth Tech report, "Seattle-Tacoma Airport Master Plan Update Low Streamflow Analysis."

a) The low flow analysis does not provide information to indicate the accuracy of the HSPF model in simulating low flows. Data provided in Table 1 for recorded average flows in August and September are for relatively-short periods of available record. Data provided for simulated average flows in August and September are for a much longer (1949-1996) period of simulation. These data sets are not directly comparable due to different periods of record. The report needs to provide a summary of simulated and observed monthly flows for periods of recorded data.

b) The report does not include HSPF input sequences to confirm what land uses and basin boundaries were assumed for any of the Des Moines or Walker Creek analyses. For Miller Creek, HSPF input sequences were provided only for year 2006 post-development conditions. In light of the major modeling discrepancies found in the previous SMP, and the fact that the present work is being conducted by three separate firms, it is important to confirm what models were used for each of the analyses.

c) As indicated in our above comments, model calibration appears to have relied on faulty measurements of groundwater tributary areas which are noncontiguous with the surface water basins (Figures B1-3 and B2-2). Walker Creek calibration relied on groundwater inputs from about 630 acres of noncontiguous pervious basin; however only about 350 acres of noncontiguous pervious basin appears to be actually available. There is also an apparent inconsistency in the modeling of noncontiguous groundwater inputs to Des Moines Creek: the text (SMP pg B1-10) indicates 1,240 acres but the model input file uses 512 acres. These inconsistencies need to be resolved if there is to be any confidence in model predictions regarding project effects on low flows.

d) Project impacts to low flows in areas of runway fill (Miller and Walker Creeks) may be underestimated because the HSPF model parameters used to simulate the fill materials produce larger low flows than indicated by the available calibration data. (See calibration plot, SMP Appendix A, Attachment B, Page 4. Wet season low flows are consistently overestimated by about 0.03 cfs from the 20-acre fill site being assessed.)

e) Project impacts to low flows in Des Moines Creek and Walker Creek have been underestimated because the assessment has ignored the post-1994 effects of lining the IWS storage lagoons.

f) Project impacts to low flows in Des Moines Creek have been underestimated because the assessment has ignored the post-1994 expansion of the IWS system by about 111 acres (per SMP page 5-4) and corresponding reduction in the Des Moines Creek tributary basin. The IWS basin expansion (Des Moines Creek basin reduction) is not reflected by the available supporting data for the low flow study. Instead, the area summaries presented with the Low Flow Study, Appendix D, Figure 3 indicate that the tributary basin to Des Moines Creek will increase by about 16 acres from 1994 to 2006.

g) Project impacts to low flows in Des Moines Creek have been underestimated because the assessment has ignored the effects of the loss of forest and excavation of 6.7 million cubic yards of outwash material from proposed borrow area sites at what are now the forested headwater areas of the basin.

In summary, insufficient information has been provided to confirm what models were used for the low flow analysis, or to establish whether the models are reasonably well calibrated for assessing low flows conditions. Furthermore, the analysis methods have overlooked several airport activities which will likely have an adverse impact on low streamflows, particularly in the Des Moines Creek basin. Individually and cumulatively, these problems result in a failure to adequately address airport impacts on low streamflows and associated water quality concerns in the affected streams, and a corresponding failure to provide reasonable assurance of adequate mitigation.

13. Estimates in the Low Streamflow Analysis (pages 5 through 9) of the mitigating effects of "Fill Infiltration Discharge" are inconsistent with the measured hydrologic response of the 1998 fill embankment as shown in SMP Appendix A. The measured runoff from the embankment indicates a relatively rapid flashy response to rainfall with rapid recession rates which are inconsistent with the statement (Low Streamflow Analysis page 6) that fill " would provide increased discharge from the fill area during the critical low flow periods in area

wetlands and streams". One of the principal problems appears to be that the PGG study[11] used as the basis for this assessment assumed a theoretical hydraulic conductivity for the fill which is far greater than the infiltration capacity which can be inferred from either the measured data or the HSPF model calibration. The PGG study (page C-4) assumed a hydraulic conductivity for the fill of 1.35×10^{-4} cm/sec (equivalent to 0.19 inches/hour) based on theoretical values for fill gradation specifications. That theoretical value is significantly greater than short term rainfall intensities associated with production of runoff during the monitoring period, and is nearly 10 times greater than the nominal infiltration rate of 0.02 inches per hour determined through HSPF model calibration (SMP page A-17). We recognize that the HSPF model infiltration parameter is not a direct measure of hydraulic conductivity. Nevertheless the difference in values shows a significant discrepancy between the fill response predicted in the Low Flow Analysis and the measured data from the 1998 fill embankment. We do not know why the observed runoff response of the fill is so different from the values predicted by PGG. However, a major discrepancy clearly exists and has caused the PGG analysis to significantly overestimate the seepage and baseflows which can realistically be expected from areas of embankment fill. There was a recommendation during recent permit negotiations for additional work which would have reconciled this discrepancy[12], but there is no record of that work ever being performed. Without further analysis such as recommended but never performed, which considers the observed data, there is no basis for claims that the fill will have a net beneficial effect on low flows.

14. Estimates in the Low Streamflow Study (pages 10 and 11) of the mitigating effects of "secondary recharge" are greatly overestimated. The secondary recharge calculation assumes a theoretical value for infiltration capacity based on the groundwater modeling (PGG study page C-4). As described in our above comment, this rate is significantly greater than the infiltration rate inferred from field measurements and HSPF model calibration. The results of the "secondary recharge" calculation are meaningless because of differences between the hydrologic response predicted in Low Streamflow Analysis and the observed runoff data.

15. Dam safety requirements established by Washington Administrative Code Chapter 173-175 and King County Surface Water Design Manual Section 5.3.1 have been overlooked in the current SMP. From the available drawings, it is apparent that Pond G, and possibly Pond D, exceed the size (and danger) thresholds which necessitate dam safety reviews. We note also that the Port has issued "Third Runway - Embankment Construction Phase 4" construction drawings and specifications dated January 29, 2001 for work which includes construction of berm embankments for Pond G, apparently without the required dam safety review.

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[11] Pacific Groundwater Group, "Sea-Tac Runway Fill Hydrologic Studies Report," for Washington State Department of Ecology, June 19, 2000.

[12] Floyd & Snider Inc, undated Final Draft, "Sea-Tac Airport Third Runway 401 Permit Negotiations, Meeting Notes Summary, October 2nd through December 8th, 2000." Resolution Pending Review dated 10/13 for Project Effect on Low Stream Flows reads in part, ". . .Results of the consultation recommend that the Hydrous model used by PGG be rerun using HSPF output for initial infiltration as input to the Hydrous model in order to analyze all components effecting base flows."

16. Based on project drawings obtained for other (non-SMP) reviews, there appears to be a dam safety issue at the proposed SASA facility. The current SMP is deficient because it fails to include any plans or design drawings for the SASA stormwater facility, and because dam safety requirements for this facility are not addressed.

17. In addition to dam safety reviews for the open water detention facilities identified above, dam safety or equivalent safety reviews are needed for proposed vaults SDS7 and G1 (Basin SDW1A) as shown in SMP Appendix D, Exhibits C140 and C151. Vault SDS7 proposes above-grade storage of 21.4 acre-feet of water volume in a rectangular structure with an above-ground water depth of 19.8 feet. Vault G1 proposes storage of about 13.8 acre-feet of water volume (detention storage plus reserve storage) with a water depth of 30 feet. There is an obvious need for a safety review to assure the structural stability of Vault SDS7. Our concerns over Vault G1 result from its close (about 20 feet) proximity to the top edge of a 140-foot high fill embankment. Furthermore, because of its proposed placement in fill, Vault G1 (and perhaps others) fails to satisfy the KCSWDM technical requirement (pg 5-37) that "Vaults shall not be allowed in fill slopes, unless analyzed in a geotechnical report for stability and constructability."

18. Many of the proposed vaults are in violation of KCSWDM pg 5-38 which specifies, "The maximum depth from finished grade to the vault invert shall be 20 feet." This requirement appears to relate to the maximum loading which a conventional vault structure can withstand without risk of structural failure. If so, then special structural designs will need to be developed for Vaults SDS3 and G1 (cover depth to about 40 feet), Vaults SDN3 and C1 (cover depth to about 30 feet), and Vaults M6 and C2 (cover depth to about 25 feet). Due to the currently-proposed depths, none of these six vault facilities are in compliance with the King County technical requirements for stormwater facilities. In some cases, this compliance problem has been caused or worsened because the facilities have been enlarged (deepened) to accommodate reserve stormwater storage for purposes of low flow augmentation. Further analysis is necessary to determine whether these facilities are viable.

19. SMP section 3.1.2.3 discusses concerns with standing open water. A drain time calculation proposed in the SMP for addressing open water concerns is inappropriate and will underestimate actual open water durations. The drain time method is inconsistent with actual prolonged-duration precipitation conditions in the Puget Sound. Continuous simulation methods need to be used. (Also see Comments 10 and 11 of our letter of November 24, 1999.) The current SMP proposes an inappropriate methodology to assess open water durations and furthermore fails to provide any analysis, by any method, of expected open water durations in any of the stormwater facilities being proposed. The consequence of using an inappropriate analysis methodology in this instance is that the duration of standing open water is likely to be significantly underestimated and that mitigation designs (for example netting over lower cells within detention ponds) could fail to prevent the creation of open water waterfowl attractants which are incompatible with safe airport operations.

20. Insufficient information has been provided regarding proposed Erosion and Sediment Control (ESC) facilities to offer any assurance that facilities are adequately sized and will perform as intended. There is no cogent explanation of how this ESC system is supposed to function and

there are numerous potential problems inherent in the current SMP plans.. Our concerns are heightened because the Port has already issued "Third Runway- Embankment Construction Phase 4" construction plans[13] and specifications for erosion control facilities and some permanent drainage facilities, without any known independent review or approval of those plans by any regulatory agency. Further review, prior to project approval, is needed to resolve the following questions:

a) Where are the clearing limits for the proposed work? King County core requirement 1.2.5.1 requires that prior to any site clearing or grading, areas to remain undisturbed during project construction shall be delineated. For example, SMP Appendix R, Exhibit C24 suggests that there will be an undisturbed strip, which includes some wetlands, between a line marked "limits of embankment" and a proposed TESC ditch some distance downhill. Is this strip supposed to remain undisturbed? On the corresponding grading and drainage plan for the same area (SMP Appendix O, Exhibit C115) there are again no work limits shown and the plans are deficient for not identifying the grading necessary to restore the wetlands which were altered by construction of TESC facilities.

b) What is the tributary area for each of the proposed ESC facilities? What are the design flows? Have the design calculations been reviewed? Who was responsible for this review?

c) How big are the pumps being proposed for this work? (Pumps need to be of sufficient capacity and compatible with ESC processing rates and storage volume.) What is the power supply for these pumps? If gas/diesel pumps (or power generators) are proposed, how will refueling be accomplished and what safeguards will be in place to contain spills?

d) How long will these "temporary" facilities be in place. One year? Six years?

e) How are the "outer swale" ditches supposed to work? According to the geotechnical engineering report (SMP Appendix L, Figure 8) these ditches are supposed to intercept the seepage flow from the base of the embankment and convey the water to wetlands. Collection of the (clean water) seepage flow is in conflict with the use of these same ditches for conveyance of (turbid water) construction site runoff as proposed in the SMP Appendix R exhibits. Capture and routing of clean water seepage flows to erosion control facilities might overload sediment pond processing capacity, causing releases of untreated turbid water during storm events. Capture and routing of clean water seepage in interceptor swales would furthermore cause downslope wetlands to be significantly de-watered during the (multi-year?) period of construction.

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[13]Port of Seattle major contract construction plans titled "Third Runway - Embankment Construction - Phase 4", Work Order #101346, Project STIA-0104-T-01, were approved on 1/25/01 by Raymond P. Rawe, Director of Engineering Services. The accompanying two-volume Project Manual, including Specifications, prepared under the direction of Raymond P. Rawe, is dated January 29, 2001.

f) Why is temporary Pond A being excavated to a depth of approximately 10 feet in the middle of a wetland? The pond location is shown by SMP Appendix R Exhibit C24; greater detail is shown on Phase 4 construction drawings. The construction drawings include a note warning the contractor to anticipate seasonal groundwater at about 1 to 1.5 feet below ground surface. It is unrealistic to expect that a simple geotextile membrane as proposed will succeed in keeping the surrounding groundwater out of this pond. It is probable that the pond will be constantly recharged by the wetland water supply and that pumping from this pond will be functionally equivalent to pumping from the wetland. In addition to adverse impacts on the wetland, it is likely that ESC facilities have not been sized to accommodate this water.

The above questions result in part from a failure to recognize or satisfy the procedural, design review provisions of the King County and Ecology requirements. In this instance, the lesser requirement is defined by Ecology's Stormwater Program Guidance Manual, which specifies that a development site of this size must prepare a Large Parcel Erosion and Sediment Control Plan[14], comprising both a narrative report plus site plans, to demonstrate compliance with minimum requirements. The current erosion control site plans do not demonstrate compliance with minimum erosion control requirements, and give rise to numerous concerns which, individually and cumulatively, create a significant risk of recurring uncontrolled releases of construction site runoff.

21. The plans do not show how runoff from the face of the MSE wall, or from the face of the embankment, will be conveyed to the stormwater detention facilities. There are two issues. First, drainage must be provided from terraces on the face of the wall and the face of the embankment drainage in order to prevent erosion damage and to minimize the possibility of surface saturation which might result in localized slope failures. Second, this water must be conveyed to the stormwater detention facilities which will provide the required Level 2 flow control. Plans in SMP Appendix O, Exhibit C115 show that undetained surface runoff collecting at the bottom of the embankment, and also from the airport security road, would be discharged directly into adjacent wetlands without any peak flow detention as required by King County and Ecology regulations.

22. SMP Page 3-7 states, "*Several examples of water-induced slope failures have occurred recently, including one airport embankment project in Telluride, Colorado, that resulted in airport closure for one year. The slope failure was primarily attributed to stormwater build-up within the embankment.*" Because of the height of the proposed 3rd runway embankment, and the potentially catastrophic consequences of a slope or wall failure, the design documentation for the SeaTac project should identify the specific design and environmental factors which were associated with those failures. For example, were previous failures associated with poorly-draining fill materials, inadequate construction methods, or insufficient drainage systems? Were previous failures associated with specific climatic conditions such as unusually intense cloudburst events or an unusually prolonged rainfall event or closely-

[14] See "Stormwater Erosion and Sediment Control for Large Parcel Construction", Department of Ecology Report WQ-R-93-012 1 #4 of 5. Also available at http://www.ecy.wa.gov/pubs/wqr93013.pdf

spaced series of intense events? Careful examination of the causes of known recent water-induced slope failures is a necessary, but missing, first step to ensure that the 3rd runway project does not repeat whatever errors or oversights may have been responsible for past slope failures.

Based on our review of the Stormwater Management Plan documents, there are at least two drainage issues affecting the fill embankment which should be addressed and resolved prior to project approval.

a) There appears to be a significant discrepancy between the embankment theoretical infiltration properties assumed by geotechnical specialists responsible for the design of the embankment and the embankment infiltration properties inferred through stormwater runoff model calibration to data from the 1998 embankment by other specialists responsible for the design of stormwater management facilities. The geotechnical analysis of the embankment and wall, and design of internal drainage systems, should account for a range of worse-case scenarios which might result from variable (or uncertain) infiltration properties. For instance, if the unexpectedly-low observed infiltration capacity was suspected to be a result of periodic applications of tackifiers or emulsions or other surface treatments for erosion control during construction, then the embankment geotechnical analysis should anticipate perching horizons and saturated zones within the embankment. Review of past slope failures should consider whether discrepancies between theoretical and actual infiltration rates may have been a contributing factor.

b) Drainage from the steps in the wall and embankment should be designed to handle cloudburst rainfall quantities computed against the surface area of these features, rather than the plan view. It is not apparent that the SMP has given any consideration to either the specific scenario of wind-driven (non-vertical) precipitation or the more general surface runoff drainage needs for the face of the wall and embankment. Review of past slope failures should assess the role and significance of surface drainage from the face of the embankment (or wall) as a contributing factor.

23. The proposed construction excavation for Pond D, as shown by SMP Appendix D, Exhibits C133 through C134.1, is very likely to intercept the local shallow regional groundwater table and to significantly disrupt the water supply to Wetland 39. We question the accuracy of groundwater levels shown by Exhibit C134.1 which suggests the maximum seasonal water level in the vicinity of the pond would be slightly below the proposed pond bottom at elevation 336.0. There is strong evidence to suggest that the excavation proposed for Pond D, to depths as great as 25 feet below grade, will intercept the local groundwater table. First, the Hart Crowser study of local groundwater conditions (SMP Appendix L) found that the shallow groundwater table is typically 10 feet below existing ground level. Second, there is an existing surface expression of groundwater at Wetland 41a which is in the footprint of Pond D. Finally, it can be seen from Exhibit C133.1 that Wetland 39 (shown but not labeled on the exhibit) begins at about elevation 348 feet, 12 feet above the proposed bottom of pond.

24. The NRMP (page 3-10) asserts that compensatory storage will be provided to mitigate for approximately 5.24 acre-ft of floodplain storage which will be lost due to embankment fill. However, our review of the proposed design has found that the compensatory storage will fail to provide any mitigation for loss of storage during frequently-occurring flood events. Loss of compensatory storage for frequently-occurring events (such as floods with return periods in the range of 2 to 10 years) might result in increased peak flows and erosion during those events.

Grading plans for the proposed compensatory floodplain area are shown by NRMP Appendix A, Sheet STIA-9805-C2. A hydraulic analysis for the associated reach of Miller Creek is presented in SMP Appendix J. The main problem with the proposed design is that the compensatory floodplain will be separated from the (relocated) stream channel by a ridge typically 2 to 4 feet higher than the floodplain. Also, the relocated channel will include a constructed 32-foot wide high flow section, independent of the floodplain, which will provide significant flow conveyance within the main channel. The ridge separating the main channel from the floodplain is apparent from the grading plans and also from NRMP Figure 5.1-6, titled "Typical Cross-Section of Miller Creek Floodplain Enhancement." The SMP hydraulic analysis shows that under major 100-year flood conditions this ridge (which has a top elevation of about 265 feet) is expected to be overtopped by depth of only about 0.5 feet. During less extreme events, the ridge will prevent floodwaters from entering the compensatory floodplain. There is no explanation for why a ridge is proposed which would prevent floodwater access to the floodplain mitigation area for all but extreme events. The compensatory floodplain design, as currently proposed, is insufficient to fully mitigate for the hydraulic effects of the embankment fill. The consequence, as stated above, is for increased peak flows and erosion during frequently-occurring flood events.

25. The proposed mitigation objectives for the Miller Creek relocation project are described by NRMP Table 5.1-2 (NRMP page 5-4). However, there are no calculations or other design information to demonstrate that the goals and design criteria will be accomplished with the design now proposed. From comparison of the December 2000 and August 1999 versions of the NRMP, we infer that some of the problems with the initial design have been recognized, but a revised design has yet to be developed which would accomplish the past or current performance objectives. The main problems are that the relocated channel is likely to go dry during low flow periods if it is constructed, as proposed, over a two-foot thick bed of highly-permeable spawning gravels. We notice that the design criteria in the December 2000 NRMP is to "Construct low flow channel 8 feet wide with 1:1 slopes and 0.5 ft deep to convey summer base flows" and does not identify a minimum flow depth which would prevent fish stranding. By contrast, the performance standard in the August 1999 NRMP (Table 5-1.1) was clearly established as a minimum flow depth of 0.25 ft at 0.5 cfs. We have commented previously that the proposed 8-feet wide channel will almost certainly not support a minimum flow depth of 0.25 cfs, especially if it is constructed over top of highly permeable gravels which will convey significant sub-surface flow. Another change between the August 1999 and December 2000 NRMP document is that the earlier (1999) design criteria was that "100 year flood flows will overtop the channel into the floodplain" whereas the current (2000) criteria is that "flows greater than the annual peak flow will overtop the channel and inundate the adjacent floodplain restoration." However, the hydraulic properties (width, slope, depth)

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for the relocated channel as shown in current design drawings (Appendix A to December 2000 NRMP) are essentially unchanged from the hydraulic properties as shown in previous versions of the design drawings. Our point is the NRMP fails to provide any calculations to indicate that the proposed relocated reach of Miller Creek channel will accomplish its changing design objectives. Our independent review suggests that the channel design as now proposed will fail to accomplish performance goals for minimum depth of flow and for floodplain inundation.

In summary, there continue to be numerous deficiencies in the analyses and preliminary designs which present a risk of significant adverse impacts to the natural stream and wetland systems if the December 2000 versions of the Comprehensive Stormwater Management Plan and Natural Resource Mitigation Plan are approved as a basis for mitigation of project impacts. We request on behalf of the Airport Communities Coalition that, prior to regulatory certification or approval of the proposed 3rd runway project, the applicant be required to respond to the issues we have raised in this letter, and that we be granted the opportunity to provide follow-up review and comment on that response.

Sincerely,

NORTHWEST HYDRAULIC CONSULTANTS, INC.

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Northwest Hydraulics Consultants, February 15, 2001 letter

The responses in this section have been prepared from the Port's perspective and knowledge.

1. It is the Port's belief that stormwater standards are described in the *Comprehensive Stormwater Management Plan*. Water quantity (flow) control standards are described in Section 2.1. Water quality management standards are described in Section 2.2. Changes to the described standards are subject to the review and approval of Ecology.

2. The Port believes the stormwater plans provided in the *Comprehensive Stormwater Management Plan* provide appropriate detail to evaluate potential stormwater impacts from the Master Plan Update projects. The protection standards are clearly detailed, and the plan shows the feasibility of providing the mitigation required to comply with the standards. In the event that modifications to the plan are necessary due to project adjustments or unanticipated field conditions, the modifications are subject to review and approval by Ecology. The standards would remain unchanged, even if the mechanism for meeting those standards were changed.

3. As part of the §401 certification process, Ecology engaged King County as a consultant to review and comment on the Port's *Comprehensive Stormwater Management Plan*. The Port has addressed all of the comments of the King County reviewers and, based on King County's review and the Port's response to the County's comments, Ecology has reasonable assurance the *Comprehensive Stormwater Management Plan* will comply with state water quality standards.

4. The Port, as a Washington municipal corporation, need not post a bond to guarantee completion of the stormwater management facilities planned as part of the Master Plan Update improvements. As a political subdivision of the State, the Port enjoys the benefits of RCW 4.92.080, which exempts the State from bond requirements.

As described in Section 7.1.5.1 of the *Comprehensive Stormwater Management Plan*, the cost estimate for the 12.6 acre-foot vault described in Appendix M is for a vault if it were to be constructed in a completely built-out area (access freeways in subbasin SDE-4). The cost estimate is presented to demonstrate that retrofitting of this specific area is not reasonably practicable. This cost estimate does not apply to areas of new construction.

5. The expansion of Industrial Wastewater System Lagoon 3 is under construction and will be completed no later than 2003, to provide at least 72.0 mg of storage, as indicated in Table 4-2 of the *Comprehensive Stormwater Management Plan*. While construction is not complete, the plans have been bid and under construction for one season. The contractor has not identified any issue about completing the construction as designed.

The Industrial Wastewater System is already treating wastewater at the rate of 4.0 mgd (the "future" rate described in the *Comprehensive Stormwater Management Plan* Table 4-2). The discharge line has capacity in excess of the treatment rate. Lagoons 1 and 2 contain 1.6 mg and 3.3 mg, indicated in *Comprehensive Stormwater Management Plan* Table 4-2. Thus, the future treatment rate and storage capacity data stated in the *Comprehensive Stormwater Management Plan* are fully supported.

As stated in *Comprehensive Stormwater Management Plan* Section 7.5, "the recommended AKART (all known available and reasonable treatment) alternative is to discharge treated effluent from the Industrial Wastewater Treatment Plant to the King County DNR East Division Reclamation Plant at Renton (EDRPR). This alternative will eliminate or reduce Industrial Wastewater System discharge to Puget Sound. Industrial wastewater system flows will continue to be treated by the Industrial Wastewater

Treatment Plant to remove oil and grease as well as total suspended solids before flowing to the EDRPR." The marine outfall will be retained and will continue to be permitted, and will be available for discharge, if necessary, to allow discharge of flows in excess of the maximum rate accepted by the EDRPR. The storage-discharge analysis presented in Section 4.2.2 and Appendix Z demonstrates that no untreated flows would occur in the 50-year King County Runoff Time Series period of record and no overflows would occur to Miller or Des Moines Creek. In fact, modeling showed that there would be no predicted overflow with future buildout at a processing rate of just 3.1 mgd, which is 78 percent of treatment capacity and less than one-half of outfall capacity. Additional treatment capacity may be available when all known available and reasonable treatment (AKART) has been implemented.

6. It is the Port's belief that the Industrial Wastewater System lagoon complies with the siting standards of the Federal Aviation Administration's Advisory Circular 150/5200-33. As required by the Circular, wildlife hazard mitigation techniques such as surface aerators, netting, and/or covers will be employed at the new Industrial Wastewater System lagoon. The site will be monitored and adaptively managed as described in the *Wildlife Hazard Management Plan* to eliminate and minimize wildlife hazards to aircraft. A key difference between constructing the Industrial Wastewater System lagoons and new wetland mitigation within 10,000 feet of runways is that wildlife and habitat management at mitigation sites is contrary to the mitigation objectives and reduces the effectiveness of the mitigation. For these reasons, even though the Port's wetland mitigation proposes on-site mitigation to fully mitigate the non-habitat wetland impacts, off-site mitigation is proposed to mitigate avian habitat at a location where there is no potential for wildlife or habitat management to reduce aviation hazards.

7. The Industrial Wastewater System is already treating at the rate of 4.0 mgd, which demonstrates feasible treatment rates. Negotiations are on-going to determine the allowable rates of Industrial Wastewater System discharge that can be routed to the King County DNR East Division Reclamation Plant at Renton (EDRPR). Routing water to EDRPR does not diminish the amount of treatment capacity that has already been proven, but instead simply provides an alternative discharge location. Under any future scenario, if operational requirements dictate a change in treatment, processing rate, outfall capacity, or other changes that could potentially increase surface water discharges to Miller or Des Moines Creeks, the Port would be obligated to evaluate potential impacts, obtain necessary permits, and provide mitigation.

8. The release rate evaluated in the *Comprehensive Stormwater Management Plan* is the proposed rate for the Industrial Wastewater System. As described above in Response #7, any changes to the treatment rate would be evaluated for impacts to the storm drainage system.

9. The Port will operate the Industrial Wastewater System in a manner consistent with the Port's NPDES permit and any conditions imposed by Ecology in its approved §401 certification. In the event that the processing rate or operations change, the Port would evaluate impacts, if any, on surface waters and seek approval from Ecology if modifications to the *Comprehensive Stormwater Management Plan* are needed.

10. The increase in storage capacity will be accomplished by expanding Industrial Wastewater System Lagoon 3, an existing facility. Runoff from small storms is stored in Lagoons 1 and 2, which are netted to prevent bird attraction. Runoff from larger storms would require the use of Lagoon 3. Bird attraction during larger storms is less of a concern, because open water will form in many other depressional areas as well, thus reducing the likelihood of bird attraction specifically to Lagoon 3. As required by Advisory Circular 150/5200-33, wildlife hazard mitigation techniques such as surface aerators will be employed at Lagoon 3. The site will be monitored and adaptively managed as described in the *Wildlife Hazard Management Plan*.

11. The tables referenced in the comment indicate live storage volume modeled and available for runoff control. Reserved storage is not included in the live storage calculations and is therefore not included in the referenced tables.

The list of low stream flow mitigation on page 6-6 of the *Comprehensive Stormwater Management Plan* describes the Port's proposed mitigation. The Tyee Golf Course well is not a "proposed" flow augmentation source to mitigate the Port's low stream flow impacts. See General Response GLR 7 on instream flow mitigation. The discussion on page 6-10 of the *Comprehensive Stormwater Management Plan* describes the Des Moines Creek Basin Committee proposal for flow mitigation. The *Low Stream Flow* analysis concluded that low flow impacts from the development of the Master Plan Update projects could be mitigated by the reserved stormwater storage. This will not conflict with King County's plans to also have a well available to mitigate existing impacts.

12. The collection and storage of surface water in underground facilities (e.g., cisterns) is not a new concept; this practice has historically been used to store water for many uses. Long-term storage of water is the basic concept of wetponds and wetvaults, which are considered pollutant removal best management practices. Stormwater that flows to the detention facilities and reserved stormwater storage has been treated by best management practices before it flows to the vaults. "Dead" sediment storage would be provided, so that water drawn from the facilities would not re-entrain remaining settled material, if any. Reaeration will be accomplished for the small flow from the facilities using passive aeration systems such as drip towers or cascades over roughened surfaces.

Exhibit C151 incorrectly labels Vault G1 with a required volume of 9.2 acre-ft. As reported in the *Comprehensive Stormwater Management Plan* Table 6-2 and Appendix A, the actual required volume is 7.4 acre-ft, which is provided in live storage in Vault G1.

The required low stream flow mitigation design is under review by King County. Reserve and live storage volumes will be confirmed as part of this review.

13. The Des Moines Creek calibration is under review by King County. The model has been calibrated and checked against the King County Gage 11F. Review of the SDS3 gage during the period in question shows that the recorded hourly low flows approach 0.06 cfs (and the corresponding calibrated flows are very close to 0.00 cfs). Thus, even if the monitoring device has been in error, the correction for that error would have been insignificant.

14. The area of noncontiguous groundwater included in the model (512 acres) is measured from interpretation of best available data. Additional interpretation of the information may yield different results by different reviewers. In addition, groundwater areas can change in area depending on seasons, variations between different climate years, and human factors such as water withdrawals. The evaluation of groundwater area used in the model was based on professional judgment and an evaluation of the significance of groundwater areas on calibration results.

15. The selection of a location to calibrate a model is subjective. Calibration of the models used for this analysis emphasized matching overall watershed conditions, and therefore utilized the lower gages.

16. Data from gage 42C is being used to improve the Walker Creek model. Preliminary results suggest that this data will enhance the calibration of the model.

17. It is difficult to quantify the size of the groundwater basin discharging to a particular point. Groundwater basins do not necessarily correspond to the surface basins defined by topography. The 630 acres used in the model resulted in an approximate match with measured low flow volumes.

18. Irrigation runoff from the golf course or leakage from the Industrial Wastewater System lagoon does not have any influence on the Walker Creek base flows, based on the fact that both are located in the Des Moines Creek surface water and groundwater basins some distance from the Walker Creek basin.

19. In preparing the plot of observed daily flows from the 1998 embankment fill for February 1999, measurements of pond volume were not made every day. On those days where no actual measurement was taken, the 'observed' daily flow was recorded as "zero." This does not mean that there were no inflows to the pond, but instead reflects days when no pond volume was measured.

20. The existing Industrial Wastewater System lagoons were shown in the calibration and future development models as water features. There is no change in the modeling input for the lagoons from pre development to post development. The expansion of Lagoon 3 and lining of the expansion area was not included in the modeling because it is not a Master Plan Update project. Moreover, the lining area (approximately 5 acres) is insignificant compared to the total impervious area and the relatively small impacts on low stream flows. Modeling of the Industrial Wastewater System lagoon areas will be modified to reflect the lining.

21. The potential hydrologic impacts of the borrow areas were not evaluated in the *Comprehensive Stormwater Management Plan* because the Port believes that modifications are considered temporary and reversible, as opposed to the construction of permanent new impervious areas and airport facilities. However, the Port believes that it is inaccurate for the commenter to assert that the hydrologic impacts of the use of the borrow sources have not been evaluated. As noted in the comment, the *Wetland Functional Assessment and Impact Analysis*, Appendices C and D, evaluate the potential impacts of the excavation of the borrow sources on wetlands, propose a plan for avoiding or mitigating those impacts, and address the post-excavation topography and drainage facilities in the areas of the borrow sources. Appendix C specifically states that "[m]itigation [of impacts from Borrow Area 1] will also include the use of a stream setback averaging 200 feet to protect Des Moines Creek from the potential impacts of borrow development activities." In addition, Appendix D makes clear that the drainage swale designed for use in Borrow Area 3 will ameliorate the changes in groundwater flow that are anticipated to occur as a result of the excavation of that Borrow Area. Finally, "reclamation of the borrow area[s] will be accomplished in accordance with Washington Department of Natural Resources criteria and the Port of Seattle landscape plans. Once final grades have been established, the drainage swale and adjacent slopes will be protected from erosion using the same techniques demonstrated to be effective by the embankment construction to date. The excavation slopes will be dressed and hydroseeded with a bonded fiber matrix. The swale will be protected with erosion control matting until grass is established as part of the post-excavation site reclamation." Appendix D at page 8.

The feasibility of stormwater control in the borrow areas is not an issue, based on the lack of limitations regarding location and feasibility of stormwater facilities in borrow areas, e.g., land areas, wetland impacts, or size requirements. Infiltration facilities are feasible in the types of soils found in the borrow areas, allowing for the mitigation of potential base flow impacts.

Field investigations and soil classification conducted in the borrow areas, along with a comparison of soil gradation tests from field samples indicate that groundwater infiltration will increase in Borrow Areas 3 and 4 because more permeable soils will be exposed, while Borrow Area 1 may show reduced infiltration. As noted above, development and reclamation plans for Borrow Area 1 will include measures to enhance on-site infiltration (e.g., terraced slopes and benches) to the extent this is necessary.

Field investigations and soil classification conducted in the borrow areas, along with a comparison of soil gradation tests from field samples indicate that groundwater infiltration will increase in Borrow Areas 3

and 4 because more permeable soils will be exposed, while Borrow Area 1 may show reduced infiltration. As noted above, development and reclamation plans for Borrow Areas 1, 3 and 4 will include measures to enhance on-site infiltration (e.g., terraced slopes and benches) to the extent this is necessary. These plans will be submitted to the appropriate permitting agencies for review.

22. Review of air photos of the borrow areas demonstrate that much of the area was formerly neighborhoods acquired by the Port in past mitigation buy-outs. Much of the soil was modified (soil or organic materials removed) when the area was residential. Nevertheless, hydrologic modifications described will occur, although to a lesser degree than described in the comment.

While it is possible in some instances that grading would reduce surface infiltration, it is more likely that the removal of less-permeable perching layers and till will in fact increase the potential for infiltration and recharge that could increase baseflows to Des Moines Creek.

23. The Port believes the "headwaters" of Des Moines Creek are misrepresented in the comment as the borrow area locations. The west branch of Des Moines Creek originates as a well-defined, dredged channel from Northwest Ponds (the drainage area of which extends about a mile north of the Northwest Ponds), which are located approximately one-half mile upstream of 200th Street. The east branch of Des Moines Creek originates in drainage channels (with a drainage basin extending approximately 0.7 miles north of the lake) flowing to Bow Lake, which is located approximately 1 mile north of 200th Street.

24. See response to Comment 21 above.

25. The Port believes there is no basis for asserting that there will be adverse impacts from the borrow areas. Mitigation, if necessary, can be provided in the borrow areas with no impacts to operations or borrow area feasibility.

26. Refer to Technical Appendix B, Volume 3, of the *Comprehensive Stormwater Management Plan*.

27. The *Low Streamflow Analysis* report did not include supplemental Hydrologic Simulation Program-Fortran (HSPF) analyses. The *Low Streamflow Analysis* report used results from the HSPF analyses contained in the *Comprehensive Stormwater Management Plan*. Refer to the *Comprehensive Stormwater Management Plan* technical appendices A and B for HSPF input sequences.

28. See response to comment #14 above regarding groundwater basins.

29. See response to comments 19, and 21 above.

30. See response to comment #20, on Industrial Wastewater System lagoon lining.

31. The Hydrologic Simulation Program-Fortran (HSPF) modeling includes the baseflow impact to all creeks due to new impervious surface constructed since 1994. The diversions to the Industrial Wastewater System area since 1994 are evaluated in the *Comprehensive Stormwater Management Plan* comparison of 1994 conditions with 2006 conditions.

32. See responses to comments 23, 24 and 25 regarding the borrow areas. The borrow areas are not forested headwaters of Des Moines Creek.

33. The models used were described in the *Low Streamflow Analysis* report (pages 2-7). The Hydrologic Simulation Program-Fortran (HSPF) modeling for the *Comprehensive Stormwater Management Plan* was used for the low streamflow analysis. As a result, there are no differences in the

modeling for the two analyses. All permanent hydrologic impacts related to the Master Plan Update were evaluated.

34. The Port believes the commentor compared the matrix conductivity used in the Pacific Groundwater Group's analysis to the INFILT parameter in the Hydrologic Simulation Program-Fortran (HSPF) model developed for the *Comprehensive Stormwater, Management Plan*. However, for comparison to HSPF model parameters, it is more appropriate to compare the HSPF INFILT parameter to the hydraulic conductivity of the bulk fill (Kbulk). It should also be recognized that Kbulk is not exactly equal to INFILT. Pacific Groundwater Group's Kbulk value of 0.085 in/hr (6x10-5 cm/sec) compares to the HSPF INFILT value of 0.02 in/hr. Based on this comparison, the difference is less than implied by the commentor. However, differences do exist between the amount of infiltration allowed by the two models. The following paragraphs explain the origins of the various values and application of results of the analysis.

The hydraulic conductivity used for the secondary recharge analysis was based on a database of measurements by others, and well-established algorithms that use soil particle size distribution. In this case, the percents of sand and silt expected of the entire fill were calculated based on geotechnical engineering plans for the fill. The resulting percents of sand and silt were considered representative of the soil matrix between gravel and cobbles. No flow was assumed to occur through the gravel/cobble fraction of the fill. As a result, the bulk hydraulic conductivity was lower than the matrix conductivityby the formula:

Kbulk = Kmatrix * (1-gravel fraction)

Where:
Kbulk =bulk hydraulic conductivity
Kmatrix = matrix hydraulic conductivity

In this case Kmatrix = 1.35x10-4 cm/sec, Kbulk = 6x10-5 cm/sec, and gravel fraction = 0.55.

INFILT for the Third Runway fill was established based on calibration of the HSPF model to Phase I fill runoff data spanning a one-month period in February 2000. At that time the Phase I fill had been contoured, densified by rolling, and treated to reduce erosion. It was virtually free of vegetation except on the slope.

The difference between the HSPF calibration result and the hydraulic conductivity implied by the particle size distribution was recognized at the time the secondary recharge analysis was performed. However, it was the opinion of more than one hydrogeologist that runoff from the completed fill would likely be less than suggested by the limited Phase I runoff monitoring data. It was recognized that stormwater designs based on the HSPF model would therefore overestimate as-built runoff, underestimate infiltration, and therefore overestimate impacts to streams in low flow periods. Because of the resulting conservative stormwater component designs, the HSPF model was not altered and the secondary recharge analysis proceeded independently.

35. A sensitivity analysis was performed in the Pacific Groundwater Group's secondary recharge analysis using reasonable assumptions for the widths of the infiltration filter strips (30 and 75 feet). Reducing Kbulk causes a reduction in estimated secondary recharge and increasing the filter-strip width causes an increase in the volume of water infiltrated (and a reduction in rate due to the increased infiltration area). By reducing the modeled Kbulk to a value equal to the HSPF model parameter (0.02 in/hr), estimated secondary recharge would be reduced by about 55% for a 75-foot filter strip (from about 22 to 10 in/yr) and by about 75% for a 30-foot filter strip (from about 48 to 12 in/yr). The secondary

recharge values estimated with the HSPF INFILT values used for Kbulk (10-12 in/yr) are less than will likely occur under the eventual built condition.

36. Dam safety design procedures defined in WAC 173-175 are followed for pond designs. All ponds requiring the Dam Safety review will incorporate that review process into the design process. If Dam Safety review is required, plans will be finalized in compliance with those regulations. All ponds constructed thus far have been exempt from a dam safety review.

37. See response to comment #36 above.

38. A geotechnical report for stability and constructability of the vaults will be completed as part of final design. Significant geotechnical evaluation of the embankment will be completed, as required to conform to all applicable regulatory requirements.

39. The depth requirement to which this comment refers is listed in the King County Stormwater Design Manual under the heading "Access Requirements." The specified depth is not a structural requirement. No depth limit is stated in the requirements under the heading "Structural Stability," on page 5-37 of the King County Stormwater Design Manual.

The Port maintains its own facilities. Due to the size and scale of operations at the Sea-Tac Airport, the Port is able to provide the necessary equipment to access and maintain these vaults.

Cast-in-place vaults will be designed and stamped by a licensed structural engineer.

40. The stormwater detention facilities will be constructed and operated consistent with the Port's *Wildlife Hazard Management Plan*. Standards for stormwater facilities are included in the *Wildlife Hazard Management Plan*. If the facilities fail to meet those standards, there are viable and feasible alternatives to retrofit the facilities to reduce wildlife attraction. Since the 1980's, the Port has staffed a full time wildlife biologist at the airport to assist in reducing and managing wildlife hazards. Accordingly, in the event of a problem, mitigation will be identified and implemented.

41. The Port believes the details described in the comment are included in plans at the appropriate level of design progress. The Port has a systematic, critical construction plan review process. Plans are reviewed at multiple design milestones by more than eight qualified Port environmental staff and consultants. In addition, the Port's individual National Pollution Discharge Elimination System (NPDES) permit requires significantly more extensive planning, implementation, and monitoring than the requirements of most construction sites in the state of Washington. Most construction sites in Washington are permitted under the General NPDES Permit for Construction Stormwater. The Port's NPDES permit requires that site-specific monitoring plans be prepared for construction projects. The Port is also required, through the Governor's Certification, to provide third-party oversight of all Master Plan Update construction activities for temporary erosion and sedimentation control. This third-party oversight is a condition of the Port's NPDES permit. The Port has a full-time temporary erosion and sedimentation control expert on staff, and monitors each of the construction sites as required by site-specific monitoring plans approved by Ecology. Problems found at the North Employee Parking Lot construction site in 1997 were effectively resolved to allow completion of the site during the wet season with no further problems.

The Port's temporary erosion and sedimentation control design and implementation procedures currently have more than three years of proven performance on large earth embankment projects, including one of the wettest winters on record. Facilities such as pumps, swales, and treatment ponds have been constructed and operated with no uncontrolled discharges.

Temporary erosion and sedimentation control is most effectively implemented with a sound. detailed plan, overseen and monitored by experts, adjusted and adapted to unique conditions at each site. using new and innovative techniques. The Port's approach to temporary erosion and sedimentation control for Master Plan Update projects meets all of these requirements.

42. Detailed temporary erosion and sedimentation control plans will be developed prior to construction, as required by the Port's National Pollution Discharge Elimination System permit. Also see response to Comment #41 above.

43. See response to comment #42 above.

44. See response to comment #42 above.

45. Temporary erosion and sedimentation control facilities will be in place as long as they are needed. Depending on the location in the construction and drainage basin, some facilities will be needed for one construction season, while others may be needed for the life of the construction (approximately 6 years).

46. As described in the *Natural Resource Mitigation Plan* (Section 5.2.3 pages 5-101 through 5-106), following construction, the outer drainage channels will serve to collect and convey seepage water to wetlands located downslope of the embankment. The temporary construction use is to collectrunoff from the construction area for diversion to a sedimentation pond and treatment. Temporary and permanent impacts to wetlands resulting from these channels have been evaluated in the *Wetland Functional Assessment and Impacts Analysis* report (Section 4.2; Table 4-5, on page 4-13).

47. Pond A and the adjacent pump pit are located in wetlands because this is the lowest part of the west-side construction area and the point to which storm water will flow during construction. These ponds are part of the temporary erosion and sedimentation control system protecting Miller Creek from potential short-term construction impacts. These ponds will be removed as soon as the adjacent disturbed ground can be revegetated and sediment is no longer a risk.

The geotextile lining is not intended to keep groundwater out of the pond, and there is some potential for Temporary Pond A to intercept a portion of the shallow groundwater that in part maintains the hydrology of Wetland 37a. We conservatively estimate the potential flow from natural groundwater into the empty pond would be on the order of 2 to 10 gpm (0.005 to 0.022 cfs). The area of wetland potentially impacted by this would be limited to between 20 and 50 feet downslope of Pond A. This volume of flow is insignificant to the wetland as a whole, except possibly during the late summer months.

It is important to note that the impact to wetland hydrology would be seasonal and temporary. The pond only needs to be pumped out when it is needed for temporary storage of storm water, typically only during the period of say October to April. Impact in winter is expected to be minimal since other hydrologic inflows will likely be sufficient to maintain moisture levels within the surficial wetland soils irrespective of any drainage effects due to Pond A. Impacts would be potentially greater in the summer, if the pond was drawn down and intercepted shallow groundwater flow that is feeding downslope wetland. However, the Port has no plans (and no need) to operate the pond except during storm events.

A management solution the Port proposes is to maintain water in the pond during the summer, when little or no stormwater retention capacity is needed. This would reduce or eliminate the drainage effect on the adjacent wetland. If necessary, management of pond levels throughout the year could be tied to anticipated weather conditions, with the water level only drawn down by pumping when storms are expected.

Based on the results of further analysis, an alternative management proposal for Pond A being considered by the Port includes placing a sheet-pile wall (or cofferdam) around the pond to isolate it from the groundwater flow that is sustaining Wetland 37a. In this alternative, sheet piles would be installed to the top of the glacial till at an anticipated average depth of 15 feet below ground surface. The sheet piles would prevent groundwater from entering Pond A, and thus prevent drawdown of groundwater levels in the adjacent wetland.

The cofferdam would divert some local shallow groundwater flow, forcing diverted water around the ends of the cofferdam, and possibly lowering water levels in the wetland area downslope of the pond as a consequence. To mitigate this, a collector/distributor trench filled with gravel (a "French drain") will be built around the outside of the cofferdam. The French drain will collect shallow groundwater that would otherwise tend to mound on the upslope side of the cofferdam, and conduct it around to the downslope side of the cofferdam. The water in this gravel-filled trench will be available to maintain water levels in the shallow wetland soils, with no volume reduction or delay to the seepage, and no introduction of channelized surface-water flow in the wetland.

48. The Port has successfully completed and implemented complex temporary erosion and sedimentation control plans for its embankment projects. The Port's National Pollution Discharge Elimination System permit already requires the detail and performance recommended in the comment, which is not typically required by applicants reviewed under the King County and Ecology Stormwater Management manuals.

49. The surface water runoff from the mechanically stabilized earth wall will be conducted laterally in the wall terraces to catch basins. The catch basins are part of the storm drainage system that includes piping and energy dissipation before delivery to the various detention facilities.

50. The Port's design includes engineering input on the embankment failure at the Telluride Airport. The factors that contributed to the failure at Telluride include:

- Failure to recognize the potential dangers of constructing embankment fill slopes atop old debris slides and other indicators of geologic instability. The natural slopes at the Third Runway site are stable by comparison;
- The Telluride construction site was in extreme topography near the top of a mountain in the Rockies, with steep slopes subject to instability, and very different from the Puget Sound lowlands;
- Failure to include in the embankment design adequate drainage to prevent the buildup of pore pressure, which was blamed as the primary cause of failure at Telluride. The Third Runway project includes a substantial drainage blanket designed expressly to prevent such dangerous build-up of pore pressures;
- The Telluride embankment materials were composed of weak shales and residual soils, which are prone to swelling. In contrast, the glacial materials that will be used at the Third Runway site are inherently stronger and more geologically stable;
- The location of the Telluride fill above a fault helped exacerbate seepage problems and contributed to the embankment failure. Such conditions are <u>not</u> present at the Third Runway site;

The relevant lessons of the Telluride Airport embankment failure have been fully incorporated in the Third Runway embankment design.

51. The Port believes the use of 1998 stormwater runoff data for the Phase 1 embankment likely skews the results toward low infiltration rates, when the bulk of the fill is in fact expected to have infiltration rates in excess of at least 0.19 inch per hour. The skew is deliberate in that it over-emphasizes stormwater runoff from the embankment, and ensures that stormwater management infrastructure is conservatively designed. However, the Hydrologic Simulation Program-Fortran (HSPF) will not yield reliable results for expected rates of infiltration and groundwater recharge through thick unsaturated zones such as created by the embankment fill, because HSPF is primarily a surface flow analysis tool, not a groundwater flow model.

The fill infiltration modeling in the Pacific Groundwater Group report is more concerned with understanding impacts to aquifers, and uses higher infiltration rates than does HSPF. These higher rates are more consistent with the expected water transmission properties of the fill, and the surface of the fill under long-term conditions (grassed, with wormholes and other macro porosity that will encourage infiltration). The Pacific Groundwater Group results support comparable modeling work on embankment infiltration performed by the Port (see Appendix C, *Embankment Infiltration and Seepage Studies, Draft Geotechnical Engineering Analyses and Recommendations, Third Runway Embankment, pages C-1 through C-12*Hart Crowser, December 4, 2000). Similar rates of infiltration used by Hart Crowser are also conservative in addressing the likelihood for perched zones of saturation to occur within the fill.

The embankment design considers observed fill drainage characteristics as well as analysis of infiltration on fill stability, and incorporates appropriate measures such as using relatively high conductivity soils for the outer part of permanent embankment slopes.

52. The bench drainage channels have been designed to conduct 200 percent of the peak flow for the 100-year, 24-hour storm event. Cloudburst rainfall and horizontal rainfall fall well within these sizing criteria.

53. 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 pages 4-64 through 4-67; 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. However, Pond D has been designed to infiltrate water into the soil and with an additional orifice to discharge treated stormwater to the wetland as a means of preventing such an indirect impact.

All pond designs and temporary and permanent erosion and sediment controls include a site-specific evaluation. A primary aspect of pond siting involves test borings and test pits in the proposed locations. Standard pond design methods are followed in each case. Design of each pond proceeds from the site-specific data so that the pond is designed to be above the observed water table levels at each site.

54. The areas described as Vacca Farm and the Miller Creek relocation sites are landscapes that have been heavily altered by decades of human impacts. The changes include watershed development with houses, roads, and commercial development; channelizing Miller Creek; excavations in the Miller Creek Detention Facility, and construction of the facility; Lora Lake excavation; farming and farm drainage; and land clearing in the floodplain. It is difficult to replicate a natural system that retains existing habitat (small stream habitat) when that habitat probably did not exist prior to human alterations and other factors influencing this habitat (watershed development) are present. However, the proposed Miller Creek relocation, considering many of the limitations of the project area, will replace the limited natural functions that this highly altered portion of Miller Creek provides, and restore many functions that have been lost by previous actions.

For example, the existing stream channel is actually located on the edge of the floodplain, several feet above the existing bottom of the "valley" through which the channel flows. If the channel were constructed in the bottom of the floodplain with the low profile and flat floodplain, it would lose definition and no longer function as a section of stream channel that is present now. It is therefore necessary to construct a channel with "built-up" walls to define the flow channel.

The 5.24 acre-feet of 100-year floodplain storage will mitigate the loss of 100-year floodplain storage as described in the *Natural Resource Mitigation Plan* (Table 4.1-2 page 4-7; Section 5.1.2 pages 5-26 through 5-43). The relative floodplain storage is matched at each depth of flooding depth, thereby mitigating impacts of small floods. The relocated channel has increased conveyance capacity when compared to the existing channel. The area through which Miller Creek will be relocated is a broad, shallow backwater area that stores flood flow even during less frequent events. The proposed channel will convey flows as indicated in the *Natural Resource Mitigation Plan* (Sections 5.1.1.2 and 5.1.1.6 pages 5-5 through 5-16), 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 includes drainage from Des Moines Memorial Drive, Lora Lake, and overflow from the new channel.

The channel will overflow with flows in excess of 40 cfs. The 100-year flood elevation in the vicinity of the relocated channel represents a large shallow backwater area that could be characterized as more of a "lake" than a conventional streamside floodplain. The floodplain will receive water from other sources as well as overflow from the creek channel. Natural levees that separate the main channel from the floodplains are frequently found in nature.

55. See response to #54 above.

56. The channel design is virtually unchanged from the previous *Natural Resource Mitigation Plan* (Section 5.1.1 in Parametrix, August 1999). Changes in text were primarily a result of questions and comments from reviewers that required clarification. The assertion that the channel will go dry by flowing through highly permeable stream material is incorrect. The gravel specifications include fine sands and silts to specifically avoid the problems that were asserted by the reviewer.

Channel hydraulics in the relocated reach of Miller Creek are influenced by high water table and downstream water surface elevations, in addition to the channel configuration, slope, and roughness. The existing channel has a similar channel cross-section that meets the flow depth criteria. The flow depths, as described in the *Natural Resource Mitigation Plan* (Section 5.1.1.6 page 5-12) are expected to be met. In the event that design standards are not met and the stream is not providing appropriate habitat, Table 5.1-7 (page 5-21) of the *Natural Resource Mitigation Plan* provides performance standards and contingency measures that can be implemented.

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Subject: Follow-up comments on stormwater, hydrology, and hydraulics aspects of proposed 3rd runway and related development actions at Seattle-Tacoma International Airport, Corps Reference No. 1996-4-02325.

Northwest Hydraulic Consultants has been retained on behalf of the Airport Communities Coalition to provide technical reviews of stormwater, hydrology, and hydraulics elements of proposed development actions at SeaTac airport. Our comments on the December 2000 version of the project stormwater management plan and related environmental documents were submitted to Ecology and the Corps in a letter dated February 15, 2001.

Responses to public comments, including those submitted by NHC, were made in a document dated April 30, 2001, by or on behalf of the Port of Seattle. The purpose of this letter is to provide our follow-up comments based on those Port responses.

Follow-up comments are provided below for each of the numbered points in our comment letter and in the Port's response. Those documents do not share a common numbering system. In order to facilitate cross-referencing to the prior documents, each comment below begins with "NHC xx; Port xx" to reference the corresponding comment and response numbers from our comment letter of February 15, 2001 and the Port's response document of April 30, 2001.

1. NHC 1; Port 1. In our opinion there is a need to eliminate ambiguity as to what stormwater standards will be applied for this project. A clear commitment is needed that the "updated" standards described in SMP Section 2.1.4 will be followed, and are not subject to further negotiation. Vague references to "the Port's stormwater management standards" (SMP page 6-3) are inappropriate and should be eliminated. Also, as noted in our original comment, it

is of concern that the now-approved major modification to the SeaTac Airport's NPDES permit has a requirement for stormwater management standards which are less stringent than the updated standards described in the SMP.

2. NHC 2; Port 2. The response does not address the substantive concern regarding the absence of a clearly-defined, post-SMP review process. The recent history for this project, particularly the major flaws in both the November 1999 and August 2000 versions of the project SMP, highlights the need for an independent design review to supplement the Port's quality assurance and review processes. Without certainty of ongoing, independent, competent review, there can be no reasonable assurance of project compliance with either King County surface water policies or Ecology conditions of approval for Section 401 Certification.

3. NHC 2; Port 3. The response is inconsistent with our understanding of the status and scope of the review work being conducted by King County. First, while the response asserts that the Port has "addressed all of the comments of the King County reviews," it is apparent from the record of subsequent Ecology-County-Port meeting notes that the King County review is an ongoing process which was not satisfied or concluded by the Port's initial responses. Second, the King County review was limited in several respects and did not consider airport impacts from non-Master Plan Projects (such as the post-1994 IWS expansion, IWS lagoon linings, or borrow pit mining) and did not assess compliance with state water quality standards. Our understanding of the study scope is based in part on the following statement from the second paragraph of King County's February 22, 2001 review findings letter: "*As with our previous review of this project, it is important to keep in mind the limitations of the work that we have performed. First, this review is limited to ascertaining whether the SMP attained minimum compliance with 1998 King County Surface Water Design Manual. Compliance with the technical provisions of the Design Manual does not mitigate all potential impacts of development and may not provide sufficient information to allow for approval under other codes and regulations.*"

4. NHC 3; Port 4. The response does not address the substantive concern regarding the cost of the proposed facilities and, per the Port's own consultant, that "Obviously, the success of the mitigation depends on the effectiveness of implementation and monitoring. . .It is critical that sufficient guaranteed funding be available. . ."

5. NHC 3; Port 4. Our comment on the unit cost of stormwater vaults was based on information provided in the SMP for Vault SDE-4. We examined the costs for all facilities shown in SMP Appendix M and selected Vault SDE-4 because 87% its costs were found to be determined by factors of basic structure cost, excavation, and backfill, all of which should be independent of whether the area had been previously developed. In contrast, we purposefully did NOT use unit cost information for SDS-3 Vault 3 which was found to have total unit costs about double those for SDE-4 due to significant (about 44% of total) costs relating to pre-development issues of removing existing pavement and constructing a new taxiway. If the Port's cost estimates are reliable, then the cost data provided in SMP Appendix M for Vault SDE-4 should provide a reasonable basis for estimating vault costs for areas of new construction. Given the Port's reluctance to provide cost estimates for storage vaults and ponds to provide peak flow control, it is of concern that the Port is using the costs

in Appendix M as justification that it is "not reasonably practicable" to construct Vault SDE-4 so that previously-developed areas can meet state water quality standards. Also see Comment 4 above.

6. NHC 4; Port 5 and 6. Response noted.

7. NHC 4; Port 5, 7, 8, and 9. Responses noted.

8. NHC 4 and 19; Port 10 and 40. The response fails to provide any analysis of the frequency and duration of standing open water in Lagoon 3 or other open water facilities. The Port's position seems to be that a realistic analysis of the frequency and duration of standing open water is irrelevant since bird attraction hazards will be controlled by other mitigation techniques.

9. NHC 5; Port 11. The amount of any "reserve storage" being proposed at stormwater facilities needs to be consistently included in SMP tables and exhibits. We agree that a distinction is needed between live storage and reserve storage.

10. NHC 5; Port 12. We disagree with the premise that the reserve storage proposal described in the SMP is a historical practice. The proposed reserve storage is not a water supply cistern from which water is regularly recharged and regularly withdrawn. The proposed reserve storage is also unlike the dead storage in a water quality wetpond in which a plug of old water is pushed out with each new storm event. Instead, the proposed reserve storage scheme involves a dead storage zone below the detention live storage. The reserve storage will be filled with the first fall or early winter storm and then function entirely as dead storage for up to nine months, accumulating whatever materials or pollutants might precipitate from the live storage zone during that time. Our point is that all of the reserve storage water will function like a dead storage zone for a very prolonged period prior to the water being put to use, and that the summer-period quality of the reserve storage water, and its suitability for low flow augmentation, is uncertain.

11. NHC 6; Port 13. Response that "The model has been calibrated and checked against the King County Gage 11F" is noted. Further comment will be offered once the results of that calibration and checking are made available for public review.

12. NHC 6; Port 14. Response appears to have mis-interpreted or has not addressed our observation of an internal inconsistency in the SMP. The calibration text (SMP page B1-10) states that there is groundwater inflow from 1,240 acres of non-contiguous area. This is inconsistent with the model input sequence which shows inflow from only 512 acres. The Port's response suggests that groundwater inflow is highly dynamic, variable, and that interpretation is subject to professional judgement. The SMP should in our opinion be internally consistent in describing the relevant factors and modeling assumptions. Also see Comment 15 below.

13. NHC 6; Port 15. Given the availability of upper-basin data, we disagree with the choice of calibrating primarily to lower gages and in matching overall watershed conditions. Our

opinion as stated previously is that because the purpose of this work is to address and mitigate conditions in the upper basin (airport) areas of the watershed, calibration efforts should place more emphasis on matching upper basin flows unless those data are confirmed to be unreliable. Emphasis on overall watershed conditions and lower-basin data will tend to mask impacts and mitigation needs from airport development activities in the upper basin.

14. NHC 7; Port 16. Response that "Data from gage 42C is being used to improve the Walker Creek model" is noted. Further comment will be offered once the results of that model improvement are made available for public review.

15. NHC 8; Port 17. The response does not address the substantive discrepancy between the 630 acres of Walker Creek non-contiguous groundwater basin assumed for model calibration, the approximately 690 gross acres (before IWS diversions) of available non-contiguous groundwater basin based on groundwater mapping (SMP Figure B2-23), and the approximately 350 acres of available non-contiguous groundwater basin once IWS areas are removed. The available mapping data suggest that diversions to the IWS system from this groundwater recharge area and implementation of IWS leak detection and repair programs could potentially cause a nearly 50% reduction in the base flows of Walker Creek. Our point is that it is difficult to provide any reasonable assurance of appropriate mitigation for airport impacts on stream base flows, or seepage flows to wetlands, when the source of those flows is so poorly understood.

16. NHC 8; Port 18. The Port response suggests with apparent certainty that leakage from the IWS lagoons does not have any influence on Walker Creek base flows. This certainty is inconsistent with Port responses 14 and 17 which suggest that groundwater inflow is highly dynamic, variable, and that interpretation is subject to professional judgement.

17. NHC 9; Port 19. Response noted.

18. NHC 10; Port 20. The response fails to address the substantive concern that post-1995 lining of the IWS lagoons has and/or will cause low streamflows in Des Moines (and possibly Walker) Creek to be reduced below the low streamflows which would have occurred during base year (1994) conditions. SMP Section 2.1.2 (page 2-2) discusses selection of the base year. Our point remains that airport impacts to stream base flows, as well as mitigation needs, have likely been underestimated because they have not considered the effect of lining these lagoons.

19. NHC 11; Port 21. Response noted. We agree that many of the potential impacts can be suitably mitigated by future reclamation activities, providing that the borrow pit areas are reclaimed to a forested basin condition. However, the SMP and related documents offer no assurance or commitment that the borrow sites will be reclaimed to a forested condition.

20. NHC 11; Port 21. The Port response does not address our comment of effects on Des Moines Creek flows due to lost flow attenuation capacity. The Port's low streamflow analysis makes the claim that summer flows in Miller Creek will be improved due to attenuation effects in the fill material which will be imported for the third runway

embankment. Because significant quantities of that same fill is being excavated (to depths of up to 100 feet) and exported from borrow pits in the upper Des Moines Creek basin, it follows that there will be some corresponding impairment of summer flows in Des Moines Creek.

21. NHC 11; Port 22. Response noted.

22. NHC 11; Port 23. Response noted. Our use of "headwaters" is intended to reflect the fact that the forested areas in question are in the upper portion of the basin where Des Moines Creek appears to be a gaining stream, and that low streamflows in Des Moines Creek are sustained, in part, by runoff from these forested areas.

23. NHC 11; Port 24. See Comment 20 above.

24. NHC 11; Port 25. We disagree with the assertion that there will be no adverse impacts from borrow pit activities. See Comments 19 and 20 above.

25. NHC 12a; Port 26. The response is inadequate and avoids the question of how well the HSPF model reproduces summer flows for the months of August and September.

26. NHC 12b; Port 27. Response noted.

27. NHC 12c; Port 28. The response is inadequate. Our point, again, is that it is difficult to provide any reasonable assurance of appropriate mitigation for airport impacts on stream base flows, or seepage flows to wetlands, when the source of those flows is so poorly understood.

28. NHC 12d; Port 29. Response noted.

29. NHC 12e; Port 30. See Comment 18 above.

30. NHC 12f; Port 31. We are confused by the response. According to the SMP, the analysis of base year 1994 conditions was made using existing (1994) land uses superimposed on future (year 2006) subbasin boundaries. Our understanding of the HSPF streamflow modeling is that areas tributary exclusively to the IWS system (as of the year 2006 basin boundaries used for both existing and future conditions) were not included in the HSPF models. With this methodology, it is impossible for the SMP to have evaluated the baseflow impact in Des Moines Creek due to the diversion of 111 acres of basin area to the IWS system. Our point is that project impacts to low flows in Des Moines Creek have been underestimated because the assessment has not accounted for the post-1994 expansion of the IWS system.

31. NHC 12g; Port 32. See Comments 19, 20, and 22 above.

32. NHC 12; Port 33. See Comments 25 through 31 above. We repeat our original comment here. Insufficient information has been provided to confirm whether the models are reasonably well calibrated for assessing low flows conditions. Furthermore, the analysis

methods have overlooked several airport activities--IWS expansion, IWS lagoon lining, borrow pits--which will likely have an adverse impact on low streamflows, particularly in the Des Moines Creek basin. Individually and cumulatively, these problems result in a failure to adequately address airport impacts on low streamflows and associated water quality concerns in the affected streams, and a corresponding failure to provide reasonable assurance of adequate mitigation.

33. NHC 13 and 22a; Port 21, 34 and 51. The responses provide a plausible explanation of how surface contouring, densification, and application of bonded fibre matrix for erosion control could have caused the monitored embankment runoff to generate far more surface runoff (and allow far less infiltration) than would be consistent with theoretical values for the embankment fill. We agree that the surficial effects of these practices should diminish over time due to weathering and biological actions. However, no information is given to address the uncertain consequences of the layers of densified soils and bonded fiber matrix which are being buried within the body of the embankment and which will not be exposed to significant weathering or biological actions.

34. NHC 14; Port 35. Response noted. See Comment 33 above.

35. NHC 15; Port 36. Response noted. We recognize that the full dam safety review will require design drawings more advanced than those presented in the SMP. However, given the size and complexity of this project, the SMP should provide a summary table to identify which of the facilities being proposed will require Ecology review and approval, prior to construction, for compliance with dam safety regulations. Also, Ecology should confirm whether a dam safety review is needed for Pond G prior to the start of construction of that facility per the "Third Runway - Embankment Construction Phase 4" drawings and specifications dated January 29, 2001 which have been approved by the Port and issued for bid.

36. NHC 16; Port 37. See Comment 35 above.

37. NHC 17; Port 38. We disagree with the response which proposes deferring substantive issues of the feasibility of certain facilities until final design. The facilities at issue are Vault SDS7 and Vault G1. Vault SDS7 proposes above-grade storage of 21.4 acre-feet of water volume in a rectangular structure with an above-ground water depth of 19.8 feet. Vault G1 proposes storage of about 13.8 acre-feet of water volume (detention storage plus reserve storage) with a water depth of 30 feet. There is an obvious need for a safety review to assure the structural stability of Vault SDS7. Our concerns over Vault G1 result from its close (about 20 feet) proximity to the top edge of a 140-foot high fill embankment. Furthermore, because of its proposed placement in fill, Vault G1 (and perhaps others) fails to satisfy the KCSWDM technical requirement (pg 5-37) that "Vaults shall not be allowed in fill slopes, unless analyzed in a geotechnical report for stability and constructability."

38. NHC 18; Port 39. Response noted.

39. NHC 19; Port 40. See Comment 8 above.

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40. NHC 20, 20a, 20b, and 20c; Port 41, 42, 43, and 44. Responses noted. However, they fail to answer the specific technical questions presented in our comments 20a, 20b, and 20c.

41. NHC 20d; Port 45. Response noted.

42. NHC 20e; Port 46. The response does not address the conflict between use of the outer swales to collect (clean water) seepage from the toe of the embankment and convey the water to wetlands with the use of the same ditches for conveyance of (turbid water) construction site runoff to erosion control treatment facilities. One consequence of this conflict is that erosion control treatment facilities may be undersized. (This relates to the unanswered, technical questions from our previous comment 20b: "What is the tributary area for each of the proposed ESC facilities? What are the design flows? Have the design calculations been reviewed?")

43. NHC 20f; Port 47. We appreciate that the Port recognizes the need for additional analyses and management solutions to the challenge of pumping erosion control water from a pond which will be excavated, within a wetland, to a depth which is about 9 feet below the seasonal groundwater level. However, this is a situation which should have been identified and corrected prior to Port approval of the construction plans[1] and specifications which describe this work. The oversight illustrates that the Port's "systematic, critical construction plan review process" (Port response 41) is fallible and would benefit from additional independent review.

44. NHC 20; Port 48. See Comment 40 above.

45. NHC 21; Port 49. The response provides an adequate proposal for drainage from the MSE wall, but fails to provide a proposal for collecting runoff from the face of the sloping embankment. Specifically, the response does not address our comment that SMP Appendix O, Exhibit C115 shows that undetained surface runoff collecting at the bottom of the embankment, and also from the airport security road, would be discharged directly into adjacent wetlands without any peak flow detention as required by King County and Ecology regulations.

46. NHC 22 and 22a; Port 50 and 51. Responses noted. See Comment 33 above.

47. NHC 22b; Port 52. Response noted.

48. NHC 23; Port 53. The response does not adequately address our concern that the proposed construction excavation for Pond D, as shown by SMP Appendix D, Exhibits C133 through C134.1, is very likely to intercept the local shallow regional groundwater table and to <u>significantly</u> disrupt the water supply to Wetland 39. These are the same exhibits as presented

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[1]Port of Seattle major contract construction plans titled "Third Runway - Embankment Construction - Phase 4", Work Order #101346, Project STIA-0104-T-01, approved 1/25/01. The accompanying two-volume Project Manual, including Specifications, is dated January 29, 2001.

in Appendix I of the Port's Wetland Functional Assessment and Impact Analysis. At issue is the degree to which the shallow regional groundwater table will be intercepted and the feasibility of providing returning some flow from the Pond to the wetland. Site soil boring logs and a much better understanding of the source of water supply to Wetland 41a and the upper end of Wetland 39 are needed for this issue to be resolved.

49. NHC 24; Port 54. Response noted.

50. NHC 25; Port 55. The response states that "The relative floodplain storage is matched at each depth of flooding depth. . ." but does not provide any hydraulic calculations to support the assertion that sufficient compensatory floodplain storage is being provided. The response has clarified that the compensatory storage area is intended to function like a lake subject to backwater from Miller Creek at the south end of the storage area. Our original comment had assumed that floodwater was supposed to enter the compensatory storage area by overflows along the full length of relocated channel. With our new understanding of how this system is supposed to work, there are questions of whether the ditch which connects Miller Creek to the compensatory storage area has sufficient hydraulic capacity in the initial design, and what long-term maintenance of this ditch will be required.

51. NHC 26; Port 56. The response fails to address our comment that there are no calculations or other design information to demonstrate that the goals and design criteria for the Miller Creek relocation project will be accomplished with the design now proposed. Absent a high local groundwater table throughout the full reach of relocated channel, it remains our opinion that the relocated channel, as designed, will at least intermittently fail to achieve the target minimum flow depth of 0.25 feet during low-flow (0.5 cfs) periods. The Natural Resource Mitigation Plan (page 5-14) indicates that the relocated channel will be located in an area with peat soils, but we are unable to locate information in that or other documents to show whether the local water table is sufficiently high to keep these peat soils saturated throughout the summer months.

52. NHC 26; Port 56. There is an apparent mis-communication over the characteristics of the stream substrate spawning gravels to be used for the relocated reach. The Port response states, "The gravel specifications include fine sands and silts to specifically avoid the problems that were asserted by the reviewer." However, that response seems inconsistent with the stream substrate description presented under the heading of "Stream Substrate" in the Natural Resource Mitigation Plan (NRMP) and which formed the basis for our assumption that the stream substrate material will be highly permeable. NRMP page 5-19 states that "Substrate in the relocated channel will consist of gravel, course sands, and cobble material" and also that "The flow velocity criteria for the channel were set to maintain suitable substrate for fish by minimizing the accumulation of fine-grained material." Our concern as expressed previously is that the relocated channel is likely to go dry during low flow periods if it is constructed, as proposed, over a two-foot thick bed of highly-permeable spawning gravels.

In summary, there continue to be numerous unresolved deficiencies in the analyses and preliminary designs which present a risk of significant adverse impacts to the natural stream and wetland systems if the December 2000 version of the Comprehensive Stormwater Management Plan and Natural

Resource Mitigation Plan are approved as a basis for mitigation of project impacts. We request on behalf of the Airport Communities Coalition that, prior to regulatory certification or approval of the proposed 3rd runway project, these deficiencies be resolved.

Sincerely,

NORTHWEST HYDRAULIC CONSULTANTS, INC.

William Rozeboom

William A. Rozeboom, P.E.
Senior Engineer

cc: Peter Eglick, Helsell Fetterman LLP, FAX (206) 340-0902
Kimberly Lockard, Airport Communities Coalition, FAX (206) 870-6540

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INTRODUCTION

OVERVIEW

King County's surface water features -- the rivers, lakes, wetlands, streams, and Puget Sound -- are a significant part of our natural beauty and rich heritage. Spawning salmon, meandering rivers, and clean water are important natural resources which must be managed wisely to protect their values.

This Surface Water Design Manual contains the requirements and standards for designing surface and storm water management systems in King County. As part of the permit approval process for certain types of permits for proposed projects, King County requires the construction of surface water and storm water management systems to mitigate the impacts on natural and existing man-made drainage systems.

This manual regulates proposed projects by a mixture of requirements, performance, and design standards. Requirements are quite specific. Performance and design standards are less specific, directing the design engineer to accomplish a defined goal in a consistent manner considering site constraints, objectives of a project, and technical limitations.

These requirements and standards are enforced by the King County Department of Development and Environmental Services (DDES). DDES is responsible for the drainage review and approval of the engineering plans and for the administration of the Sensitive Areas Ordinance and Rules and all other King County codes governing development.

The Water and Land Resources (WLR) Division of the King County Department of Natural Resources is responsible for developing the requirements and standards, which includes publishing, updating and providing the technical support for this manual. The WLR Division also reviews requests for experimental design adjustments and blanket adjustments as described in Chapter 1, Section 1.4.

The chapters of this manual are organized as follows:

Chapter 1 - DRAINAGE REVIEW AND REQUIREMENTS

Describes the basic drainage requirements that implement King County adopted surface water runoff policies and explains how these requirements are applied to proposed projects through the drainage review process.

Chapter 2 - DRAINAGE PLAN SUBMITTAL

Describes the requirements and specifications for submittal of design plans for drainage review, including report and plan formats, and scopes.

Chapter 3 - HYDROLOGIC ANALYSIS AND DESIGN

Presents the acceptable methods of hydrologic analysis used to estimate runoff and design flow control, conveyance and water quality facilities.

Chapter 4 - CONVEYANCE SYSTEM ANALYSIS AND DESIGN

Presents the acceptable methods, details and criteria for analysis and design of conveyance systems.

Chapter 5 - FLOW CONTROL DESIGN

Presents the acceptable methods, details and criteria for analysis and design of flow control facilities.

Chapter 6 - WATER QUALITY DESIGN

Presents the acceptable methods, details and criteria for analysis and design of water quality facilities.

DEFINITIONS - A formal list of the words, terms and abbreviations accompanied by their meaning as applied in this manual.

APPENDICES:

APPENDIX A - MAINTENANCE REQUIREMENTS FOR PRIVATELY MAINTAINED DRAINAGE FACILITIES

Contains the frequency, thresholds and standards for maintenance of all privately maintained storm drainage facilities.

APPENDIX B - MASTER DRAINAGE PLAN OBJECTIVES, CRITERIA AND COMPONENTS AND REVIEW PROCESS

Describes in a general outline, the objectives, criteria, components and review process for Master Drainage Plans prepared for Urban Planned Developments and very large projects.

APPENDIX C - SMALL SITE DRAINAGE REQUIREMENTS (Separate Detached Publication)

Describes in a separate booklet available from the WLR Division or DDES, the simplified drainage requirements for smaller projects that qualify for small site drainage review.

APPENDIX D - EROSION & SEDIMENT CONTROL STANDARDS (Separate Detached Publication)

Describes in a separate booklet available from the WLR Division or DDES, the required measures to be implemented during construction to prevent discharges of sediment laden runoff from the project site. It also describes effective management practices which may be needed to supplement the required erosion and sedimentation control measures.

REFERENCE - Includes materials which are strictly **for reference only** and have not been adopted by the public rule adopting this manual. The applicant is responsible to insure that the most current materials are used in preparing a permit application.

INDEX

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December 18, 2001

Post-it® Fax Note 7671	Date 12/19/01	# of pages ▶ 8
To Andrea Grad	From Bill Rozeboom	
Co./Dept. Helsell Fetterman	Co. NHC	
Phone #	Phone #	
Fax # 206-340-0902	Fax #	

Colonel Ralph H. Graves
Ms. Muffy Walker
Ms. Gail Terzi
U.S. Army Corps of Engineers
Seattle District
P. O. Box 3755
Seattle, WA 98124-3755

Dear Colonel Graves, Ms. Walker and Ms. Terzi:

Re: Corps Ref. No. 1996-4-02325; Port of Seattle Document Inconsistencies

As you know, Northwest Hydraulic Consultants has been retained on behalf of the Airport Communities Coalition (ACC) to provide a technical review of stormwater facilities and streamflow impacts from development activities at SeaTac airport. The purpose of this letter is to identify inconsistencies in the Port's proposals for site development and stormwater management. It supplements our prior letters and declarations in this matter, the latest of which is our November 26, 2001, letter to you.

Since our last letter, numerous additional documents relating to the airport development activities have been obtained by ACC public disclosure requests. This letter focuses on the two documents identified below.

- Port of Seattle – Commission Agenda Item No. 8a for Meeting on November 13, 2001. Memorandum dated October 16, 2001 regarding Resolution No. 3469, agreements between the Port of Seattle and the City of SeaTac for use and redevelopment of borrow areas 3 and 4 on Port property within the City. A copy of that memorandum is enclosed for reference.

- "Natural Resource Mitigation Plan, Seattle-Tacoma International Airport, Master Plan Update Improvements," November 2001, prepared by Parametrix, Inc. for Port of Seattle.

Please note that this letter does not reflect a detailed review of the project Natural Resource Mitigation Plan (NRMP). In particular, the November 2001 version of the NRMP does not adequately address or resolve our previously-expressed concerns over the water-holding capability of the relocated Miller Creek channel, or the uncertain performance of relocated drainage channels. This letter is instead limited to two comments which highlight inconsistencies between newly-disclosed information and core assumptions in the Port's Stormwater Management Plan (SMP) for SeaTac Airport Master Plan Update Improvements.

Comment 1. Currently-proposed future land use development at the borrow pit areas is inconsistent with the Port's justification for ignoring such future conditions in the SMP.

- Information from the Port of Seattle Commission Agenda memorandum dated October 16, 2001, which was Item No. 8a for a meeting on November 13, 2001, supports the position that the SMP Master Plan Update hydrologic modeling of the borrow pit areas should consider the future developed condition of these areas.

- The Port's prior justification for NOT doing this was, from the Port's April 30, 2001 response to 401/404 comments by NHC:

  > "The potential hydrologic impacts of the borrow areas were not evaluated in the Comprehensive Stormwater Management Plan because the Port believes that modifications are considered temporary and reversible, as opposed to the construction of permanent new impervious areas and airport facilities."

- Now, the Commission Agenda memorandum provides conflicting information:

  > The October 16, 2001 memo anticipates commercial development of the borrow areas sites within five years. Borrow Areas 3 and 4 are zoned as Aviation Commercial and/or Aviation Operations. Memo background information includes "Although there are no current plans for redevelopment, the areas will be graded to leave flat or gently sloping pads that can be redeveloped to future uses." Other statements give actions from date of agreement which we infer is probably November or December 2001. The agreement proposed by the Port specifies that "The Port will prepare and initiate within 6 months of the agreement a marketing plan to promote future redevelopment of the borrow areas after excavation." The agreement also "Provides a Port commitment to in good faith pursue having the redevelopment of the borrow areas completed within 5 years after the date the agreement is signed. . ."

- The November 2001 NRMP (Figure 1.3-1 and elsewhere) shows that Borrow Areas 1, 3, and 4 are Master Plan Update Improvement Projects. If the agreement described in the Port's October 2001 memorandum is (was) executed and the Port in good faith pursues and accomplishes site redevelopment as described, then Borrow Areas 3 and 4 will be fully redeveloped as aviation commercial and operation properties as of year 2006. That is the same year adopted in the SMP to represent future conditions for the other Master Plan Update projects.

- The Port's October 2001 memorandum pertains to agreements with the City of SeaTac and does not address Borrow Area 1, which is located in the City of Des Moines. We have been informed verbally by City of Des Moines staff that Borrow Area 1 is zoned for Business Park development.

- The on-site borrow areas (1, 3, and 4), which are proposed to be mined as a source of about 6.7 million cubic yards of fill material, are shown by NRMP Figures 1.3-1 and 4.1-2 to have a combined excavation and future development footprint of about 155 acres. Borrow Areas 3 and 4 alone have an excavation and development footprint of about 60 acres. NRMP Figure 2.1-1 shows that the combined footprint of the borrow areas is comparable in size to the footprint of the third runway embankment, for which detailed hydrologic impact assessments have been performed.

- In light of the above discrepancies, the current SMP and Low Flow Impact analyses are unable to assess and mitigate the full impacts of airport Master Plan Update Improvement projects at year 2006 build-out because they ignore the proposed year 2006 developed condition of the borrow site areas.

Comment 2. The current NRMP reverts to an old stormwater management development proposal which is not examined in the current SMP.

- One of the problems with the November 1999 version of the project SMP is that it relied largely on flow control benefits to result from Regional Detention Facilities (RDFs) to be constructed by others. The problem with this approach is that the SMP was unable to provide any certainty whether or when the proposed RDF facilities would be constructed. Furthermore, the SMP failed to provide any analyses or designs for contingency scenarios in which regional facilities failed to materialize. Subsequent versions of the SMP proposed and fine-tuned refined a single proposal which does not require construction of regional facilities by others. The most recent SMP (December 2000, amended July 2001) furthermore does not provide any contingency analyses or designs to describe the airport stormwater facilities which would be required under a scenario in which RDF projects are constructed by others.

- Currently-proposed Master Plan Update Projects are summarized by NRMP Table 1.3-1, Pages 1-6 through 1-10. Stormwater facilities are listed on Page 1-8 and appear consistent with the facilities for which analyses and designs are presented in the SMP. However, the NRMP summary of stormwater facilities includes a footnote which states that the Port is now anticipating construction of a RDF by others, and does not anticipate constructing the stormwater facilities identified in the SMP. The footnote from NRMP Page 1-10 reads, with emphasis added:

December 18, 2001

> "Des Moines Creek Basin Plan Committee **will construct an RDF** on the Tyee Golf Course to provide regional flow control. This **project will eliminate the need for STIA retrofit facilities described** above. As this is a cumulative action subject to future federal action, it is not a Master Plan Update improvement."

- There are two significant problems with this approach to stormwater management. First, there is no certainty that the proposed RDF will be constructed or on what schedule. Second, RDF construction does not eliminate the need for on-site stormwater control facilities, and the SMP does not provide any analyses or designs for airport stormwater facilities which would be required under an RDF scenario.

In summary, the Port's recent documents disclose that the future land use development and stormwater management facilities anticipated by the Port are inconsistent with the land use development and stormwater management facilities described in the project SMP. The current SMP and Low Flow Impact analyses are unable to assess and mitigate the full impacts of airport Master Plan Update Improvement projects at year 2006 build-out because they ignore the proposed year 2006 developed condition of the borrow site areas, and because they fail to address the other significant technical issues and uncertainties we have identified previously. Finally, the Port appears to be proposing development of an RDF-based system of stormwater controls for which no analyses or designs are presented in the project SMP.

On behalf of the ACC, we thank you for your consideration of these concerns.

Sincerely,

northwest hydraulic consultants

William Rozeboom

William A. Rozeboom, P.E.
Senior Engineer

Enclosure

cc: Peter Eglick, Helsell Fetterman LLP
Kimberly Lockard, Airport Communities Coalition

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PORT OF SEATTLE
MEMORANDUM

COMMISSION AGENDA

Item No. 8a

Date of Meeting November 13, 2001

DATE: October 16, 2001

SECOND READING FINAL PASSAGE

TO: M. R. Dinsmore, Chief Executive Officer

FROM: Michael Ehl, Director, Aeronautical Line of Business
Michael Cheyne, Director, Aviation Planning
Diane Summerhays, Manager, Airport Community Programs
Troy Brown, Senior Aviation Planner

SUBJECT: Resolution No. 3469, First Reading, Authorizing the Director, Aviation Division to: 1) Execute an Agreement between the Port of Seattle and the City of SeaTac regarding the excavation of material from borrow areas on Port property within the City and eventual redevelopment of the areas; and 2) Execute an amendment to the September 4, 1997 Interlocal Agreement between the Port of Seattle and City of SeaTac regarding allowed uses within the Aviation Commercial and Aviation Operations zones.

BACKGROUND

The Port of Seattle must transport about 14 million cubic yards of fill material to the construction site for the third runway in order to expand the airfield plateau and construct the new runway. To help expedite this effort, reduce air quality impacts, minimize construction traffic impacts on the neighboring communities, and avoid additional costs, the Port intends to obtain approximately 2.3 million cubic yards of embankment fill from sources on Port-owned property south of the Airport (e.g., "borrow areas"). The Port is proposing to include borrow areas 3 and 4 in the Phase 5 (2002) and Phase 6 (2003) runway embankment contracts.

Since February 2001, the City of SeaTac and the Port have regularly discussed land use, construction activities, maintenance, and other responsibilities associated with the excavation of borrow areas 3 and 4 and the eventual redevelopment of the areas. These discussions built upon the provisions of the 1997 Port and City Interlocal Agreement ("1997 ILA"), which contemplated the use and redevelopment of the borrow areas. The proposed Agreement is the culmination of these discussions. A map of the borrow areas is included as Attachment A to the proposed Agreement.

After excavation, the City and Port are both interested in having the areas redeveloped to airport supportive uses that foster community economic development and are attractive and high quality. Although there are no current plans for redevelopment, the areas will be graded to leave flat or gently sloping pads that can be redeveloped to future uses. Redevelopment will be subject to further planning and review in accordance with the parameters set forth in the proposed Agreement.

PREVIOUS COMMISSION ACTION

August 1, 1996: Port Commission adopted Resolution No. 3212 approving the Master Plan Update for Seattle-Tacoma International Airport.

May 27, 1997: Port Commission reaffirmed by Resolution No. 3245 its earlier approval of the Master Plan Update. Resolution No. 3245 authorized Port staff to begin property acquisition needed for construction of the third runway.

August 26, 1997: Port Commission adopted Resolution No. 3251 authorizing the Port Executive Director to enter into an Interlocal Agreement with the City of SeaTac.

November 14, 2000: Port Commission adopted Resolution No. 3445 authorizing the Port Executive Director to enter into an Interlocal Agreement with the City of SeaTac to transfer building and grading permit responsibilities from the City to the Port.

PROPOSED AGREEMENT

The proposed agreement addresses how the borrow areas will be excavated and provides parameters to guide their eventual redevelopment. It is designed to address community concerns during the operation of the borrow areas and to facilitate redevelopment that is beneficial to both the Port and the City. Key provisions of the proposed Agreement are as follows:

1. Best Management Practices (BMPs): Specifies the measures that the Port will follow in excavating the areas in order to reduce traffic, noise, dust, and other impacts on the community.

2. Neighborhood Open Houses: The Port will hold informational open houses before excavating each borrow area.

3. Permits and Approvals: The Port will obtain any necessary building or grading permits through the Port's permit office. The Port, or the Port's designee, will obtain any haul permits from the City of SeaTac.

4. Haul Routes: The haul route shall include at-grade crossings of S. 200th Street, 18th Ave. South, and a grade separated crossing of S. 188th Street. A segment of S.188th Street between Starling Drive and the 188th Street Bridge may be used as a haul route. Other routes will be subject to a City of SeaTac haul permit.

5. SR 509 Crossing: The City and Port agree to jointly request that the Washington State Department of Transportation include a 2-lane crossing of the extended SR 509 for direct, secured access from the redeveloped area to the airfield.

6. Landscaping: Minimum 50-foot landscape / existing vegetation areas will buffer residences from the excavation and eventual redevelopment uses.

7. Public Access: The Port will provide public access from the redeveloped borrow areas to adjacent recreational uses, subject to certain conditions.

8. Potential Residential Acquisition: The Port will consider offering voluntary acquisition to a number of residences adjacent to the borrow areas.

9. Marketing: The Port will prepare and initiate within 6 months of the agreement a marketing plan to promote future redevelopment of the borrow areas after excavation.

10. Allowed Uses for Redevelopment: Specifies a subset of uses from the 1997 ILA that the Port can redevelop on the borrow areas after excavation.

11. Timing for Redevelopment: Provides a Port commitment to in good faith pursue having the redevelopment of the borrow areas completed within 5 years after the date the agreement is signed, subject to SR 509 construction, market conditions, and environmental review.

AMENDMENT TO 1997 ILA

On September 4, 1997, the Port and the City of SeaTac entered into an Interlocal Agreement ("1997 ILA") regarding their respective jurisdiction. Sections of the agreement stipulate that:

- The Port shall appropriately mitigate borrow areas and reclaim and consider economic development of the areas
- Borrow area 3 is zoned as Aviation Commercial (AVC)
- Borrow area 4 is zoned as AVC to the west and Aviation Operations (AVO) to the east of the Washington State Department of Transportation right-of-way, which bisects the site
- Permitted land uses for properties zoned as AVC and AVO are listed in Attachment A-2 of the ILA

In order to clarify the intent of the 1997 ILA regarding use of the borrow areas and to implement the proposed Agreement, the City and Port have determined that an amendment is needed to the 1997 ILA. The proposed amendment is to specify that borrow areas are an allowed use within the Aviation Operations (AVO) and Aviation Commercial Zones (AVC).

BUSINESS PLAN MISSION

The third runway supports the Aeronautical Line of Business mission to provide a safe, secure, technologically advanced, and efficient air transportation system to facilitate the movement of aircraft and passengers to accommodate increasing demands.

FINANCIAL IMPLICATIONS

The borrow site excavation is included within the overall third runway project budget of $773,362,000. One of the assumptions in developing the budget for the third runway was that a portion of the fill material would be obtained from borrow Areas 3 and 4. Should utilization of the borrow areas not occur, the impact to the CIP budget would be approximately $20 million.

Capital costs for future redevelopment of the areas will be subject to further site planning, business planning, and environmental review.

COMMUNITY/CUSTOMER/ORGANIZATION IMPACTS

Utilization of borrow Areas 3 and 4 will provide benefit to the surrounding communities by reducing the amount of truck traffic on City of SeaTac streets and regional roads, reducing air emissions, and expediting completion of the third runway project. The ILA specifies the best management practices that the Port will follow in excavating the areas in order to reduce traffic, noise, dust, and other impacts on the community.

Redevelopment of the areas after excavation will benefit the community by fostering economic development and providing uses that are attractive and high quality.

PROJECT SCHEDULE

- Advertise for Phase 5 Embankment — November 2001
- Start Phase 5 Construction — March/April 2002
- Complete Phase 5 Embankment — March 2003
- Start Phase 6 Construction — March/April 2003
- Complete Phase 6 Embankment — March 2004
- Complete Final Embankment Project — Fall 2006

REQUESTED ACTION

Resolution No. 3469, First Reading, Authorizing the Director, Aviation Division to: 1) Execute an Agreement between the Port of Seattle and the City of SeaTac regarding the excavation of material from borrow areas on Port property within the City and eventual redevelopment of the areas; and 2) Execute an amendment to the September 4, 1997 Interlocal Agreement between the Port of Seattle and City of SeaTac regarding allowed uses within the Aviation Commercial and Aviation Operations zones.

V:/av planning/borrow sites commission memo.doc

IN THE MATTER OF GRANTING A WATER QUALITY CERTIFICATION TO: the Port of Seattle, in accordance with 33 U.S.C. 1341 FWPCA § 401, RCW 90.48.260 and WAC 173-201A.	**ORDER #1996-4-02325 (Amended -1)** Construction of a Third Runway and related projects. Components of the project include construction of a 8,500-foot-long third parallel runway with associated taxiway and navigational aids, establishment of standard runway safety areas for existing runways, relocating S. 154th Street north of the extended runway safety areas and the new third runway, development of the South Aviation Support Area and the use of on-site borrow sources for the third runway embankment.

TO: Port of Seattle
Seattle-Tacoma International Airport
Attn: Elizabeth Leavitt
17900 International Blvd., Suite 402
SeaTac, WA 98188-4236

The Port of Seattle (Port) requested a water quality certification from the state of Washington for the above-referenced project pursuant to the provisions of 33 U.S.C. 1341 (FWPCA§ 401). The request for certification was made available for public review and comment through the U.S. Army Corps of Engineer's Second Revised Public Notice No. 1996-4-02325 dated December 27, 2000, as amended by the Corps' Amendment and Erratum to the Second Revised Public Notice dated January 17, 2001. Ecology issued a 401 certification for this project on August 10, 2001. Ecology has decided to amend that certification. Accordingly, Ecology hereby rescinds Order Number 1996-4-02325 and replaces it in its entirety with Order Number 1996-4-02325 (Amended-1).

The Third Runway site and related Master Plan Update projects and on-site mitigation are located in Sections 4, 5, and 9, Township 22N, Range 4E and Sections 20, 21, 28, 29, 32, 33, Township 23 N, Range 4E in King County. Offsite mitigation will be located in Section 31, Township 22N, Range 5E in King County. The project areas, on-site mitigation and the proposed offsite mitigation are located within Water Resource Inventory Area 9. The projects covered by this Order are described in detail in the December 27, 2000 Public Notice issued by the U.S. Army Corps of Engineers, the October 25, 2000 Joint Aquatic Resource Permit Application (JARPA) and in the plans approved by Ecology as a part of this Order.

For purposes of this Order, the term "Port" shall mean Port of Seattle and its agents or contractors.

Work authorized by this Order is limited to the work described in the October 25, 2000, JARPA, as amended, unless modified by this Order or by conditions contained in other permits sought for the Master Plan Update Improvement projects.

AUTHORITIES:

the monitoring wells on Port property. Depth of excavation and maximum seasonal ground water elevations shall be submitted annually to Ecology's Federal Permit Manager, SeaTac Third Runway.

I. **Conditions for Mitigation of Low Flow Impacts:**

1. Ecology has reviewed and approved the December 2000 Low Streamflow Analysis and the Summer Low Flow Impact Offset Facility Proposal dated July 23, 2001. In order to ensure clarity, within 45 days of receipt of this Order the Port shall submit a revised plan integrating the Low Streamflow Analysis and Summer Low Flow Impact Offset Facility Proposal into a single document that addresses the following issues:

    a) General:

        i) The revised plan shall be stamped by a licensed professional civil engineer.
        ii) All supporting documents shall be clearly labeled and included in a technical appendix and/or on one clearly labeled CDROM. Only those files which directly correspond to results presented in the report should be included.
        iii) The plan shall include a specific section discussing the accuracy of the calibration in predicting low flows at upper stream gauges, and a statement of adequacy of the calibrations for the purpose of low flow simulation.
        iv) Revised conceptual drawings for reserve storage vaults shall be submitted that include any changes required by this Order and that include details on how constant discharge will be maintained in reservoirs with variable hydraulic head pressures. Reserve vault inlets and outlets shall be configured so that water is added/discharged from the middle of the reserve storage depth in order to avoid disturbing sediments and/or floatables that could be present in the reserve vault. In order to ensure that reserve water is well aerated, reserve storage vaults shall include open ventilation consistent with King County Surface Water Design Manual wetvaults. Mechanical aeration shall be provided if grating is not feasible. Conceptual drawings shall include detail on reserve water outfalls. Where feasible, outfalls shall discharge directly to wetlands that are adjacent (in hydrologic continuity) to streams rather than directly to streams.
        v) A final Operations and Maintenance Plan shall be included in the revised plan. The Operations and Maintenance plan section of the report shall require the release of any water remaining in the reserve vaults during the month of November or until substantial rains occur. The Operations and Maintenance Plan shall address management of accumulated sediments in reserve storage vaults. All accumulated sediments shall be disposed of in

an appropriate upland disposal site.

vi) The revised plan shall include a monitoring protocol to determine whether placement of the Third Runway embankment fill and other fill used for Master Plan Update Improvements meets fill specifications for type of material, meets specifications for compaction rates, and meets assumption for infiltration rates.

vii) The revised plan shall include contingency measures to offset reduced recharge in the event the Third Runway embankment fill and other fill used for Master Plan Update Improvements does not meet performance standards for infiltration rates.

viii) The revised plan shall include information demonstrating that low flow mitigation (vault releases) can be conveyed to streams without being lost to soil.

ix) The Port shall develop a pilot program to test one reserve stormwater vault for performance. The Port shall include a proposal for a pilot in the revised plan. The pilot shall be completed within three years after receipt of the Section 404 permit from the U.S. Army Corps of Engineers.

x) The revised plan shall identify and analyze all direct or indirect impacts to wetlands as a result of low flow impacts and the proposed low flow mitigation. The revised plan shall contain contingencies to mitigate for impacts to wetlands if wetland impacts are identified as a result of monitoring.

b) Des Moines Creek-

i) The revised plan shall provide data comparing the existing simulation of low flows against the Tyee Golf Course weir gauge data. The Port shall provide representative hydrographs, associated discussion and statement of adequacy of the calibration for simulating low flows.

ii) SDS3 vault design (sheet C141) indicates that not all inlet pipes are tributary to the reserve storage vault. The revised plan shall factor into the vault filling calculations the effects of having a reduced tributary area.

iii) SDS4 vault design (sheet 139) shall be reconfigured to show the vault inlet pipe at a lower elevation. A note similar to the one found on exhibit C131 should be included here. The Port shall evaluate the feasibility of providing reserve storage only in the SDS3 vault.

c) Walker Creek-

i) In place of the Port's proposal to line 3.5 acres of filter strip within the SDW2 subbasin, the Port's revised plan shall provide that low flow mitigation water for Walker Creek will be obtained from the collection of winter runoff from the 69 acres of impervious surface being added in the

Walker Creek non-contiguous groundwater basin. Reserve stormwater collected from this area may be stored in either the proposed 15-acre foot vault in Walker Creek or in the SDS3 vault. If, within thirty (30) days of receiving this order, the Port submits to Ecology information demonstrating that another feasible and implementable alternative exists, Ecology will review the alternative and consider amending this Order to allow implementation of the alternative.

ii) The current proposal for Walker Creek assumes no contribution from the Third Runway embankment fill. If the revised plan includes a reinstatement of the Third Runway embankment model, the area of the fill embankment tributary to Walker Creek shall be verified and modeled accordingly.

d) Miller Creek-

i) The revised plan shall verify whether the 1991 impact number is 0.11cfs or 0.12cfs. Unless shown otherwise, Ecology shall presume that 0.12cfs is the correct number.
ii) The revised plan shall include the correct "Low Flow Miller 91-94.xls" file and back-up data that produce a future 1991 7-day low flow of 0.67cfs shall be included on CDROM.
iii) The revised plan shall include documentation that clarifies whether the existing (1994) condition 1991 low flow is 0.784cfs as was used in electronic files or 0.79cfs as was presented in the July 23, 2001 memorandum.
iv) The revised plan shall correct the impervious acreage figures provided for the new North Employees Parking Lot (NEPL) vault to reflect 26.29 acres of impervious (Miller 2006 HSPF model), rather than 32.31 acres.
v) The Port shall evaluate orifice sizing and determine whether a change in orifice size and/or a reduction in the number of reserve stormwater vaults is warranted. The revised plan shall evaluate vault locations for feasibility and special design considerations (e.g., upstream spill control, oil controls, downstream compost filters, etc.) to ensure that reserve stormwater from the NEPL and cargo vaults will receive adequate treatment to ensure water quality.
vi) The revised plan shall include BMPs developed to ensure infiltration into the Third Runway embankment rather than into the Third Runway embankment conveyance system.
vii) The revised plan shall include revised Grading and Drainage sheets 129 and 130. The revised sheets shall clarify the flow in the collection swales.
viii) Revised conceptual drawings, and supporting analysis, shall be submitted with the revised plan that address water quality concerns for the NEPL and Cargo reserve storage areas.

e) Monitoring and Reporting Requirements: The revised plan shall develop a comprehensive monitoring protocol that, at a minimum, addresses the following elements:

i) Collection of stream gage data and an evaluation/correlation to expected flow rates established by the model.
ii) Water quality sampling and reporting. Water quality shall be tested at vault outflow and instream at a point 100 feet downstream of the outflow.
iii) Metering of water from vaults.
iv) Infiltration rate sampling and monitoring to evaluate performance of the fill.
v) Contingency if water quality in vaults does not meet water quality criteria (e.g., additional treatment, other source, flocculation, coalescing oil water separator, etc.).
vi) Instream biologic monitoring shall occur in Des Moines, Miller and Walker Creeks to assess the impacts of the Port's low flow offset proposal. The Port shall develop an instream monitoring protocol that shall at a minimum include the following elements:

- Existing low-flow conditions of Des Moines, Miller and Walker Creek will be evaluated by conducting Benthic Index of Biotic Integrity (BIBI) monitoring (Karr and Chu 1999). Monitoring shall occur four times per year and shall continue through year five (5) after construction and then yearly until completion of the fifteen (15)-year monitoring period. In addition to the BIBI monitoring required above, the Port shall develop a that monitors at a minimum temperature, turbidity, channel morphology, substrate quality, type and amount of large woody debris and other habitat features, riparian habitat cover and fish use. Representative stream channel cross-sections shall be utilized. Information must be synthesized to determine how these elements may be impacting overall stream health.

- Mitigation during the proposed period appears to effect low flow frequencies during June and July. Monitoring shall specifically address potential adverse impacts to fish or aquatic biota during June and July. If monitoring shows an adverse effect during this time period the Port shall implement contingencies to address the impact (such as providing additional mitigation water during June and July).

J. **Operational Stormwater Requirements:**

1. Approved Stormwater Plan: The Comprehensive Stormwater Management Plan (CSMP), Volumes 1 through 4, December 2000 as revised by the July 2001 Replacement pages is the approved stormwater management plan for this project. It shall be implemented in its entirety. No changes to the CSMP

J

U.S. Department of Transportation

Federal Aviation Administration

Port of Seattle

FINAL ENVIRONMENTAL IMPACT STATEMENT

for

PROPOSED MASTER PLAN UPDATE DEVELOPMENT ACTIONS

at

SEATTLE-TACOMA INTERNATIONAL AIRPORT

VOLUME 3 OF 7

APPENDICIES G - P

This statement is submitted for review pursuant to the requirements of Section 102(2)(C) of the National Environmental Policy Act of 1969 (42 U.S.C. 4321 et seq); E.O. 11990, Protection of Wetlands; E.O. 11998, Floodplain Management; the 49 USC Subtitle VII; 42 U.S.C. 7401 et seq; 49 U.S.C. 47101 et seq; Washington State Environmental Policy Act (RCW 43.21C); and other applicable laws. The proposed action will impact the 100-year floodplain as indicated on the Federal Emergency Management Agency's Flood Insurance Rate Map. This Environmental Impact Statement (EIS) is a combined National Environmental Policy Act and Washington State Environmental Policy Act (SEPA) document. With regard to SEPA requirements, this EIS represents the second step of a phased environmental review which began with publication of the 1992 Flight Plan Final EIS, which assessed alternatives for addressing regional aviation needs. This Final EIS also contains the draft conformity statement, as required by the Clean Air Act amendments.

The Port of Seattle, operator of Seattle-Tacoma International Airport, has prepared a Master Plan Update for the Airport. The Plan shows the need to address the poor weather operating capability of the Airport through the development of a third parallel runway (Runway 16X/34X) with a length of up to 8,500 feet, separated by 2,500 feet from existing Runway 16L/34R, with associated taxiways and navigational aids. Other development needs include: extension of Runway 34R by 600 feet; establishment of standard Runway Safety Areas for Runways 16R/34L and 16L/34R; development of a new air traffic control tower; development of a new north unit terminal, Main Terminal improvements and terminal expansion; parking and access improvements and expansion; development of the South Aviation Support Area for cargo and/or maintenance facilities, and relocation, redevelopment, and expansion of support facilities. This Environmental Impact Statement assesses the impact of alternative airport improvements, including installation of navigational aids, airspace use, and approach and departure procedures. The proposed improvements would be completed during the 1996-2020 period, with initial 5-year development focused on the proposed new parallel runway, and existing passenger terminal, parking and access improvements. The proposed improvements and its alternatives would result in wetland impacts, floodplain encroachment, stream relocation, social, noise, water, and air quality impacts.

Responsible Federal Official:
Mr. Dennis Ossenkop
Federal Aviation Administration
Northwest Mountain Region
1601 Lind Ave, S.W.
Renton, Washington 98055-4056

SEPA contact:
Ms. Barbara Hinkle
Health, Safety and Environmental Management
Port of Seattle
P.O. Box 68727
Seattle, Washington 98168

Date: February, 1996

APPENDIX G

HYDROLOGIC MODELING STUDY
For SeaTac Airport
Master Plan Update EIS

April 7, 1995
Revised November 16, 1995

MONTGOMERY WATER GROUP, INC.
Water Resources•Environmental•Civil Engineering

620 KIRKLAND WAY, SUITE 202, P.O. BOX 2517, KIRKLAND, WA 98083-2517
(206) 827-3243 (206) 827-3509 FAX

lower Miller Creek during these design storms are 172 cfs, 277 cfs, and 433 cfs, respectively, compared to the flood frequency estimates of 173 cfs, 293 cfs, and 468 cfs, respectively (for the

TABLE 3-1
SUMMARY OF LAND USE CHANGES IN SEATAC SUBBASINS
ASSUMED FOR PROPOSAL

	Des Moines Creek (acres)	Miller Creek (acres)	Total
CURRENT LAND USE			
- SDS impervious area[a]	369	60	429
- IWS[a]	204	50	254
- Fill and other[a]	410	83	493
- Non-airport[b]	204	326	530
Total	**1,187**	**519**	**1,706**
PROPOSED CHANGES			
- New SDS impervious area	95.4	97.4	192.8
- New IWS	65.7	0	65.7
- New fill	282.5	262.3	544.8
PROPOSED LAND USE			
- SDS impervious area	464.4	157.4	621.8
- IWS	269.7	50	319.7
- Fill and other	452.9	311.6	764.5
Total	**1,187**	**519**	**1,706**

[a] Includes Subbasins 19 and 24 (SDW-3), 20 and 25 (SDS-3), 21 and 26 (SDS-1), and 23 and 28 (SDE-4) in Des Moines Creek, and Subbasins 23 and 27 (SDN-1), 24 and 28 (SDN-2), and 25 and 29 (SDN-3 and SDN-4) in Miller Creek.

[b] Areas in other subbasins affected by airport expansion.

2-year, 10-year, and 100-year return intervals). Since the January 1990 runoff event was less than the estimated 100-year flow, the hourly precipitation amounts in this storm were proportionately increased by a factor of 1.10, which raises the total runoff volume from that event to an amount equal to the average of the January and November 1990 runoff events (the two largest events on record).

AR 014727

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RECEIVED
DEC 1 9 2000
DEPT OF ECOLOGY

COMPREHENSIVE STORMWATER MANAGEMENT PLAN

FOR AGENCY REVIEW

SEATTLE-TACOMA INTERNATIONAL AIRPORT MASTER PLAN UPDATE IMPROVEMENTS

Prepared for

PORT OF SEATTLE
Seattle-Tacoma International Airport
P.O. Box 69727
Seattle, Washington 98168-0727

Prepared by

PARAMETRIX, INC.
5808 Lake Washington Blvd. N.E., Suite 200
Kirkland, Washington 98033-7350

December 2000
556-2912-001 (28)

Table 4-1. Summary of Miller, Walker, and Des Moines Creek drainage areas at STIA and change in impervious area between 1994 baseline and 2006 future conditions (acres).[a]

	1994 Baseline			2006 Future Condition			Increase in Impervious Area
	Pervious	Impervious[b]	Total	Pervious	Impervious[b]	Total	
Miller Creek							
SDN1	6.2	9.9	16.1	3.5	12.7	16.1	2.8
SDN1LWR	5.0	0.4	5.4	4.9	0.6	5.4	0.2
SDN1OFF	25.8	10.5	36.3	28.3	8.0	36.3	-2.5
SDN2Xn	4.3	0.0	4.3	3.9	0.3	4.3	0.3
SDN3	33.4	14.5	47.9	23.6	24.3	47.9	9.8
SDN3A	28.6	1.9	30.5	22.2	8.2	30.5	6.3
SDN3X	25.4	0.0	25.4	25.4	0.0	25.4	0.0
SDN4	27.7	2.6	30.3	18.1	12.3	30.3	9.7
SDN4X	14.1	1.1	15.2	11.0	4.2	15.2	3.1
SDW1A	52.0	0.9	52.8	37.4	15.4	52.8	14.5
SDW1B	92.5	4.3	96.9	69.9	27.0	96.9	22.7
NEPL	41.4	0.9	42.3	10.0	32.3	42.3	31.4
CARGO	7.0	1.1	8.1	0.0	8.1	8.1	7.0
Other STIA[c]	246.5	15.1	261.8	247.8	13.8	261.8	-1.3
Total							**103.7**
Walker Creek							
SDW2	41.3	3.3	44.6	35.1	9.5	44.6	6.2
M8	22.2	6.6	28.8	22.2	6.6	28.8	0.0
M9	76.1	22.5	98.6	76.1	22.5	98.6	0.0
Total							**6.2**
Des Moines Creek							
SDE4	50.7	115.5	166.2	40.1	126.1	166.2	10.6
SDS1	0.9	16.8	17.7	1.4	16.3	17.7	-0.5
SDS2	7.7	1.5	9.2	8.1	1.0	9.2	-0.5
SDS3	165.5	178.0	343.5	144.3	199.2	343.5	21.2
SDS3A	62.7	7.1	69.8	34.6	35.1	69.8	28.0
SDS4	45.4	19.2	64.6	32.1	32.5	64.6	13.3
SDS5	32.1	0.4	32.5	28.3	4.2	32.5	3.8
SDS6	12.5	4.3	16.7	13.5	3.2	16.7	-1.1
SDS7	83.2	8.0	91.3	55.1	36.2	91.3	28.2
SASA	25.3	8.9	34.3	0.0	34.3	34.3	25.4
Other STIA[d]	136.1	57.7	194.4	136.0	57.5	193.5	-0.2
Total							**128.2**
IWS							
NCPS	6.9	28.8	35.7	4.8	30.9	35.7	2.1
NSMPS	6.6	0.0	6.6	4.7	2.0	6.6	2.0
NSPS	0.3	13.5	13.8	0.3	13.4	13.8	-0.1
Primary	24.9	277.6	302.6	13.5	289.1	302.6	11.5
SASA	51.8	6.5	58.3	0.1	58.3	58.4	51.8
Total							**67.3**
TOTAL	**1462.1**	**839.4**	**2302.6**	**1156.3**	**1145.1**	**2301.7**	**305.7**

Note: Rows may not total exactly as shown due to rounding. Source: GIS coverage.

[a] The purpose of this table is to provide supporting data for comparing pervious areas; this data was not used for modeling purposes.

[b] Impervious area includes impervious area, lakes, and detention ponds.

[c] Includes subbasins M6, MC1, MC2, MC3, MC4, MC5, MC6, MC7.

[d] Includes subbasins D5, D6, D11, D13.

L

Permit No. WA-002465-1
Issuance Date: February 20, 1998
Effective Date: March 1, 1998
Expiration Date: June 30, 2002
Modification Date: May 29, 2001

NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM WASTE DISCHARGE PERMIT No. WA-002465-1

State of Washington
DEPARTMENT OF ECOLOGY
Northwest Regional Office
3190 – 160th Avenue SE
Bellevue, WA 98008-5452

In compliance with the provisions of
The State of Washington Water Pollution Control Law
Chapter 90.48 Revised Code of Washington
and
The Federal Water Pollution Control Act
(The Clean Water Act)
Title 33 United States Code, Section 1251 et seq.

PORT OF SEATTLE
SEATTLE-TACOMA INTERNATIONAL AIRPORT
P.O. Box 68727
Seattle, Washington 98168

Facility Location	Industry Type
Sea-Tac International Airport Seattle, Washington King County	Airport
Water Body I.D. No.	**Receiving Water**
(i) WA-PS-0270	(i) Puget Sound (Industrial Wastewater)
(ii) WA-09-2000	(ii) Des Moines Creek, (Stormwater)
(iii) WA-09-2005	(iii) Miller Creek (Stormwater)
(iv) WA-09-1020	(iv) City of SeaTac Storm Sewer, tributary to Gilliam Creek and the Green River (Stormwater)
	(v) Midway Sewer District Sanitary Sewer (Miscellaneous Blowdown)
(vi) 1223370474523	(vi) Walker Creek and tributaries (Construction Stormwater)
(vii) 1222552474518	(vii) Gilliam Creek and tributaries (Construction Stormwater)

is authorized to discharge in accordance with the special and general conditions which follow.

Kevin C. Fitzpatrick
Kevin C. Fitzpatrick
Water Quality Section Manager
Northwest Regional Office
Washington State Department of Ecology

S1. DISCHARGE LIMITATIONS (CONTINUED)

E. Stormwater Drainage System

Discharge of industrial wastewater to the Storm Drain System is prohibited. Stormwater associated with industrial activity and construction activity may be discharged to the storm drainage system in accordance with the terms and conditions of this permit. Overflows of untreated industrial wastewater from the IWS collection systems or lagoons due to stormwater flows in excess of the design criteria are authorized bypasses that are not subject to this condition.

F. Ground Water Discharges

The Permittee shall apply the following known, available, and reasonable methods to prevent the unintentional release of industrial wastewater to groundwater:

1) The Permittee shall clean and line Lagoon No. 3 as part of the Compliance Schedule set forth in Special Condition S4; and

2) On or before June 30, 1999, the Permittee shall submit a scope of work to Ecology to investigate the integrity of the IWS collection system by assessing the structural integrity of a representative portion of the IWS piping system. The assessment shall provide an overview of the entire IWS Collection System including the IWTP interconnecting piping, and shall explain how the "representative portion" of the system was selected. The assessment shall be completed prior to December 31, 2001.

   If the assessment detects significant leaks, the Permittee shall assess the remaining portions of the represented system in the shortest practicable time and, in consultation with the Department, shall assess whether any of the leaks show a reasonable potential to violate ground water quality standards. If a reasonable potential to violate ground water standards is shown, the Permittee shall, in consultation with the Department and within six (6) months of such a showing, develop a schedule to repair, if feasible, the leaking portion of the collection system. If it is not feasible to repair the leaking portion, the Permittee shall propose an alternative. The Permittee may, at its discretion, forego the reasonable potential analysis and elect to develop, within six (6) months of detection of the leaks, a schedule to repair the pipeline. Cleanups of residual contamination due to releases of industrial wastewater or contaminants are regulated under the Model Toxics Control Act ("MTCA") and are not regulated under this permit. Ongoing discharges of industrial wastewater or contaminants are regulated under this permit.

Discharge of stormwater to ground water is permitted.

M

Due to a clerical error this number has been omitted.

NATURAL RESOURCE MITIGATION PLAN

SEATTLE-TACOMA INTERNATIONAL AIRPORT

MASTER PLAN UPDATE IMPROVEMENTS

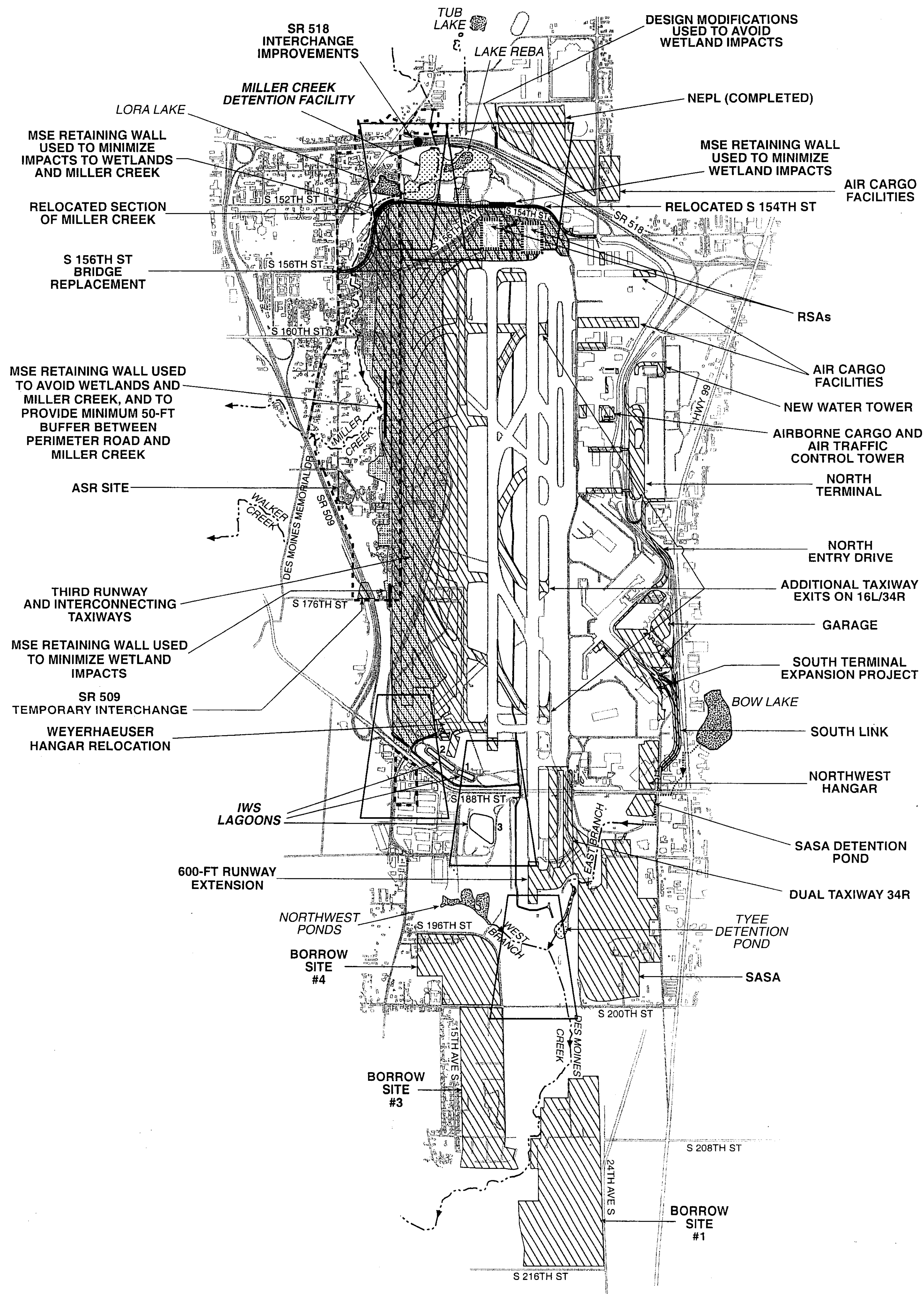
Prepared for

PORT OF SEATTLE
Seattle-Tacoma International Airport
P.O. Box 69727
Seattle, Washington 98168-0727

Prepared by

PARAMETRIX, INC.
5808 Lake Washington Blvd. N.E., Suite 200
Kirkland, Washington 98033-7350

November 2001
556-2912-001 (03)



Port of Seattle/Natural Resource Mitigation Plan/556-2912-001/01(03) 11/01 (K)

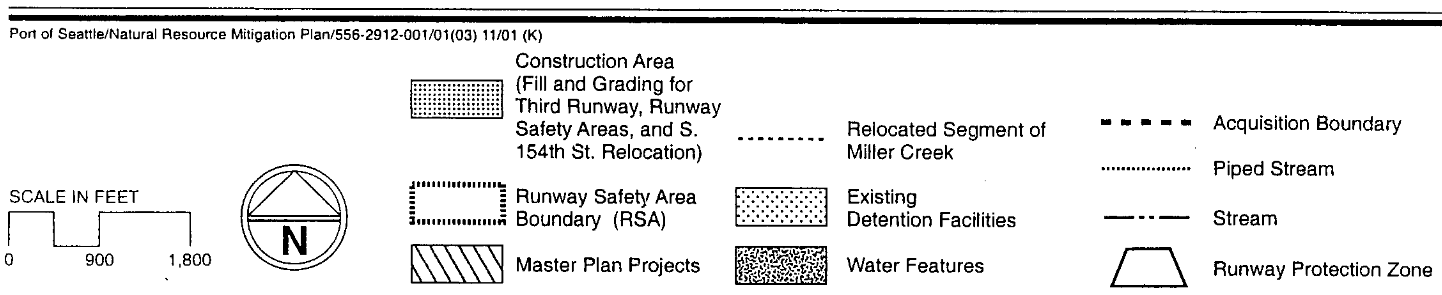


Figure 1.3-1
Master Plan Update Improvement Projects at STIA

AR 014737

N

PORT OF SEATTLE
MEMORANDUM

COMMISSION AGENDA

Item No. 8a

Date of Meeting November 13, 2001

SECOND READING
FINAL PASSAGE

DATE: October 16, 2001

TO: M. R. Dinsmore, Chief Executive Officer

FROM: Michael Ehl, Director, Aeronautical Line of Business
Michael Cheyne, Director, Aviation Planning
Diane Summerhays, Manager, Airport Community Programs
Troy Brown, Senior Aviation Planner

SUBJECT: Resolution No. 3469, First Reading, Authorizing the Director, Aviation Division to: 1) Execute an Agreement between the Port of Seattle and the City of SeaTac regarding the excavation of material from borrow areas on Port property within the City and eventual redevelopment of the areas; and 2) Execute an amendment to the September 4, 1997 Interlocal Agreement between the Port of Seattle and City of SeaTac regarding allowed uses within the Aviation Commercial and Aviation Operations zones.

BACKGROUND

The Port of Seattle must transport about 14 million cubic yards of fill material to the construction site for the third runway in order to expand the airfield plateau and construct the new runway. To help expedite this effort, reduce air quality impacts, minimize construction traffic impacts on the neighboring communities, and avoid additional costs, the Port intends to obtain approximately 2.3 million cubic yards of embankment fill from sources on Port-owned property south of the Airport (e.g., "borrow areas"). The Port is proposing to include borrow areas 3 and 4 in the Phase 5 (2002) and Phase 6 (2003) runway embankment contracts.

Since February 2001, the City of SeaTac and the Port have regularly discussed land use, construction activities, maintenance, and other responsibilities associated with the excavation of borrow areas 3 and 4 and the eventual redevelopment of the areas. These discussions built upon the provisions of the 1997 Port and City Interlocal Agreement ("1997 ILA"), which contemplated the use and redevelopment of the borrow areas. The proposed Agreement is the culmination of these discussions. A map of the borrow areas is included as Attachment A to the proposed Agreement.

After excavation, the City and Port are both interested in having the areas redeveloped to airport supportive uses that foster community economic development and are attractive and high quality. Although there are no current plans for redevelopment, the areas will be graded to leave flat or gently sloping pads that can be redeveloped to future uses. Redevelopment will be subject to further planning and review in accordance with the parameters set forth in the proposed Agreement.

7. Public Access: The Port will provide public access from the redeveloped borrow areas to adjacent recreational uses, subject to certain conditions.

8. Potential Residential Acquisition: The Port will consider offering voluntary acquisition to a number of residences adjacent to the borrow areas.

9. Marketing: The Port will prepare and initiate within 6 months of the agreement a marketing plan to promote future redevelopment of the borrow areas after excavation.

10. Allowed Uses for Redevelopment: Specifies a subset of uses from the 1997 ILA that the Port can redevelop on the borrow areas after excavation.

11. Timing for Redevelopment: Provides a Port commitment to in good faith pursue having the redevelopment of the borrow areas completed within 5 years after the date the agreement is signed, subject to SR 509 construction, market conditions, and environmental review.

AMENDMENT TO 1997 ILA

On September 4, 1997, the Port and the City of SeaTac entered into an Interlocal Agreement ("1997 ILA") regarding their respective jurisdiction. Sections of the agreement stipulate that:

- The Port shall appropriately mitigate borrow areas and reclaim and consider economic development of the areas
- Borrow area 3 is zoned as Aviation Commercial (AVC)
- Borrow area 4 is zoned as AVC to the west and Aviation Operations (AVO) to the east of the Washington State Department of Transportation right-of-way, which bisects the site
- Permitted land uses for properties zoned as AVC and AVO are listed in Attachment A-2 of the ILA

In order to clarify the intent of the 1997 ILA regarding use of the borrow areas and to implement the proposed Agreement, the City and Port have determined that an amendment is needed to the 1997 ILA. The proposed amendment is to specify that borrow areas are an allowed use within the Aviation Operations (AVO) and Aviation Commercial Zones (AVC).

BUSINESS PLAN MISSION

The third runway supports the Aeronautical Line of Business mission to provide a safe, secure, technologically advanced, and efficient air transportation system to facilitate the movement of aircraft and passengers to accommodate increasing demands.

FINANCIAL IMPLICATIONS

The borrow site excavation is included within the overall third runway project budget of $773,362,000. One of the assumptions in developing the budget for the third runway was that a portion of the fill material would be obtained from borrow Areas 3 and 4. Should utilization of the borrow areas not occur, the impact to the CIP budget would be approximately $20 million.

Capital costs for future redevelopment of the areas will be subject to further site planning, business planning, and environmental review.

COMMUNITY/CUSTOMER/ORGANIZATION IMPACTS

Utilization of borrow Areas 3 and 4 will provide benefit to the surrounding communities by reducing the amount of truck traffic on City of SeaTac streets and regional roads, reducing air emissions, and expediting completion of the third runway project. The ILA specifies the best management practices that the Port will follow in excavating the areas in order to reduce traffic, noise, dust, and other impacts on the community.

Redevelopment of the areas after excavation will benefit the community by fostering economic development and providing uses that are attractive and high quality.

PROJECT SCHEDULE

• Advertise for Phase 5 Embankment	November 2001
• Start Phase 5 Construction	March/April 2002
• Complete Phase 5 Embankment	March 2003
• Start Phase 6 Construction	March/April 2003
• Complete Phase 6 Embankment	March 2004
• Complete Final Embankment Project	Fall 2006

REQUESTED ACTION

Resolution No. 3469, First Reading, Authorizing the Director, Aviation Division to: 1) Execute an Agreement between the Port of Seattle and the City of SeaTac regarding the excavation of material from borrow areas on Port property within the City and eventual redevelopment of the areas; and 2) Execute an amendment to the September 4, 1997 Interlocal Agreement between the Port of Seattle and City of SeaTac regarding allowed uses within the Aviation Commercial and Aviation Operations zones.

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APPENDIX I

DETERMINATION OF LOW FLOW QUANTITY IMPACTS AND MITIGATION

MILLER CREEK

7-DAY LOW FLOW OCCURRENCES IN MILLER CREEK (1994)

BAR GRAPH LOW FLOW OCCURRENCES IN MILLER CREEK (1994)

7-DAY LOW FLOW OCCURRENCES IN MILLER CREEK (1991-1994)

CALCULATION OF 50% RETURN FREQUENCY FOR MILLER CREEK

COMPARISON OF 7-DAY LOW FLOW BY YEAR

7-DAY LOW FLOW OCCURRENCES IN MILLER CREEK (1994)

Start of 7-Day Low Flows with Average Flow Rates

	Date		1994 Miller Creek at SR509 Flow / cfs
1949	Sep	7	0.59
1950	Sep	17	0.88
1951	Sep	17	0.79
1952	Nov	23	0.53
1953	Sep	15	0.75
1954	Oct	3	0.87
1955	Sep	6	0.83
1956	Sep	3	0.87
1957	Sep	20	0.78
1958	Sep	29	0.63
1959	Aug	24	0.88
1960	Sep	29	0.84
1961	Sep	29	0.83
1962	Sep	3	0.73
1963	Sep	27	0.71
1964	Oct	25	0.88
1965	Sep	27	0.78
1966	Sep	3	0.78
1967	Sep	22	0.73
1968	Aug	7	0.97
1969	Sep	6	0.82
1970	Aug	27	0.72
1971	Aug	14	0.92
1972	Sep	11	1.01
1973	Sep	12	0.65
1974	Oct	13	0.72
1975	Aug	11	0.78
1976	Dec	10	0.69
1977	Aug	16	0.53
1978	Aug	17	0.80
1979	Oct	7	0.54
1980	Oct	17	0.66
1981	Sep	12	0.69
1982	Sep	17	0.81
1983	Oct	10	0.90
1984	Oct	1	0.78
1985	Sep	29	0.62
1986	Oct	18	0.59
1987	Oct	24	0.58
1988	Sep	11	0.60
1989	Oct	3	0.67
1990	Sep	25	0.71
1991	Oct	9	0.79
1992	Sep	16	0.65
1993	Nov	9	0.58
1994	Oct	6	0.50
1995	Sep	20	0.76

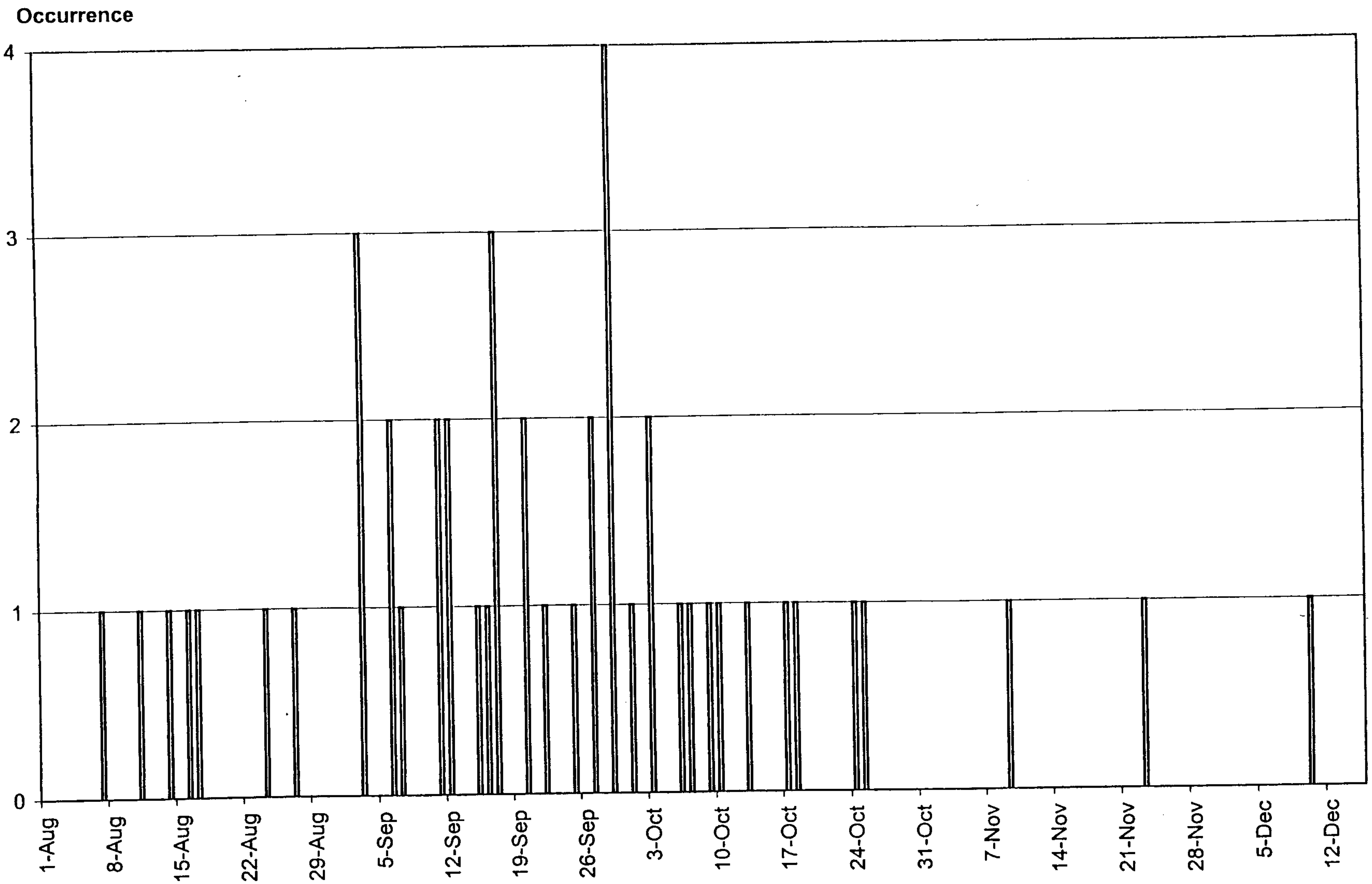
Statistical Ranking of Average 7-Day Low Flows
Period of Record: 1949 - 1995

Year	Average 7-Day Lows Ordered	Rank	Rank/(N+1)	Return Frequency
1994	0.50	1	0.02	2.08
1952	0.53	2	0.04	4.17
1977	0.53	3	0.06	6.25
1979	0.54	4	0.08	8.33
1987	0.58	5	0.10	10.42
1993	0.58	6	0.13	12.50
1949	0.59	7	0.15	14.58
1986	0.59	8	0.17	16.67
1988	0.60	9	0.19	18.75
1985	0.62	10	0.21	20.83
1958	0.63	11	0.23	22.92
1973	0.65	12	0.25	25.00
1992	0.65	13	0.27	27.08
1980	0.66	14	0.29	29.17
1989	0.67	15	0.31	31.25
1976	0.69	16	0.33	33.33
1981	0.69	16	0.33	33.33
1963	0.71	18	0.38	37.50
1990	0.71	18	0.38	37.50
1974	0.72	20	0.42	41.67
1970	0.72	21	0.44	43.75
1962	0.73	22	0.46	45.83
1967	0.73	23	0.48	47.92
1953	0.75	24	0.50	50.00
1995	0.76	25	0.52	52.08
1966	0.78	26	0.54	54.17
1957	0.78	27	0.56	56.25
1975	0.78	27	0.56	56.25
1965	0.78	29	0.60	60.42
1984	0.78	29	0.60	60.42
1951	0.79	31	0.65	64.58
1991	0.79	32	0.67	66.67
1978	0.80	33	0.69	68.75
1982	0.81	34	0.71	70.83
1969	0.82	35	0.73	72.92
1961	0.83	36	0.75	75.00
1955	0.83	37	0.77	77.08
1960	0.84	38	0.79	79.17
1956	0.87	39	0.81	81.25
1954	0.87	40	0.83	83.33
1950	0.88	41	0.85	85.42
1964	0.88	41	0.85	85.42
1959	0.88	43	0.90	89.58
1983	0.90	44	0.92	91.67
1971	0.92	45	0.94	93.75
1968	0.97	46	0.96	95.83
1972	1.01	47	0.98	97.92

Rank = Numerocal Position of ordered low flow data with driest year equal to one.
N = 47

BAR GRAPH LOW FLOW OCCURRENCES IN MILLER CREEK (1994)

Low Flow Occurrences in Miller Creek, 1949-1995 (1994 HSPF)



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7-DAY LOW FLOW OCCURRENCES IN MILLER CREEK (1991-1994)

Start of 7-Day Low Flows with
Average Flow Rates

	Date		1994 Miller Creek at SR509 Flow / cfs
1991	Oct	9	0.79
1992	Sep	16	0.65
1993	Nov	9	0.58
1994	Sep	24	0.54

Statistical Ranking of Average 7-Day Low Flows
Period of Record: 1949 - 1995

Date	Average 7-Day Lows Ordered	Rank	Rank/(N+1)	Return Frequency
1994	0.54	1	0.20	20.0
1993	0.58	2	0.40	40.0
1992	0.65	3	0.60	60.0
1991	0.79	4	0.80	80.0

Rank = Numerical Position of ordered low flow data
with driest year equal to one.
N = 4