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EXHIBIT NO. 229
2-5-02
M. Green

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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.

We are highly qualified to perform this review. Mr. Rozeboom has over 20 years of sp[illegible] 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 requirement described in the MDP guidelines "Master Drainage Planning for Large or Complex Sit Developments"; and 2) demonstrate that the proposed project complies with all the core a special requirements in Sections 1.2 and 1.3 of the KCSWDM. The present SMP

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.

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