ORIGINAL

BEFORE THE POLLUTION CONTROL HEARINGS BOARD
STATE OF WASHINGTON

AIRPORT COMMUNITIES COALITION, Appellant, CITIZENS AGAINST SEA-TAC EXPANSION, Intervenor/Appellant, v. STATE OF WASHINGTON, DEPARTMENT OF ECOLOGY; and PORT OF SEATTLE, Respondents.	PCHB No. 01-160 DIRECT TESTIMONY OF DAVE GARLAND SUBMITTED ON BEHALF OF THE DEPARTMENT OF ECOLOGY

AR 002903

ATTORNEY GENERAL OF WASHINGTON
Ecology Division
PO Box 40117
Olympia, WA 98504-0117
FAX (360) 586-6760

I. My Background

1. I am employed by the Department of Ecology in the Water Quality Program in the Northwest Regional Office. I am a hydrogeologist and supervisor of the Watershed Unit at Northwest Region Water Quality. The Watershed Unit is responsible for surface water cleanup planning (TMDLs), implementation of the Forests and Fish Agreement, and Water Quality Financial Assistance. I have been a hydrogeologist for 24 years and employed by Ecology since October, 1979. My duties as a hydrogeologist during my tenure with Ecology have included investigating and preparing findings for water right applications, defending controversial water right decisions before the Pollution Control Hearings Board, providing expert testimony at EFSEC hearings for proposed Northern Tier pipeline river crossings, investigating and reporting on groundwater quality impacts at dairies, gravel mines and at wastewater land application sites. I also served on a state personnel committee which established the state Hydrogeologist employee classification.

2. During my tenure with Ecology, I authored or co-authored the following reports and publications; Seawater Intrusion on South Camano Island, Washington, Water Rights near Lake Sawyer, King County Washington, High Rock Aquifer Break of 1993 (co-authored), Groundwater Quality Survey near Edaleen Dairy, Whatcom Co., WA(1994), Groundwater Contamination at Plowman Dairy near Yelm, Washington, Groundwater Impacts at Alger Rock Quarry, Bellingham Frozen Foods Response Summary, and San Juan Watershed Water Quality Needs Assessment.

3. During most of the year 2000, I was Ecology's lead in managing special legislature mandated SeaTac Runway Fill and Maury Island gravel mining studies. Managing the studies involved developing the Request for Proposals, selection of a consultant, periodic briefings on study results, news releases, fact sheets, stakeholder meetings with legislators & Port of Seattle, and public meetings to present the study results. The lead consultants selected to conduct the studies were Pacific Groundwater Group (PGG) of Seattle. Charles Ellingson

ATTORNEY GENERAL OF WASHINGTON
Ecology Division
PO Box 40117
Olympia, WA 98504-0117
FAX (360) 586-6760

was the Runway Fill Studies Project Manager for PGG. The studies culminated in reports which contained data, analyses, modeling results and findings of the consultants and recommendations for the proposed projects; a proposed Maury Island gravel mine and the SeaTac third runway fill embankment. The study results pertinent to the third runway are found in PGG's SeaTac Runway Fill Hydrogeologic Studies Report dated June 19, 2000 (PGG, 2000).

4. During my management of these studies for Ecology, I became familiar with the Hydrus and Slice models being used by PGG to characterize hydrologic impacts of the runway fill embankment. The models proved to be useful in depicting the delay and dampening effects of the fill on water infiltrating into the embankment. Since the Maury and SeaTac studies were completed, I have been involved to a lesser degree as a reviewer in Ecology's SeaTac Third Runway Project 401 Certification. Primarily, I have provided hydrogeological expertise and assistance to Ecology's Project Manager for the Runway Project; Ann Kenny. In 2001, the Port of Seattle hired PGG in order to utilize the PGG embankment model for the Port's 401 application process. In my capacity as reviewer for some of the 401 submittals, I reviewed wetland impacts from proposed excavation in Borrow Area 3 and subsequent versions of the PGG embankment model. Most recently, I reviewed PGG's updated modeling of the embankment for the December 2001 Low Stream Flow Analysis and Summer Low Flow Impact Offset Facility Proposal submitted by the Port of Seattle. The results of my reviews have been documented in memos to Ann Kenny and others dated March 9, 2001, May 5, 2001, August 7, 2001, and March 6, 2002.

5. My educational background is a Bachelor of Science degree in Geology from the University of Puget Sound and undergraduate studies at University of Washington, Michigan State University and Western Washington University. The work with Michigan State University involved glaciological geological studies on the Juneau Icefield, Alaska under a National Science Foundation Grant. Other training courses include aquifer analysis,

groundwater modeling, geochemistry, stream gaging and hydrologic instrumentation, and water quality field techniques. A copy of my resume is attached hereto as Attachment A.

II. PGG's Embankment Fill Hydrologic Study

6. In 1999, public concerns prompted the Washington State Legislature and Governor Locke to approve this study, which focused on aquifers, wetlands, and Des Moines, Miller, and Walker Creeks, which drain the area. The study was conducted under the Washington State Department of Ecology's oversight by a team of consultants: Pacific Groundwater Group (PGG); Earth Tech, Inc.; and Ecology and Environment, Inc., (E & E).

7. The scope of work for this project contained the following tasks: reviewing existing documents; interviewing Port staff, community organizations, individuals, and consultants; collecting additional field data; reviewing models used by Port consultants to assess hydrologic impacts; providing independent evaluation of certain hydrologic effects using new and existing data; reviewing Port mitigation proposals; informing stakeholders and the public on project progress; and reporting.

8. Existing data were compiled and analyzed to characterize land use, surface water flow, geologic conditions, groundwater flow, groundwater recharge, wetlands, and fish in the study area. These data were used to assess potential impacts associated with the proposed runway construction. Where existing data were insufficient or required independent confirmation, additional data were collected in the field, including borehole data, streamflow quantity and quality, wetland delineations and functions, and fish population and habitat information. This study also reviewed impact assessments previously completed by the Port.

9. The Ecology PGG study limited characterization of hydrogeology to the embankment and borrow areas. Existing data were used to characterize deep geology and groundwater conditions. Shallow conditions were observed by team personnel during drilling of boreholes and collection of groundwater measurements. PGG developed a "slice" model to quantify the behavior of the fill over a characteristic cross section. The study found that local

ATTORNEY GENERAL OF WASHINGTON
Ecology Division
PO Box 40117
Olympia, WA 98504-0117
FAX (360) 586-6760

shallow aquifers are recharged by precipitation and, in the buy-out area west of the embankment, they were also recharged by water that discharged from septic drain fields. The quantities of precipitation recharge, infiltration of onsite effluent and other factors affecting recharge were estimated in the PGG report.

10. One of the significant findings of the 2000 PGG study pertained to the predicted impact of the embankment on the local hydroperiod. A hydroperiod is the seasonal change in the timing of groundwater discharge to wetlands and streams. For the PGG project, effects to the hydroperiod were evaluated using a cross section of the proposed embankment fill near Miller Creek. The timing changes would generally benefit the local wetlands that remain after filling and would slightly moderate seasonal low base flows and temperatures in Miller Creek. Also, since the embankment is a small part of the Miller Creek watershed, the overall effect on streamflow is small. If the modeled fill is siltier than it is under actual built conditions, the lag may be overestimated and the recharge volume may be underestimated.

III. December 2001 Low Flow Analysis

11. The report by Pacific Groundwater Group (PGG) of November 27, 2001 titled, *"Port of Seattle Sea-Tac Third Runway Embankment Fill Modeling in Support of Low-Streamflow Analysis"*, which occurs as Appendix B in Low Streamflow Analysis and Summer Low Flow Impact Offset Facility Proposal (Port of Seattle, December 2001) presents significant drainage estimate improvements for the proposed runway fill embankment over drainage estimates presented in *"Sea-Tac Airport Master Plan Update Low Streamflow Analysis"* (Earth Tech, 2000). There were several concerns with the drainage estimates presented in the prior report and these concerns were expressed in my memo to Ann Kenny and Kevin Fitzpatrick dated March 9, 2001.

12. The most significant concern with the earlier Low Streamflow Analysis (Earth Tech, 2000) was the use of an unrepresentative 'slice' or cross section, which was then integrated over the length of the runway. Since the 'slice' used for integration was taken at the

thickest portion of the fill, this method of characterizing embankment drainage had high potential for overstating the delayed drainage most relevant to low flows. The improvement contained in the current report is a 'fill-depth sensitive' integration of the proposed embankment fill hydrology, which sums the drainage contribution from the embankment over the entire length of the runway. PGG accomplished this integration by using Hydrus and Slice models operating on three hydrogeologic cross sections, which were representative of the range of proposed embankment geometries.

13. Consultants for the Port of Seattle modeled the hydrology of watersheds in the regional study area around the SeaTac Airport Master Plan Improvements using the HSPF streamflow model. The PGG scope in this modeling effort was limited to the area to be underlain by the proposed fill. Their task was to model recharge, infiltration and redistribution of water within the fill embankment. The PGG study focused on a modeled fill area (MFA) that was excised from the larger regional study area modeled using HSPF. The MFA did not include the steeper perimeter slopes along the western and northern edges of the embankment. The HSPF model was used over the MFA to calculate runoff from impervious surfaces and infiltration into pervious areas, and was also used to account for evapotranspiration on the MFA. Total infiltration calculated by HSPF at the MFA surface was then used as input to the subsurface Hydrus and Slice models. The HSPF modeling team used PGG's study results to evaluate low-stream-flow impacts in Miller and Walker Creek basins.

14. PGG used the specifications for Phase 1 fill (installed in 1998 and 1999) to characterize the texture of fill soils in their embankment model. Two types of fill were used; General Fill made up of predominantly sand and silt and a coarser 'Type 1' fill used as drain layers behind the retaining walls and beneath runways and taxiways. Of the two types of fill, the sand-plus-silt matrix or 'General Fill' was deemed to be controlling in terms of the dampening and delaying effects of the fill on drainage. The hydraulic conductivity value used in Hydrus for the General Fill was calculated as 1.35 X 10 -4 cm/sec. This conductivity value

ATTORNEY GENERAL OF WASHINGTON
Ecology Division
PO Box 40117
Olympia, WA 98504-0117
FAX (360) 586-6760

is reasonable based on being near the mid-range of published values of conductivities for silty sand. The approach used by PGG to characterize fill soils is reasonable given the existing design of the embankment fill and the fact that final geometries and stratigraphic subtleties of the fill are not known prior to construction.

15. To accurately characterize the overall embankment hydrology, the thickness and extent of the fill needed to be determined along its length. Fill thickness was determined by subtracting pre-fill topography from "built" topography. The topographic fill thickness was then approximated for the purposes of the model into block increments of 10, 20, 30, 50, 70, 90, 110, 130, and 150 feet thick. This improved, spatially variable characterization of fill thickness is much more representative of the amounts and thicknesses of fill in each stream basin than the 'prism' fill block used in the previous calculation.

IV. Comments on Dr. Lucia's Testimony

16. Dr. Lucia commented for the ACC on two aspects of runway construction; the embankment fill screening criteria, and the low streamflow analysis. Several of Dr. Lucia's assertions, however, are based on erroneous assumptions or mis-characterizations of the PGG modeling.

17. One of Dr. Lucia's assertions is that existing analyses for the 3rd runway do not consider the ability of the embankment to store water prior to discharging water into the underlying gravel drain. Lucia asserts there will be a period of up to six years where actual drainage will be less than predicted because of the time it will take between the end of construction and the initial arrival of drainage out of the embankment. It is not anticipated, however, that construction of the embankment will be instantaneous nor that the fill will be absolutely dry at the time of emplacement. The third runway fill will likely be placed over a five to six year period and will receive infiltrating rainfall during the period of construction. In addition to rainfall, imported water may be applied to the embankment fill elevations for dust control and compaction purposes.

ATTORNEY GENERAL OF WASHINGTON
Ecology Division
PO Box 40117
Olympia, WA 98504-0117
FAX (360) 586-6760

18. Dr. Lucia criticizes PGG and the Port for relying in their model on a single set of soil parameters to represent the drainage characteristics of the embankment. He asserts that by relying on a single fill type in their model, PGG does not derive modeling results that are representative of the "potential range of behavior". The goal of the embankment hydrology modeling, however, is not to represent a "range of behavior" so much as to characterize the preponderance of quantity and timing of flow from the embankment. In my opinion, PGG has done this by using the sand-plus-silt matrix (or characteristics of the 'General Fill') as having the controlling conductivity in their model. The saturated hydraulic conductivity of the silty sand was calculated as $1.35X10^{-4}$ cm/sec which is deemed reasonable because it is mid-range among the published conductivity values for silty sand. The hydraulic conductivity of the General Fill is an important parameter because it is considered to be a controlling factor in terms of the dampening and delaying effects of the fill on drainage.

19. Dr. Lucia's assertion that there will be a time lag of several years before the embankment toe begins draining is disproved by the drainage currently emanating from the existing SeaTac Third Runway 1998 fill. The 1998 fill was draining in 1999, one year following beginning of construction and continues to drain on an annual basis. Drainage from the 1998 fill also refutes Dr. Lucia's model and model results as depicted in his accompanying illustratives in Figure 6.

V. Conclusions

20. In summary, although I have not reviewed the computations of the Hydrus-Slice model in detail, it is my opinion based on my familiarity with the model's development, my experience as a hydrogeologist, and my previous reviews, that the assumptions used in the model are reasonable. Further, PGG's December 2001 version of the Hydrus-Slice embankment fill model contains significant improvements over the December 2000 Low Streamflow Analysis offered by the Port. With the above mentioned improvements to the embankment hydrology model, I have reasonable assurance that drainage from the proposed

fill embankment is adequately characterized for modeling purposes to protect low streamflows in Miller and Walker Creeks.

I declare under penalty of perjury under the laws of the state of Washington that the foregoing is true and correct.

DATED this 7th day of March, 2002.

DAVE GARLAND

ATTORNEY GENERAL OF WASHINGTON
Ecology Division
PO Box 40117
Olympia, WA 98504-0117
FAX (360) 586-6760

Dave Garland
Department of Ecology
425-649-7031 or dgar461@ecy.wa.gov

Statement of Qualifications and Experience
for NWRO Water Quality Watershed Unit Supervisor

U.S. Geological Survey Water Resources Division — *1976 – 79*
Hydrologic Assistant - Hydrologist

In 4 years working in the Washington District office of USGS in Tacoma, I obtained the following experience:

- Constructing and calibrating stream gaging stations and stream gaging equipment, taking stream discharge measurements, maintaining stream discharge rating curves, and developing stream discharge statistics.
- Collecting groundwater and surface water quality samples, and working up field laboratory preparation and analyses for dissolved oxygen, total organic carbon, total and fecal coliform, temperature and pH.
- Report writing, computer modeling, statistics
- Publications; Coal Mine Drainage in Washington: Data Supplement.

Washington State Dept. of Ecology — *1980 – 86*
Water Resources Hydrogeologist

Wrote water right findings and reports of investigations for controversial water allocation situations over 6 years with Northwest Regional Office Water Resources including:

- Interacting with public in water use controversies
- Wrote findings and made water right permit decisions.
- Dealt with numerous appeals at Pollution Control Hearings Board.
- Provided expert testimony at EFSEC hearings for proposed Northern Tier pipeline river crossings
- Publications; Seawater Intrusion on South Camano Island, Washington, Water Rights near Lake Sawyer, King County Washington.

Washington State Dept. of Ecology — *1987 – 2000*
Water Quality Hydrogeologist

During 13 years as Northwest Region Water Quality hydrogeologist, conducted numerous short-term and long-term investigations and studies including;

- Groundwater impacts at dairies
- Groundwater impacts of gravel mining
- Groundwater impacts and monitoring conditions for wastewater land application state waste discharge permits
- Personnel; served on committee to establish state Hydrogeologist classification
- Project Management – SeaTac and Maury Island gravel mining studies: technical water quantity and quality studies in context of intense public opposition and political pressure. Projects included Fact Sheets, stakeholder meetings with legislators & Port of Seattle, and public meetings with strong agendas and hostility.

Attachment A

Washington State Dept. of Ecology
Water Quality Hydrogeologist *(continued)*

- EAP: worked directly with EAP to propose, design and help conduct water quality studies and helped interpret and report results.
- Publications and reports; High Rock Aquifer Break of 1993, Groundwater Quality Survey near Edaleen Dairy, Whatcom Co., WA(1994), Groundwater Contamination at Plowman Dairy near Yelm, Washington, Groundwater Impacts at Alger Rock Quary, Bellingham Frozen Foods Response Summary, and San Juan Watershed Water Quality Needs Assessment document (also involved in Nooksack, Kitsap, Skagit/Stillaguamish, and Snohomish/Island scoping efforts).

Washington State Dept. of Ecology — *2000 – 2001*
Acting Water Quality Unit Supervisor

Since assuming duties of Nonpoint Unit Supervisor for NWRO Water Quality, I have;

- Supervised 11 – 12 technical staff
- Completed one round of Employee Development and Performance Plans(EDPP) for 11 staff.
- Instituted staff presentations at monthly staff meetings
- Instituted regular 'Team Meetings' for TMDL Team and Dairy Regulation Team.
- Developed CQs, put out job announcement bulletins, conducted interviews, and hired 2 staff.
- Obtained training in EDPP, Hiring Process, Resolving Interpersonal Conflict, Corrective Action, Decision Making, and Completed Staff Work. Training in 'Basics of Supervision' is scheduled for this fall.
- TMDLs – attended training and conferences for over 2 years, exposure to process, worked directly with HQ TMDL team to group 303(d) listings into potential TMDL water quality studies and plan public processes relating to TMDLs.

References available on request.

Dave Garland
Department of Ecology
425-649-7031, dgar461@ecy.wa.gov or
10212 184th Ave. NE
Redmond, WA 98052
425-885-5666, digarland@msn.com

AR 002913