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August 6, 2001

U.S. Army Corps of Engineers
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ATTN: Muffy Walker
Gail Terzi

Washington State Department of Ecology
Shorelands and Environmental Assistance Program
3180-169Th Avenue Southeast
Bellevue, Washington 98008-5452
ATTN: Ann Kenny

Subj: The Port of Seattle's (Port) Low Flow Analysis/Flow Impact Offset Facility Proposal, prepared by Parametrix, Inc., July 2001.

Dear Ms. Walker, Ms. Terzi, and Ms. Kenny:

At the request of the Airport Communities Coalition (ACC), I have evaluated the Port's plan to use detained stormwater to augment summer low flows in Miller, Walker, and Des Moines Creeks. I offered some initial comments on the use of detained stormwater for this purpose in my *Rebuttal to the Port's Response to 401/404 Comments*, dated June 20, 2001, based on a general response (GLR7, page II-7) to comments to the Port's Sect 404 Permit Application. I earlier (September 2000) commented on the Port's plans to use either Seattle Public Utilities water or well water for this purpose. In undertaking this effort, I have relied on my education, specialized training, and professional skills acquired over a 26-year career (post Ph.D.) as an environmental scientist (see attached *Curriculum Vitae*).

Conclusions

In my opinion, for the following reasons, the Port has not provided sufficient information to enable the Washington Department of Ecology (Ecology) or the Army Corps of Engineers to conclude with reasonable assurance that detained stormwater, proposed for

use in offsetting impacts of low summer flows in project creeks, will not harm the valued aquatic resources of the Miller Creek and Des Moines Creek Watersheds.

- Violations of toxic substances (water quality) criteria in Miller Creek, Walker Creek, and Des Moines Creek, particularly for copper and zinc, occur as a result of stormwater discharged at Seattle-Tacoma International Airport (STIA); and will continue, and potentially worsen as a result of the Port's proposed flow impact offset facility. There is the distinct possibility that sediments in detention vaults will turn anoxic, bringing about a change in the ionic state of metals (more metals will be in the dissolved state), resulting in greater bioavailabilty and toxicity downstream of the detention vaults, once the detained stormwater is released. Before any approval is issued which would in effect involve experimentation with the creeks, the Port should be required to model and undertake bench-scale tests to determine the transport, fate, and potential toxic effects of metals residues discharged from detention vaults to project streams.

- The presence of fecal coliforms of human origin from airplane wastewater in Des Moines Creek raises the possibility that other human pathogens (bacteria, viruses, and protozoa) enter Des Moines Creek and will collect and persist in sediments of the proposed detention vaults, posing potential human health risks when they are discharged to the project streams to augment summer low flows.

- No procedures are in place to manage accumulated sediments in the proposed stormwater detention facilities. The key questions is, how the Port will safely remove and dispose of sediments enriched in metals, other chemicals, and possibly human pathogens (bacteria, viruses, and protozoa) without their release to the creeks. This is a significant issue.

- The Port's proposed monitoring plan is incomplete. It lacks detail and some elements, e.g., the frequency of sampling, the Benthic Index of Biotic Integrity, may be insensitive to detecting early signs of degradation from chemical residuals found in detained stormwater discharged to the project creeks. All too often the plan indicates that "final design specifications will be submitted to Ecology for their approval prior to the plans implementation," which denies rigorous scientific peer review. The Port also proposes to only report problems with detention facilities in their annual report and not when they are encountered, and only to Ecology and not other responsible resource agencies, e.g. Washington Department of Fish and Wildlife (WDFW). Perhaps more importantly, reasonable assurance that the water quality in the project creeks will not be impaired, should not be based on just monitoring, let alone imperfect monitoring, as it seems in this case. Rather, it should also include a facility design that is grounded on accepted scientific principles, a learned assessment of the potential problems associated with its operation, bench-scale experimentation, and external peer review.

The detailed evaluations on which the above conclusions are based are found in the following sections:

The Plan Diminishes the Toxic Effects of Metals in Stormwater Discharged from Seattle-Tacoma International Airport.

The Port's representation of the status of metals in stormwater discharges from STIA is totally incorrect. The Port would have us believe that metals are a non-problem in the project creeks and that water quality will only improve if the Master Plan Update Improvements are implemented. Despite the Port's caveats that metals concentrations are reported as "total recoverable metals" and not dissolved metals as in applicable Water Quality Criteria, or that reported metals concentrations are "less than typical urban runoff," the truth remains that concentrations of metals (copper and zinc) in stormwater discharged to Miller and Des Moines Creeks have repeatedly exceeded Washington Water Quality Criteria (Port 1997, 1998, 1999). I have often commented that use of these caveats are not good science and could be construed as an effort to bias the results of the Port's compliance monitoring (see my letter to Tom Luster, Permit Coordinator, Department of Ecology, dated December 13, 1999). I should also add that data presented by the Port in their most recent Annual Stormwater Monitoring Report (2000) confirm that exceedances of toxic metals criteria continue to occur at the Port's stormwater outfalls to the creeks.

The Port is also incorrect in its inference that it is in compliance with Washington Water Quality Criteria because it is required by their National Pollution Discharge Elimination Permit to conduct and report the results of Whole Effluent Testing (WET) of its stormwater discharges. The point is that the Port's treatment of "metals" on page 21 of their *Low Flow Analysis Report/Flow Impact Offset Facility Proposal* would have us believe that WET has not detected any toxicity in their stormwater, yet appreciable toxicity did occur recently in the discharge from SDN1 (Parametrix 2000). Percent survival of daphnia ranged between 10 and 80 percent over three test dates, the most recent 1/24/99. Mean survival over these three tests was only 40 percent. Percent survival of fathead minnow ranged between 40 and 78 percent, with a mean of 60 percent. This level of toxicity is not trivial and begs the question what is (are) the offending chemical (s) in the stormwater discharged in SDN1? For detailed comment on this topic, please see my letter to Jonathan Freedman and Ann Kenny on February 16, 2001, and in my letter to Muffy Walker, Gail Terzi, and Ann Kenny on June 20, 2001.

More importantly and in the context of the new materials presented in the Port's *Low Flow Analysis Report/Flow Impact Offset Facility Proposal*, the Port does not address the fate (including bioavailability) of metals detained in vaults over the period of intended storage. There is a need to follow potential changes in the ionic state of metals in detained stormwater as a function of time in storage and dissolved oxygen concentration.

If sediments collected at the bottoms of detention vaults turn anoxic (become oxygen depleted), there is a real potential for reducing conditions as opposed to oxidation conditions to prevail, with the result that metals bound to particulate matter will partition to the water column and persist in a more ionic, bioavailable state (Cooke et al. 1993). This could render residual metals more toxic, increasing the risk to valued aquatic resources in the project streams. The Port indicates that the detention vaults will not

become anoxic but says elsewhere that it may be necessary to aerate, which suggests that the Port really doesn't know what will happen in the detention vaults. This tells me that the Port cannot at this time provide reasonable assurance that stored stormwater, if used to offset summer low flows, will be compatible in quality with the streams into which it is discharged. What should be required, as a minimum before any approval is considered, is additional modeling and bench-scale testing subject to peer review to determine if long-term (three month) detention brings about a change in the ionic state of metals, greater bioavailability, and possibly higher toxicity.

The Proposed Plan does not Address the Fate and Possible Human Health Effects of Enteric Bacteria, Viruses, and Protozoa that Occur and Persist in Stormwater Detention Vaults.

The Port proposes monitoring a number of important water quality parameters or constituents in stormwater detention vaults including temperature, turbidity, dissolved oxygen, and metals, but fails to address enteric bacteria, viruses, or protozoa that also could occur there. Fecal coliforms in the Port's stormwater have long exceeded Washington Class AA Water Quality Criteria (Port 1997, 1998, 1999, 2000). More recently, we learned from the Port's *Microbial Source Tracing Study* (Port 2001) that coliforms collected in Des Moines Creek in May 2000 included those of human origin, some of which originated in airplane wastewater at STIA.

Because human coliforms have been found in Des Moines Creek, it is not unreasonable to assume that other enteric human pathogens, e.g., bacteria, viruses, and protozoa (*Cryptosporidium, Giardia*), also enter the project streams. The issue to be resolved, then, is whether or not these agents will occur and persist in the proposed detention vaults at concentrations high enough to pose a risk to human health, once the stored stormwaters are released (flushed out of the detention vaults) to the project creeks. Our concern is the potential risk that pathogens pose to humans who will manage the detention vaults or will continue to use the project creeks for recreation, e.g., wading, fishing, or clam digging at the mouth of the creeks.

The key question is how long enteric bacteria, viruses, and protozoa [*Cryptosporidium, Giardia*] remain viable (alive) and infective after being shed by their human host. The available scientific literature (there are many studies over the last 30 years) indicates that human enteric bacteria, viruses, and protozoa can persist and are infective for considerable lengths of time in both fresh and marine waters. For example, enteric viruses can last for 130 days in marine waters but can survive even longer in freshwater (Vasconcelos 2001). They also die off sooner if not associated with particulate matter; that is, they are left in the water column unbound (Vasconcelos 2001). Human enteric viruses also can remain infective if bioaccumulated by other living organisms, e.g., fish and shellfish (Weingold et al. 1994). Colder water temperatures seem to prolong their viability. Bacteria may not last as long as viruses in either the water column or in sediments. Some protozoa form resting stages (cysts) that can remain viable and infective even longer than viruses. Based on the scientific literature, then, if human enteric bacteria, viruses, and protozoa collect in the sediments on the bottoms of

detention vaults, they could persist and remain infective for several months, which is about the length of time the Port contemplates detaining stormwater.

No Plan is in Place to Manage Accumulated Sediments in the Proposed Detention Vaults.

The draft plan also doesn't address how accumulated sediment (particulate matter) in the detention vaults will be managed. It will not take long for particulates to settle out, although this will depend on the size and weight of the particles. The point is that sediment will accumulate in the vault bottoms requiring periodic removal and disposal. The key question is, how will the Port safely remove and dispose of accumulated sediments without some release of sediments downstream, which could pose a risk for the aquatic resources of the project streams and possibly facilities operators and other humans using the stream. As we already established, the accumulated sediments will be rich in metals, which could be more bioavailable and toxic to fish and invertebrates. These sediments also may contain enteric microorganisms, which could infect human operators and other humans downstream.

The Proposed Monitoring Plan is Incomplete and Denies Opportunity for Meaningful Scientific Comment

The Port's management approach is to monitor the quality of detained or discharged stormwater, and only when a problem is encountered, will it take steps to mitigate the impacts of altered water quality. For example, if the problem is low dissolved oxygen, the Port will aerate. How the waters in the vault or the stream will be aerated, we aren't told except in a very general way. While several types of aeration devices are listed on page 18, including microbubble diffusers, gas injection, mechanical aerators, etc., there is no commitment at this time to any of these technologies. It may be expected that one or more of these devices will work better than others but this has not been determined. This is purported to be a plan ready for scientific scrutiny, but clearly, based on my experience, it is not!

There is also the important issue of how frequently to monitor the stored stormwater during discharge. For example in the case of dissolved oxygen, the Port proposes a weekly monitoring requirement for the operational period, August through October (see page 32), which may not detect early signs of degradation. Dissolved oxygen, can change very quickly (in a matter of hours) in response to biochemical oxygen demand, rainfall, and even air temperature. I therefore cannot agree with the Port's notion on page 33 that "water quality of stored water is not expected to change," and recommend more frequent monitoring, at least daily for dissolved oxygen, turbidity, and temperature during the operational (discharge) period. Again, what should be required is modeling and bench-scale testing to determine how long-term (three month) detention can change the basic properties of stormwater.

While it may be of interest to undertake a long-term assessment (10 years) of benthic insect productivity in the project streams (see page 34), as demonstrated by the Benthic

Index of Biotic Integrity (BIBI), this kind of biological monitoring also will not detect potential early impacts associated with the discharge of detained stormwater to the project streams. In other words, harm to the resource could occur before it was detected. There is also no real BIBI baseline for the project streams because so few samples have been collected to date from which the BIBI can be calculated. Using this approach, one will also have to wait several years to see a trend in the data that had sufficient statistical reliability to determine if benthic invertebrate productivity was being altered. In my opinion, then, it's a stretch to suggest as the Port does on page 34, "this monitoring will be able to be used in assessing any biological effects of the flow offset facility in the receiving water." Instead of the BIBI, use of either laboratory or *in situ* bioassays aimed at determining potential bioaccumulation and toxicity of metals and other chemicals is one approach that would provide more timely indications of whether or not stored stormwater was having an impact on the receiving water.

Throughout the monitoring plan, reference is made to provisions that the Port's final design specifications will be submitted to Ecology for their approval prior to the plans implementation. For example, on page 25 it says that the "Operation and Monitoring Plan will be finalized and submitted to Ecology after final design of the facility is completed and before operation commences." Clearly, the plan is incomplete if the final design specifications for monitoring have not yet been developed. Why then are we reviewing this draft? Perhaps more importantly, why is Ecology attempting to review the plan before it is complete? To do so only denies rigorous scientific peer review let alone meaningful public input on whether there is reasonable assurance that water quality standards will not be violated.

Also questionable is the provision on page 28 to include in an annual data report submitted to Ecology, a discussion of any water quality problems that were encountered during the year, and also the immediate actions taken by the Port to address any problem(s). Why shouldn't the Port be required to immediately report to Ecology, as well as other responsible resource agencies, when a problem is encountered on the creeks. The WDFW would certainly want to know if water low in dissolved oxygen was being released to Miller, Walker, or Des Moines Creeks, especially if coho salmon were on spawning grounds in those streams. Coho salmon spawn in the project creeks during the Port's period of proposed discharge, July through October.

Monitoring, however, should not be the basis for approving (certifying) the proposed project. The Port appears to seek Ecology's approval with a vague promise that if anything does go wrong the Port will fix it. Because the Port does not know what will happen (they haven't done their homework), monitoring in this case could be viewed as a "pass" to risk the integrity of the streams. If monitoring detects a problem it usually means that the stream(s) has/have suffered some degree of harm. More importantly, the streams will continue to undergo harm until the problem(s) is /are rectified. If the monitoring is flawed as it appears the Port's monitoring is, the degree of harm incurred could be all that more. Reasonable assurance that the water quality will not be impaired, in my opinion, should not based on monitoring alone, as it seems in this case. Rather, it should be based on a facility design that is well grounded on scientific principles, a

learned assessment of the potential problems, laboratory experimentation (not experimentation on the streams), and external peer review.

We have only just received the Port's proposal to use detained stormwater to offset impacts of summer low flows in the project streams: hence the timing of submittal of these comments. Please consider these comments in your final deliberations on whether or not to grant a Section 401 Certification and Section 404 Permit. Thank you for the opportunity to again comment on the Port's proposed Master Plan Update Improvement projects. I am available by phone, email, or in person to discuss any of my comments in greater detail.

Yours very truly,

John A. Strand

John A. Strand, Ph.D.
Principal Biologist

Attachment (*Curriculum Vitae*)

cc: Peter Eglick
Kimberly Lockard

References

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John A. Strand, Ph.D., Fellow A.I.F.R.B.
Environmental Scientist

Dr. Strand is an internationally recognized environmental scientist specializing in studies to determine potential effects of human activities on aquatic resources. During his 26 years (post Ph.D.) of experience, he has conducted a wide variety of projects, large and small, in Alaska, California, Idaho, Washington, British Columbia, Guam, and Venezuela. These included field studies to evaluate environmental impacts of engineered structures, and field and laboratory studies to assess ecological and health risks from discharge of contaminants to surface waters, including sewage, storm water, oil, other organic chemicals, radionuclides, and heavy metals. Dr. Strand also has developed watershed management plans and regional restoration and monitoring plans.

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Education:

Ph.D.; University of Washington; Fisheries Biology; 1975
M.S.; Lehigh University; Biology; 1862
A.B.; Lafayette College; Biology; 1960

Employment:

1999- Principal Biologist, Columbia Biological Assessments, Richland, WA. Also, Adjunct Faculty, Environmental Sciences and Regional Planning Program, Washington State University Tri-Cities, Richland, WA.

1996-1999; Water Quality Planner,
King County Department of Natural Resources, Seattle, WA.

1993-1995; Senior Biologist and Group Leader,
EA Engineering, Science, and Technology, Inc., Redmond, WA.

1990-1993; Restoration Manager and Co-Chair, *Exxon Valdez* Oil Spill Restoration Planning Working Group, NOAA/NMFS; Auke Bay, AK.

1969-1990; Senior Research Scientist and Manager, Battelle, Pacific Northwest Laboratory, Richland and Sequim, WA. Also, Affiliate Faculty (1987-1991), School of Fisheries, University of Washington, Seattle, WA.

Registration/Certification:

Fellow, American Institute of Fisheries Research Biologists; 1993
Certified Fishery Scientist (No. 442), American Fishery Society; 1969

Specialized Training:

Health and Safety Training for Hazardous Waste Sites; 1996; 1997; 1998
Wetland Delineation, Shoreline Community College; 1996
Litigation Support Short Course, EA Engineering, Science, and Technology, Inc.; 1994
NEPA Refresher Training, US Forest Service; 1991

Experience:

Aquatic Toxicology and Risk Assessment----In 2000, investigated the effects of stormwater on fish and other aquatic life in Miller, Walker, and Des Moines Creeks, King County, Washington. From 1996 to 1998, studied ecological and human health risks of combined sewer overflows in the Duwamish River and in Elliott Bay, Washington. In 1995, prepared sampling plans to study fate of metals and organic contaminants in groundwater and marine sediments in Liberty Bay, Washington. At a gold mine in Southeast Alaska in 1994, assessed human health risks for arsenic discharged in treated tailings pond effluents. In 1990, evaluated survey design and sampling procedures to determine the fate of oil refinery and coking plant wastes in sediments and benthic biota in Amuay Bay, Venezuela. In 1980, developed exposure pathway models and determined potential ecological and human health risks associated with metals and radionuclides released from a hypothetical uranium mine and smelter at three locations in British Columbia.

Resource Management and Planning---- In 1999, appointed to King County Biological Review Panel with responsibility to evaluate King County policies and programs most relevant to conservation of salmon. In 1995 evaluated NMFS biological opinion and conducted field studies to assess potential impacts of construction and operation of a proposed gold mine on endangered spring and summer run chinook salmon in the Salmon National Forest, Idaho. From 1992-1993, was Federal Co-chair of *Exxon Valdez* Oil Spill Restoration Planning Work Group in Anchorage, Alaska. Responsible for developing a restoration plan, and for designing, implementing and reviewing long-term restoration and monitoring projects for injured resources and human services. From 1987-1990, helped prepare the *Sequim Bay Watershed Management Plan* in an effort to mitigate cumulative effects of nonpoint source pollution from timbering, road building, agriculture, marina operations, and failed septic systems throughout the Sequim Bay watershed in Washington.

Regulatory Compliance ----Conducted numerous National Environmental Policy Act reviews for nuclear power plants, a nuclear fuels reprocessing facility, a hydroelectric impoundment, petroleum and synthetic fuels refineries, a gasoline pipeline, an acoustic measurement facility, and general construction projects. For example in 1994, directed an environmental assessment of alternate sites for construction of replacement housing at McChord Air Force Base, Washington. In 1985-1987, managed an environmental assessment of the Navy's Southeast Alaska Acoustic Measurement Facility near Ketchikan, Alaska. Also conducted Section 316 (a) (b) Demonstrations of Compliance with the Clean Water Act. For example in 1994, designed monitoring plans to address "special conditions" of National Pollution Discharge Elimination System (NPDES) permit renewals at two coastal power plants in California. In 1988, performed chemical analyses and bioassays in support of NPDES Permit renewals at oil industry facilities in Port Valdez and Cook Inlet, Alaska

Selected Publications and Presentations:

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