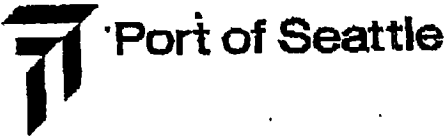


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August 18, 2000

Ms. Jillian Hoyt  
Seattle Public Utilities  
Key Tower Suite 3100  
700 5<sup>th</sup> Avenue  
Seattle WA 98104

Dear Ms. Hoyt:

RE: Port of Seattle/Des Moines Creek Basin Plan - Flow Augmentation Facility

Pursuant to our telephone conversations and my email message, I am forwarding hard copies of an implementation plan for the proposed Des Moines Creek flow augmentation facility. To summarize the proposal, the Port is participating with the cities of SeaTac and Des Moines, King County, and the Washington Department of Transportation on the Des Moines Creek Basin Planning Committee. The committee has developed a plan that includes the reconstruction of the Marine View Drive bridge over the creek, the construction of a regional detention facility, and a flow augmentation facility. The flow augmentation facility is designed to maintain an in-stream flow of one cubic feet per second and temperatures of 16C or less during the summer months. The preferred design uses a Port-owned well as the source of water for augmentation. However, questions have been raised over the validity of the existing water right associated with the well. In order to provide a level of assurance the facility will be built, the Port and basin planning committees are seeking to obtain an alternate supply in the event that the water right issue is not favorably resolved. Therefore, we would like to initiate discussions with SPU to explore the possibility of purchasing water for this purpose from SPU. The attached documents provide additional details of the proposed project. The construction schedule for the basin plan shows the flow augmentation facility being constructed in 2002, so there is ample time to develop our proposal in more detail.

Thank you for taking the time to discuss this issue. If you need additional information, I can be reached at 206-328-5500 or [ksmith.k@portseattle.org](mailto:ksmith.k@portseattle.org). I look forward to hearing the results of the initial discussion of our request.

Sincerely,

A handwritten signature in black ink that reads 'Keith R. Smith'.

Keith R. Smith  
Water Resources Manager

Enclosures

Seattle-Tacoma  
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Seattle, WA 98168 U.S.A.  
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### Des Moines Creek Flow Augmentation Implementation Plan

The Des Moines Creek Basin Planning Committee, comprised of the cities of SeaTac and Des Moines, King County, the Port of Seattle, and the Washington Department of Transportation, have proposed several projects to enhance the Des Moines Creek watershed. One of these proposals is a flow augmentation facility. There are two goals associated with the flow augmentation facility: increasing streamflow to one cubic foot per second during low flow periods, and decreasing instream temperatures to 16 degrees Celsius during summer low flow periods. By introducing cool water to the stream in mid- to late summer, both of these goals can be met and water quality and aquatic habitat should be improved.

The preferred option is to use water from a Port-owned well to provide water for flow augmentation. The well is currently used to irrigate a tenant-operated golf course. The well has a water right certificate for 400 gallons per minute (0.88 cfs), which is sufficient to obtain the target streamflow of one cfs. An application to change the water right to allow the proposed use was filed with the Department of Ecology in June 2000 and is currently under review.

Figure 1, from the report "Des Moines Creek Flow Augmentation Plan", by Parametrix, Inc., dated August 1998, shows the layout of the various facilities associated with the flow augmentation project. The wellhead and pump, located near south 200<sup>th</sup> Street, will be reconfigured to discharge into an eight-inch PVC pipe. The pipe will convey water from the well approximately 800 feet north, to the point where it will be introduced to the creek just downstream of the confluence of the east and west branches. The pipe will discharge into a manhole-type structure, which will act as a stilling basin, followed by a 20-foot channel of small riprap quarry spalls leading to the stream. Water cascading down the rock channel would aerate the water before it enters the stream. The actual entry point to the stream would be designed to prevent erosion of the stream channel.

A station to monitor streamflow and temperature would be located approximately 375 feet downstream from the augmentation point, at an existing weir. The weir would be modified to achieve more accurate low-flow measurements, and a rating curve will be established. A stilling well would be installed to contain the flow and temperature sensors. At depths corresponding to flows of 1.0 cfs or less, or water temperatures of 16 degrees C or greater, a signal would be sent via a well control system to turn on the pump. A 4-20 ma signal will automatically adjust the variable speed-pumping rate to maintain 1.0 cfs or 16 degrees C in the creek. Additional monitoring after implementation will be conducted to determine if the temperature criteria needs adjusting based on the effect of the flow augmentation on downstream temperatures. A data logger will be installed at the monitoring station to record continuous (15-minute interval) readings of stage, temperature, pumping rate, and pumping time.

If water from the well is not available for flow augmentation, the Port intends to use water from its water distribution system. Although the majority of this water is purchased from Seattle Public Utilities, the Port also purchases water from Highline Water District and King County Water District 125 to serve properties owned by the Port. If this option is implemented, the basic design of the system will not change (i.e., point of introduction and monitoring station);

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however, a different pipeline configuration will be constructed to get the water from the Port's distribution system to the point of introduction to the stream, and a facility to monitor and de-chlorinate the water prior to its introduction to the stream will be added to the design. In addition, since water from this source will have a different temperature than well water, the temperature/pumping criteria will also be revised. Discussions with the Port's utility manager and review of the agreements with the water suppliers revealed no language that would prevent the use of water from these sources for flow augmentation.

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## Revised Flow Augmentation Implementation Plan for Des Moines Creek August 18, 2000

This revised implementation plan is response to a request from the Department of Ecology for more information regarding the Des Moines Creek Flow Augmentation Facility. Because construction of the facility is not scheduled to begin until June 2002 (see attached Des Moines Creek Basin Plan Construction Schedule) and the final decision on the source of the water has not been made, the design of the facility has not progressed to the point where detailed design drawings and information is available. However, the Port has worked in the last several weeks to collect more information to provide an additional level of detail about the facility's design and operation. In addition, the Port and the other basin planning committee members are in the final stages of developing the next interlocal agreement, which will cover the final design and permitting of all basin planning projects, including the flow augmentation facility. This work is scheduled to be completed in 2001. While the current plan calls for flow augmentation from the Port-owned well, the Port will commit to funding the design and construction of the facility using water from Seattle Public Utilities (SPU) if the water right issue cannot be resolved by the time construction needs to start, and final approval from SPU is obtained. Available details on the design alternatives are presented in this document.

The Port and the Des Moines Creek Basin Planning Committee are still considering two sources for the water: the Port-owned well currently used to irrigate the Tyee Valley Golf Course, and water from Seattle Public Utilities through the Port's existing connections. The Port has initiated discussions with SPU to determine the feasibility of the second option. Considering the maximum annual volume proposed for augmentation, the maximum increase in volume over existing annual use at the airport is 33.4%. (Annual existing airport use is 30,951,800 cubic feet; maximum annual flow augmentation amount is 10,951,800 cubic feet.) In reality, since the target flow in the stream (combined natural flow and augmentation flow) is one cfs, and the maximum augmentation rate and duration is based on the most extreme climatic conditions, actual use for flow augmentation would be less than the maximum value of one cfs. SPU is meeting later in August to discuss the Port's request in more depth.

Although the Port is committing to flow augmentation from either source, the well is the preferred option, assuming the water right issue can be satisfactorily resolved. Use of water from SPU is more complex and costly due to the need to construct a pipeline from the airfield, construct and operate a dechlorination facility, and the cost to purchase the water (\$2.29 per 100 cubic feet at the current commercial rate charged to the Port during peak usage time of May 16 through September 15.) Costs associated with the well option are much lower and include modifying the wellhead, replacing the existing pump with a variable-speed pump, constructing a shorter discharge pipe, and electricity to run the pump. Both sources will be able to provide water in perpetuity. If the well is the selected source, water rights are issued in perpetuity. Although a water right is technically subject to curtailment if the uses of senior rights in the basin cannot be met, this has not happened in the more than 50 years that this well has been used. If SPU were the selected source, water for flow augmentation would have the same assurance of supply as the Port's current use and all other uses that obtain their water from SPU. SPU has

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historically been able to meet demands, therefore, in both cases; the availability of a source in perpetuity is assured. The Port and its legal counsel believe it has strong arguments that the water right associated with the well is valid, and will be presenting that information to Ecology's Water Resources program staff in support of our current Water Right Change application.

If the water right issue is resolved favorably and the well is selected as the source of augmentation water, the well and associated equipment will be modified. The Port and the basin planning committee have studied two pump configurations. One configuration would replace the existing pump with a submersible pump and motor. Specifications include a 75-Hp, 3500-rpm motor with 2-stage pump bowls optimized for the 12-inch well casing. The other configuration replaces the existing pump with a turbine pump (motor mounted on top of the well with a shaft extending to a submerged pump). This configuration uses a motor similar to the submersible pump, but the pump is a 7-stage pump with 8-inch bowls. Both pump configurations allow for variable speed operation to allow the augmentation flow to be matched to the needs of the stream. The existing pump does not allow for this type of operation. The primary differences between the two proposed configurations are cost and efficiency (submersible pumps are generally more efficient because the motor is connected directly to the pump.) Water would be delivered to the stream through a discharge line, either through a stilling basin and rock channel, or through an existing pond and constructed channel (see discussions below). Estimated construction costs for the flow augmentation facility using the well as the water source are attached.

If SPU water is used, it will need to be conveyed to the augmentation site and treated prior to being introduced into the stream. The Port will construct a pipeline from Port-owned water mains on the airfield through Port-owned property to the flow augmentation site. The pipeline would be six or eight inches in diameter and approximately 4,500 feet in length. The proposed route will be along the perimeter road east of runway 34R and taxiway A to a point adjacent to the golf course, and then through the golf course to the flow augmentation site. The entire route is on Port property. No wetlands will be impacted by the pipeline or other facilities associated with the flow augmentation project. A valve controlled by the stream monitoring system will control the discharge from the pipeline into the treatment system. Review of water quality reports from SPU indicate that removal of chlorine is the only treatment required as no other constituents are present in amounts that cause toxicity concerns or that violate water quality standards. Preliminary consultation with Kennedy-Jenks, an engineering firm retained by the Port for water treatment issues, indicate that two types of dechlorination systems are possible for the flow augmentation facility. One is a chemical-feed system consisting of a mixing chamber and a holding tank sized to provide adequate contact time. The chemical used will probably be sodium thiosulfate, although a system could be designed to use other chemicals. Sodium thiosulfate is a readily available chemical used in the photo processing industry, as an antidote to cyanide poisoning, and in products to dechlorinate tap water for use in home aquariums. The last use is of interest because it demonstrates the chemical can be used to dechlorinate water with no harmful effects to fish and other aquatic organisms. Introduced in liquid form, the reaction with chlorine is virtually instantaneous. Based on the expected residual chlorine concentration of the supply water (1 milligram per liter or less) and the volume of flow, the size of the mixing chamber and tank is on the order of a common residential septic tank, something that could easily be constructed at the flow augmentation site. A mechanism to match the rate of chemical

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injection to the variable rate needed for augmentation would need to be designed. Similar facilities have been developed to provide dechlorination for many industrial uses, so the technology exists and can be readily adapted for the flow augmentation project.

The other option for providing dechlorination is a passive-type system. Sunlight is very effective in reducing chlorine concentrations, so a small holding pond exposed to sunlight could provide an adequate level of dechlorination. In fact, an alternate design for the flow augmentation facility has the well discharging into an existing pond on the golf course, and then into the creek through a constructed channel over weirs to provide aeration (see attached figure). Note that the scale of this figure does not allow it to show the monitoring station(s), which would be constructed regardless of the water source. This option could be adopted to provide dechlorination of SPU water. Advantages to this type of system are its simplicity, ability to handle variable flows, and low construction and operational costs. Given the variability of sunlight during the times when augmentation is required and the pond's impact on water temperature, this option will be researched and developed further. As stated in other flow augmentation documents (attached), the plan includes monitoring and testing during the first year of operation to determine the effects of various temperature settings on downstream temperatures, and determining the optimal augmentation rates to achieve the desired results. Impacts on temperature of the holding pond will also be evaluated during this period. If SPU water is the selected source, the Port commits to evaluating all dechlorination alternatives and constructing the one that is best suited for the flow augmentation project.

No matter what the water source, a minimum of one monitoring station needs to be constructed, both to provide control over the augmentation facility and to provide data on the effectiveness of the project. (Early in the project, to avoid having to construct a monitoring and control system, the basin planning committee evaluated simply opening the well and letting it flow continuously throughout the summer, but dismissed this option.) The Port will evaluate the option of constructing two monitoring stations (upstream and downstream) to allow the collection of more complete data on the facility. As stated in the previous plan, the monitoring facility (ies) will be constructed at one or more of the three existing weirs on the reach on Des Moines Creek between the confluence of the east and west branches and south 200<sup>th</sup> Street. The existing rectangular weir(s) will be modified by adding a V-notch or Parshall flume to achieve more accurate measurements during low flows. Trash racks will be included to prevent debris from accumulating in the flow measurement section, and a stilling well(s) will be constructed at the weir(s) to contain the water level and temperature sections. A streamflow rating curve will be developed for the modified weir(s), and depths corresponding to a 1 cfs flow rate will be established.

The Port consulted with Taylor and Associates, its consultant on water quality monitoring. Taylor and Associates have experience developing monitoring and control equipment on similar flow augmentation projects. Commercially available probes with analog (4-20 milliamps) will sense flow and temperature (and dissolved oxygen, if desired.) The heart of the system will be a Campbell Scientific CR10X or CR500 programmable recorder/controller. This unit will receive signals from the monitoring station(s), and will be programmed with logic to turn on the well pump (or open the pipeline valve if SPU is the source), control the pumping rate or pipeline flow, and record streamflow and temperature. The unit can also be set up to provide remote

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access, query, and programming using cell phone or hard-wire technology, or alternatively, incorporated into the Port's telemetered maintenance/operation system. Control and target conditions will be defined to optimize operation of the flow augmentation facility. Persistence or rate of change in flow and temperature will be established to prevent rapid pump (well) or valve (pipeline) cycling. It is envisioned that temperature and flow data will be collected at fifteen-minute intervals. It will be established if a single reading below one cfs or over 16C would activate the pump or valve, or if a specific duration would pass before the system is activated. Programming in a specific duration before activation would eliminate false starts due to the system noise inevitable in electronic monitoring/sensing equipment. Logic to resolve this issue will be developed and programmed into the control module, and can be modified based on operational experience.

Because of the current uncertainty over the source of water, the resulting uncertainty over the need to construct a dechlorination facility, and the desire to keep the components of the flow augmentation facility in a small area to minimize potential conflicts with other projects (SASA and the proposed SR509 extension), the Port has decided to pursue the design utilizing the pond and constructed channel to the creek, and not construct a discharge pipeline to a point near the confluence of the east and west branches, no matter which source of water is developed. This assures that the flow augmentation facility will not interfere with other proposed projects in the area. WSDOT was consulted via their participation in the basin planning committee, and has confirmed that the selected layout and location does not interfere with the SR509 alignment. The Port's legal counsel (Foster Pepper & Shefelman) is developing language for restrictive covenants for a variety of Port projects. Foster Pepper has been provided information regarding the layout and location of the proposed flow augmentation facility, and will develop a restrictive covenant specific to the flow augmentation project. The Port will continue to coordinate with the basin planning committee to assure that the restrictions are consistent with basin planning projects in the area.