APPLICATION FOR FUNDING

UNDER THE CLEAN LAKES PROGRAM

Administered by

Oregon Department of Environmental Quality

FLOW AUGMENTATION STUDY

FOR SMITH AND BYBEE LAKES

conducted by

METROPOLITAN SERVICE DISTRICT

PLANNING & DEVELOPMENT

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FLOW AUGMENTATION STUDY

FOR SMITH AND BYBEE LAKES

PROBLEM STATEMENT

Historical significant water sources for Smith and Bybee Lakes either have been eliminated or are potential pollution sources. To prevent further degradation of and improve water quality in the lakes, an alternative source of water to the lakes is needed. To determine the most viable source of water that will result in improving water quality and meeting management goals for the area, a water augmentation feasibility study is needed.

DESCRIPTION OF LAKES AREA

The Smith and Bybee Lakes wetland complex is a large remnant of the formerly extensive lakes, sloughs, and marshes of the lower Columbia River bottomlands. Located near the confluence of the Willamette and Columbia Rivers, the lakes and wetlands are in an urban setting within the Portland city limits (see attached map). The lakes are within the approximately 2000-acre Smith and Bybee Lakes Management Area. The lakes are accessible to Oregon's largest population center, the Portland metropolitan area.

The Smith and Bybee Lakes natural area is mostly owned by government entities, primarily Metropolitan Service District (METRO), Port of Portland, and City of Portland. The remaining privately-held properties are being acquired for consolidation of all land within the Management Area under public ownership. Public access, which is currently available, will be enhanced in a way compatible with the management goals for the area. Current plans propose additional trails and boat access in the area.

The Natural Resource Management Plan for Smith and Bybee Lakes (attached), adopted in November, 1990, details the goals and objectives for managing the area, summarized as:

(1) maintain and enhance the lakes, to the extent possible, in a manner faithful to their original natural condition;
(2) provide and maintain habitat diversity; and,
(3) encourage educational and passive recreational use of the lakes area.

Any activities within the Lakes Management Area must comply with the Management Plan.

As the manager of the Lakes Trust Fund established to manage the lakes, METRO is responsible for implementation of the Management Plan. METRO staffs the Lakes Management Committee, which is composed of resource agencies, environmental groups, landowners, and neighborhood associations. The Management Committee guides METRO staff in implementation of the Management Plan.

ECOSYSTEM SUMMARY

The Smith and Bybee Lakes and wetlands are a complex of lakes, ponds, sloughs, marshes, meadows, shrub/scrub and forest habitats. These habitats support a variety of resident and migratory fish and wildlife species. The structure and function of the wetlands complex is largely determined by surface water hydrology. The system's hydrology is currently controlled by human development.

The lakes and associated wetlands have been historically manipulated for development and waterfowl management purposes. By 1980, the entire north side of the lakes area had been filled for industrial development. The historic direct link from the lakes to the Columbia River was eliminated by this development. The more indirect link to the Willamette and Columbia Rivers through the Columbia Slough was restricted by the 1983 construction of a water level control structure at the east end of the North Slough. This structure not only restricted flow exchange between the lakes and the slough, but also maintained the lakes at a static level year-round. This dramatically increased the retention time of the lakes and changed the vegetation types in the lakes and wetlands (see attached Management Plan and Environmental Studies Summary Report).

Lakes Morphology

Lake data given below assumes the surface water elevation of the lakes is at 10.4 feet AMSL, which is the elevation of the fixed weir at the east end of North Slough. Smith and Bybee Lakes are directly connected over the normal surface water levels observed. Although they are distinct basins, they can be treated as one water body for many management decisions.

	Smith & Bybee Lakes	Smith Lake	Bybee Lake
Surface Area	1050 ac	725 ac	325 ac
Drainage Area	appr. 1600 ac	----	----
Volume	3860 ac-ft	2660 ac-ft	1200 ac-ft
Maximum Depth	-----	6.7 ft	7.6 ft
Trophic Status	-----	Eutrophic	Eutrophic
Stratified	-----	?	?

Water Budget

The lakes are essentially isolated from influences of the slough and rivers much of the year. However, when the lakes' level or the slough/river levels exceed 10.4 feet AMSL, there is a direct connection between the North Slough and the lakes. This usually occurs during the Willamette River freshet in winter months and during the Columbia River freshet in late spring.

Based on the attached Environmental Studies Report and recently-collected data, the major components of the water budget are precipitation and evaporation. Surface runoff inflow and groundwater flux are relatively minor in the water budget.

Water Quality

Smith and Bybee Lakes are identified in the 1990 Water quality Status Assessment Report (305b) as water quality limited, not able to provide the designated beneficial uses. The uses affected are aesthetics, water contact, and aquatic life. The causes are excessive amounts of weeds, algae, nutrients, fecal bacteria, and low dissolved oxygen. The lakes are designated candidates for Phase 1/2 Clean Lakes Funds.

Nutrient values observed in the lakes indicate eutrophic conditions. Total Phosphorus and Total Nitrogen annual and summer mean values exceed 0.10 mg/l. Chlorophyll-a values observed in the lakes more often exceed 0.01 mg/l.

Aquatic macrophytes have reached nuisance levels for boating. Compared to areal coverage shown in aerial photographs, swamp smartweed (Polygonum amphibium) has proliferated beyond historical record, believed due to the lake levels being held static for the past 10 years. Eurasian milfoil (Myriophyllum spicatum) has been found in adjacent isolated sloughs.

Historically, water quality in the lakes has been influenced by rivers and slough water quality because the slough has been the primary inflow and outflow for the lakes. The construction of the water level control structure in 1983 isolated the lakes. The potential exists for degradation of lake water quality because of:

(1) the isolated nature of the lakes;
(2) the poor water quality in Columbia Slough;
(3) the anticipated increase in urban/industrial development in the small drainage area; and,
(4) the influence of the St. Johns Landfill adjacent to the lakes.

The Columbia Slough is designated water quality limited, being out of compliance with water quality standards and action levels, including bacteria, pH, chlorophyll-a, and nutrients. The slough has not been designated water quality limited for toxins but has elevated levels of 307(a) pollutants, warranting further study.

The option of re-establishing the flow between the lakes and the slough is not highly desirable at this time given the present water quality of the slough. The dominant sources of bacteria and nutrients in the slough originate from combined sewer overflows (CSOs) from Portland's sewer system. A 20-year schedule of action to reduce these sources to acceptable levels has been established. No schedule for action to control toxins in the slough has been proposed. Metals, pesticides, and other organic contaminants identified in the slough water column and sediments pose additional threat to lake water quality. In addition, the effect of the St.

Johns Landfill on the slough is unknown at this time. Given these uncertainties, another source of water to the lakes is preferred for the foreseeable future.

New stormwater discharges from surrounding streets and industrial developments being proposed for discharge to the lakes will be treated prior to entering the lakes. Both the City of Portland and the Port of Portland are designing stormwater treatment facilities that will incorporate sedimentation basins followed by passive treatment using vegetated swales and created wetlands. The potential for treating existing stormwater discharges is being examined.

PROPOSED FEASIBILITY STUDY

To augment water flow to the lakes other than from the Columbia Slough, two alternatives exist:

1. ground water from on-site wells; and,
2. direct flow from the Columbia River to the lakes.

Augmenting lake water with ground water appears to have potential for improving water quality in the lakes. However, preliminary work conducted by Sweet-Edwards/EMCON, Inc. indicates high installation and operation costs associated with the necessary water yield rates. Also, the effect of pumping from the sand/gravel aquifer may have on the potential movement of leachate from the landfill is unknown at this time. Additional information on aquifer characteristics is needed.

Connecting the Columbia River directly with the lakes has been under consideration as a management option. The most obvious route of directly connecting the lakes to the Columbia River is between the northeastern corner of Smith Lake going north to the North Portland Harbor, a distance of approximately 2000 feet. This option appears desirable because:

1. Columbia River offers a practically unlimited, long-term source of water quantity;
2. re-connecting will restore the lakes closer to former natural conditions;
3. opening to the river will provide greater access for migrating juvenile salmonids seeking refuge, as surveys have indicated;
4. the water quality appears to be consistently-reliable in comparison to the alternatives;
5. the water level gradient between the river and lakes will eliminate potential pumping costs for much of the year; and,
6. with the existing outflow structure from the lakes to North Slough, having inflow directly from the river will promote flushing of the water quality-degraded North Slough.

Potential problems associated with using Columbia River water are:

1. the high sediment load carried in the river may result in an increase in sediment load to the lakes;

2. the nutrient levels in the river water at certain times of year may be undesirable for introducing into the lakes;
3. the potential physical, legal, and permit obstacles of creating either an open channel or closed conduit between Smith Lake and the river is unknown.

Scope of Work

There are two objectives in the proposed study: develop a nutrient budget for the lakes and determine the feasibility of connecting the lakes directly to the Columbia River.

I. **Develop a Nutrient Budget for the Lakes**

A nutrient budget of the lakes is needed to determine the feasibility of re-connecting directly to Columbia River. Insufficient data exists for development of a nutrient budget for the lakes.

A draft Proposed Monitoring Plan for Smith and Bybee Lakes Management Area, including St. Johns Landfill, includes sampling the lakes for nutrients at two locations (see attached Draft). For the purposes of developing a nutrient budget, additional monitoring is needed.

Hydrological monitoring will be comprised of continuous water level gaging stations at three locations: (1) the lake side of the existing water level control structure, (2) the confluence of the North Slough and Columbia Slough, and (3) in Portland Harbor of the Columbia River. Data loggers will be installed on all water level gaging stations for continual recording of data.

Sampling will occur at four locations: Smith Lake, Bybee Lake, mid-North Slough, and Columbia River (Portland Harbor). Samples integrated throughout the water column will be taken. Water column profiles of temperature and D.O. will be made.

PROPOSED WATER QUALITY MONITORING
FOR SMITH AND BYBEE LAKES

Parameters	Smith Lake Bybee Lake	Mid-North Slough	Columbia River
	Sampling Frequency (April-Oct) / (Nov-March)		
Basics			
Water Temperature	2X month/ monthly	2X month/ monthly	2X month monthly
Dissolved Oxygen			
Specific Conductivity			
pH			
Secchi Disk			
Total Solids			
Total Suspended Solids			
Nutrients			
NH_3-N		monthly/ bimonthly	monthly/ bimonthly
NO_2+NO_3-N			
Total Kjeldahl Nitrogen			
Total Phosphorus			
Dissolved Ortho-Phosphorus			
Biological			
Enterococci Bacteria			
Zooplankton			
Algal Counts			
Chlorophyll a			

II. Determine the Feasibility of Connecting the Lakes to Columbia River

To determine the feasibility of re-connecting the Columbia River directly to the lakes, two task are to be performed: (1) model the hydrodynamics of linking the river and lakes, and (2) examine the physical barriers to linking the waters and costs of overcoming those barriers.

1. An existing 2-dimensional hydrodynamic numerical model has been developed for the lower Columbia Slough and lakes by Portland State University. This model will be expanded to include the near-field Columbia River. Continuous water level data logged at the lakes, slough, and river locations will be used to calibrate the model. The hydrodynamic model will provide flow estimates necessary to meet water quality objectives. The model will also provide channel capacity requirements for meeting flow objectives.

2. To determine the feasibility of physically connecting the lakes and river, the following information must be obtained:
   (a) determine the shortest, feasible route;
   (b) evaluate the availability and cost of land for easement/in-fee purchase;
   (c) assess the potential environmental risks associated with adjacent properties and river connection;
   (d) assess the environmental impact of connecting the water bodies.

Project Costs

	Clean Lakes	METRO	TOTAL
I. Nutrient Budget			
Water Quality Lab Analysis	$ 9,000	$ 3,000	$12,000
Field Sampling Equip. (boat, Hydrolab)	$ 1,000	$ 2,000	$ 3,000
Field Technicians	$ 1,000	$ 2,000	$ 3,000
Analysis and Report	$ 5,000	$ 2,000	$ 7,000
II. Feasibility Study			
Water Level Recorders	$ 7,500	$ 4,500	$12,000
Hydrodynamic Modeling	$ 7,000	$ 3,000	$10,000
River to lake connection	$ 5,000	$ 5,000	$10,000
Report	$ 1,500	$ 500	$ 2,000
TOTAL	$37,000	$22,000	$59,000

METRO is requesting $37,000 from the Clean Lakes Fund to fund portion of this project. The remaining local matching funds will come from the Smith and Bybee Lakes Trust Fund.

Schedule

Water Level Recording	April 92 - Oct. 93
Field Sampling	Nov. 92 - Oct. 93
Hydrodynamic Modeling	March 93 - Nov. 93
Connection Study	Nov. 92 - Sept. 93
Report/Recommendations	December, 1993