Capitol Lake RESTORATION

Summary

Prepared For
DEPARTMENT OF GENERAL ADMINISTRATION
STATE OF WASHINGTON

January 1976

CH2M HILL

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PREFACE

In response to increasing concern about sedimentation in Capitol Lake, the Department of General Administration requested funds to develop a program to restore Capitol Lake. Funds for the study and engineering necessary to develop the restoration program were approved during the 1975 first extraordinary session of the Washington State Legislature.

To assist the department in developing this program, a consulting firm has prepared a specific plan of action. This summary briefly describes the recommended plan and its effect on the environment.

The process for program selection included interaction with various state and local public agencies and private organizations. Based upon an extensive study by Washington State University, four alternative concepts were developed by the consultant and evaluated according to cost, engineering feasibility and effectiveness, environmental impact, energy consumption, and compliance with established planning goals. The concept which best satisfied these criteria was chosen as the recommended plan.

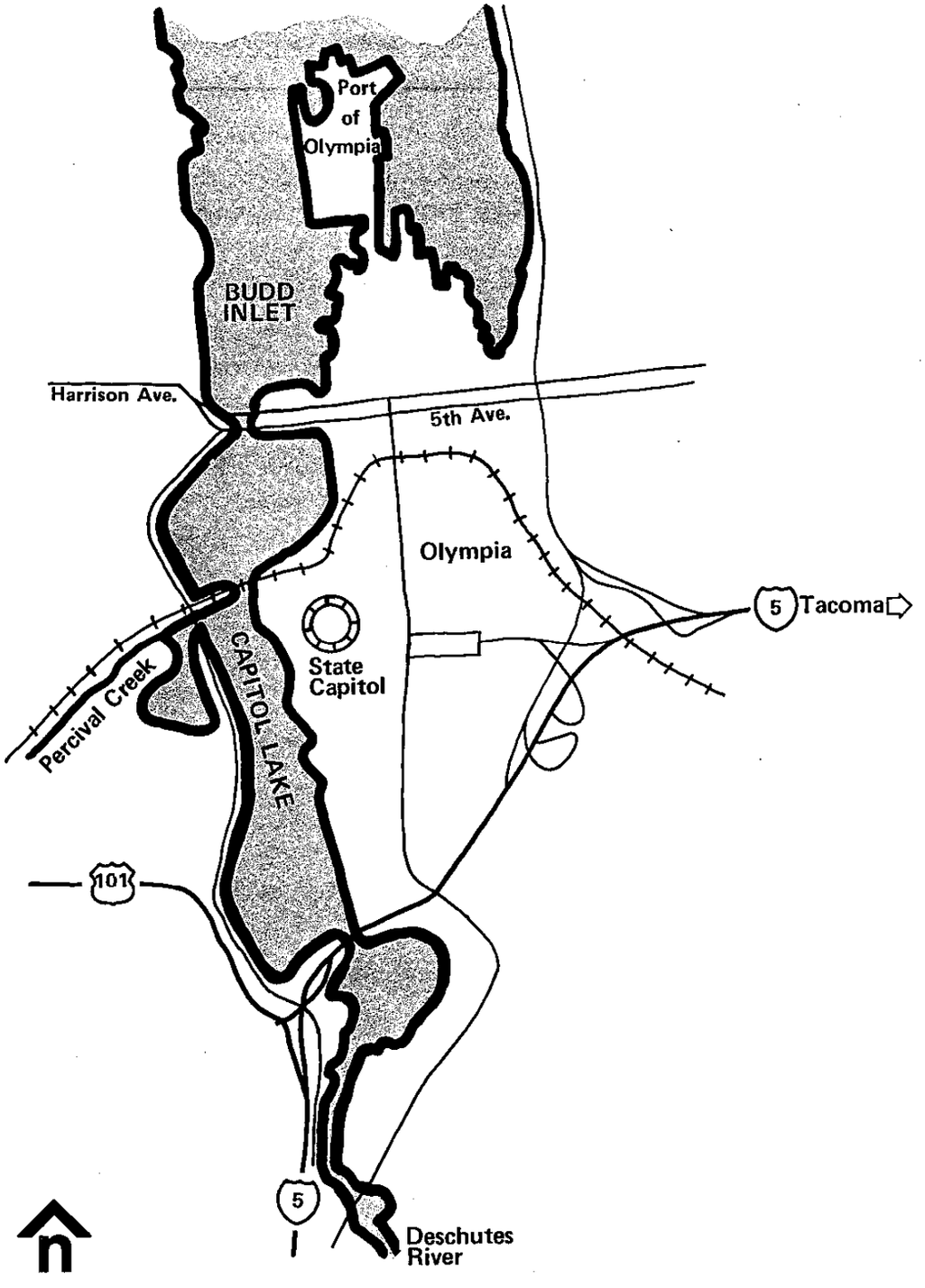
CONTENTS

INTRODUCTION

Capitol Lake is located in Olympia, Washington, at the southern end of Puget Sound's Budd Inlet (figure 1). A unique biological and recreational resource for 25 years at the state capitol, the lake now faces ultimate extinction from sediment deposits which have been accumulating since the lake's creation.

The importance of removing this threat and restoring the lake environment is emphasized by the fact that Capitol Lake is a valuable and versatile resource for the State of Washington. An integral part of the capitol campus, the lake is largely in public ownership, is close to an urban population, and is a fragile fresh-water resource located near saltwater.

The following plan has been developed to remove a portion of the lake's accumulated sediment and restore the lake environment.



Vicinity Map 1

RECOMMENDED PLAN

DREDGING

Initial dredging of 360,000 cubic yards of existing sediment from the upper and middle basins and Percival Cove will be adequate to restore them to their former uses and provide sediment traps. Deadheads and other hazards will be removed. Initial excavation will begin in the fall of 1976 and continue for 13 to 15 months on a 16-hour-a-day basis. Maintenance dredging to retain the improved condition of the lake will take place approximately every 2 years in the upper basin sediment trap and as necessary in the middle basin trap.

In the initial dredging program, the upper basin will be dredged to improve the channel and provide a sediment trap for coarser materials while preserving much of its present usage. This dredging will remove about 160,000 cubic yards of material.

A sediment trap will also be dredged in the southern end of the middle basin to catch finer materials escaping from the upper basin. The middle basin will be dredged selectively throughout to a 6-foot minimum depth, except in the area within 150 feet of the west shoreline. This section will remain undisturbed in order to protect the adjacent roadway fill and to preserve the existing fishery habitat. About 180,000 cubic yards of sediment will be dredged from the middle basin. Another 20,000 cubic yards of material will be removed from Percival Cove to facilitate its drainage during lake drawdown and to provide a sediment trap.

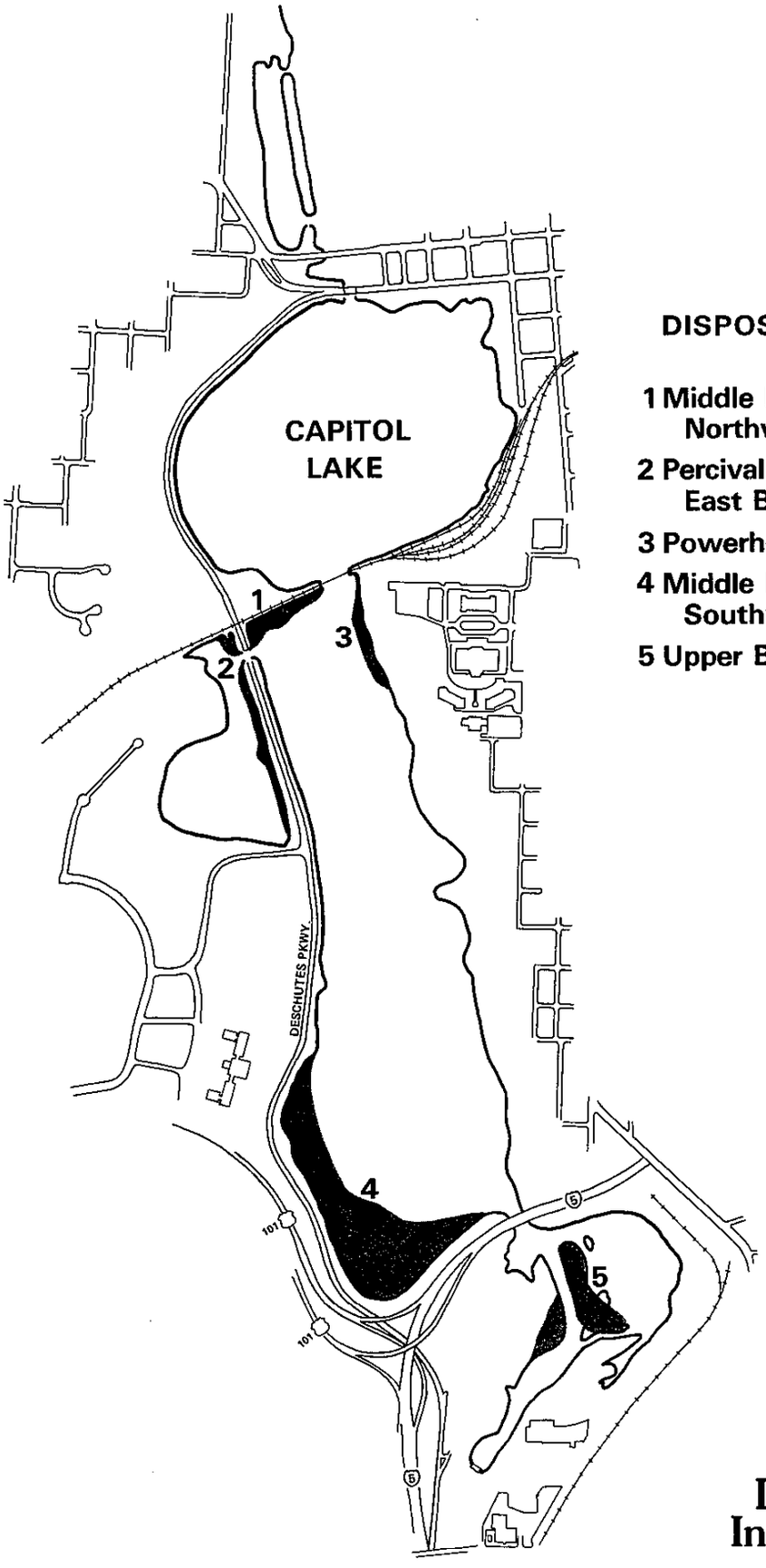
The maintenance dredging program calls for dredging of an average 50,000 to 60,000 cubic yards of material from the sediment traps every 2 years. Each maintenance dredging will last about 3 months.

The recommended dredging plan was successfully tested with a physical model by researchers from Washington State University.[1] Their research considered hydraulics, water quality, current patterns, and sedimentation. All initial and maintenance dredging would be performed by a small hydraulic dredge.

SEDIMENT DISPOSAL

All initially dredged materials will be retained in the lake's basins to provide new land masses and marsh areas. Areas approved by the Department of Fisheries for in-basin disposal are shown in figure 2.

1 Hydraulics Research Section and Environmental Research Section. September 1975. *Hydraulic and Water Quality Research Studies and Analysis of Capitol Lake Sediment and Restoration Problems.* A report for the Washington State Department of General Administration by Washington State University.



DISPOSAL SITES

1 Middle Basin
Northwest Corner

2 Percival Cove
East Bank

3 Powerhouse Fill

4 Middle Basin
Southwest Corner

5 Upper Basin Island

Disposal Sites 2
Initial Dredging

A portion of the materials removed from the upper basin by initial dredging will be used in that basin to develop an island and marsh area. The remainder will go into the southwest corner of the middle basin along with all the sediment taken from the middle basin.

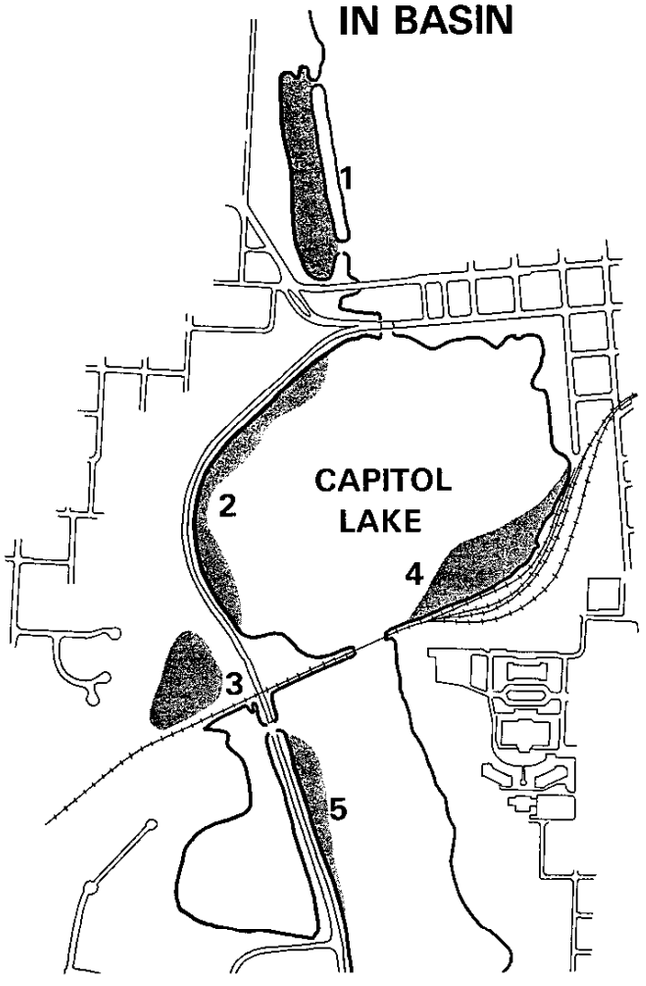
Sediment from the first maintenance dredging will be deposited in the southwest corner of the middle basin. Potential locations for disposal of additional maintenance material are shown in figure 3.

The total capacity of the sites shown in figures 2 and 3 is estimated to exceed 1 million cubic yards. This amount is adequate to dispose of all dredged materials for 20 years.

COSTS

The estimated costs for the recommended plan are $2,291,700 for the initial dredging and $763,200 for 20 years of maintenance dredging. All costs are based on prices estimated for mid-1976. A detailed breakdown of expenses arranged in order of expected occurrence is presented in table 1, followed by a brief description of the activities expected to occur during each of the phases of this schedule.

Delay of initial dredging beyond mid-1976 will increase costs by 12 to 15 percent a year because of inflation. The value of sport and commercial salmon catches is reduced by as much as $450,000 per year by the accumulated sediment, according to Department of Fisheries estimates.



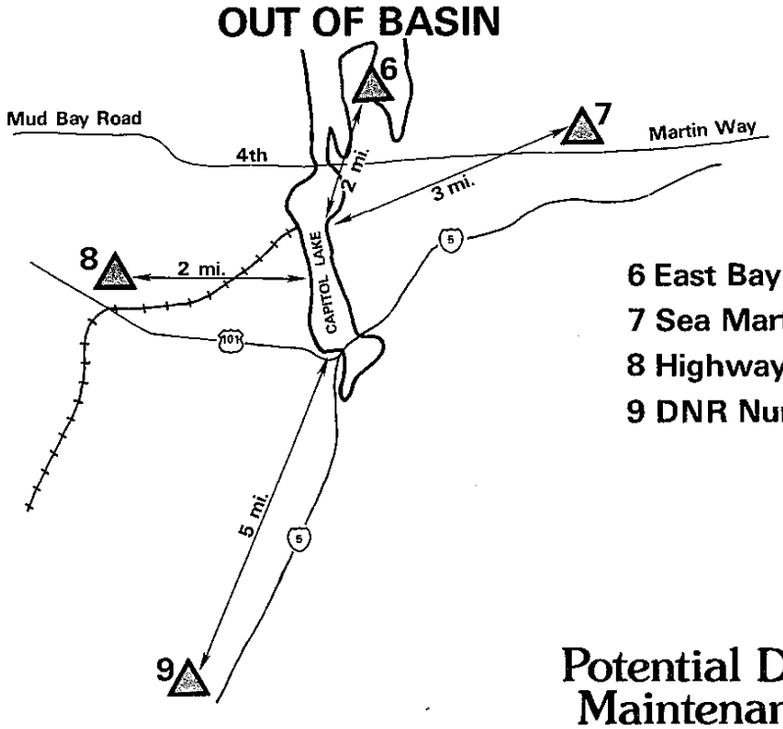
1 West Waterway Channel

2 Lower Basin West Shore

3 Percival Cove Gravel Pit

4 Lower Basin Southwest Corner

5 Middle Basin West Shore



6 East Bay Marina

7 Sea Mart Site

8 Highway101 Pit

9 DNR Nursery Site

Potential Disposal Sites Maintenance Dredging 3

Table 1. RECOMMENDED PLAN COST ESTIMATE

INITIAL DREDGING	
Phase I	
1. Dredge upper and middle basins and dispose in-basin	$ 498,000
2. Dredge Percival Cove and dispose along east bank of cove	24,400
3. Remove debris and deadheads from upper and middle basins	231,100
4. Construct groin in upper basin	194,000
5. Survey affected property	13,800
6. Purchase small dredge and support equipment	379,500
Total Phase I	$1,340,800
Phase II	
1. Acquire gravel pit in-basin	$ 125,100
2. Prepare in-basin sites for maintenance dredging	671,000
Total Phase II	$ 796,100
Phase III (Contingency Plan)	
1. Acquire out-of-basin disposal site	$ 101,800
2. Acquire additional pipe and booster pump	53,000
Total Phase III	$ 154,800
Total for Initial Dredging	$2,291,700
BIENNIAL MAINTENANCE DREDGING	
1. Maintenance dredging every 2 years for 20 years with small hydraulic dredge (average $76,320 per biennium)	$ 763,200

- All prices as of July 1976, with no escalation included beyond July 1976.
- All above prices do not include previous appropriation of $425,000, of which $300,000 required to complete engineering and design.
- Prices include fees, taxes and contingency.

SCHEDULE OF ACTIVITIES

The following activities are expected to occur during the various phases of the cost schedule.

Initial Dredging

Phase I

The initial dredging work will provide sediment traps in the upper and middle basins, and will remove sediment from the east shore and other shallow areas in the middle basin. Percival Cove will be dredged to allow complete drainage during the annual lake drawdown and to provide a sediment trap at the mouth of Percival Creek.

A small portion of the dredged material will be deposited in the upper basin to form an island and protective groin. The remainder will go into the southwest corner of the middle basin to improve water circulation, as recommended in the Washington State University hydraulic study report.

Debris will be removed from the upper and middle basins.

Phase II

To prepare for the biennial maintenance dredging, the state should acquire the existing gravel pit just north of Percival Creek as a dredge material transfer, handling, and disposal site. The state should also provide containment dikes for other in-basin disposal sites.

Phase III

In the event identified in-basin disposal sites are not available when needed, out-of-basin disposal will be necessary. To prepare for this option, it is recommended that the state acquire a disposal site within 2 miles of the lake, right-of-way to the site, and the additional pipe and pumps to transport the dredged material to this out-of-basin site.

Biennial Maintenance Dredging

Future accumulation of sediment will be removed from the sediment trap in the upper basin approximately every 2 years, and from the middle basin sediment trap every 5 to 10 years depending on rate of accumulation.

BACKGROUND

HISTORY

The need for positive action to restore Capitol Lake can best be understood by examining the lake's history and present condition.

Capitol Lake covers about 300 acres, has 4 miles of shoreline, and is divided into 3 basins. The lower basin is nearest the Port of Olympia; the middle basin is the largest segment and connects with Percival Cove; the upper basin is partly separated from the middle basin by fill from highway I-5. Most of the lake is owned by the state.

Formation of the lake was authorized by the state legislature. The lake began filling in 1951 following construction of a dam at the Fifth Avenue Bridge. An extension of the state capitol campus, the lake provides an attractive setting for Washington's governmental seat. Because most of the lake's shoreline is publicly owned and remains undeveloped, numerous recreational activities take place in and around its waters. The lake is one of the state's most important fish-rearing impoundments, with the annual fall migration of spawning Chinook salmon drawing crowds of spectators. The lake's diverse terrestrial and aquatic vegetation provides abundant habitat for wildlife, making it a valuable biological resource in an urban setting.

The lake's location also has historic and prehistoric significance. Lying at the northern end of the Oregon Trail, the area contains artifacts from the first American pioneer settlements north of the Columbia River. The remains of early Indian fishing and hunting villages and sites also are evident.

SEDIMENT THREAT

However, this unique visual, recreational, and biological resource now faces ultimate extinction from the continuing deposition of sediment. Ever since the dam was constructed and the Deschutes River flow into Puget Sound became restricted, silt has been pouring in from the river and Percival Creek. Other filling of the lake by manmade structures such as the highway has further modified its geometry, hydraulics, and water quality.

The magnitude of the problem was documented in a preliminary engineering report in 1973.[1] Since the time the lake was filled in 1951, it has accumulated 750,000 to 1 million cubic yards of sediment. Sediment deposition since 1949 is shown in figure 4.

The upper basin in 1952 occupied 28 acres, averaging 8 feet in depth. It is now becoming a river delta consisting of several islands and submerged sandbars, reducing the average water depth to approximately 2 feet. Although some deposition continues in the upper basin, the majority of sediment now entering the lake is already being transported by the higher water velocities directly into the middle basin, forming a large submerged sandbar north of the I-5 overpass. Water depth over the middle basin delta has been reduced to as little as 2 feet.

The shallow water and sandbars have increasingly restricted active water sports. The environments created by continued accumulation of sediments have seriously reduced the lake's ability to produce natural fish food. The previous natural food production of 100 to 125 pounds per acre may be reduced to 10 to 12 pounds per acre in sandy sediment areas of the lake.

ALTERNATIVES

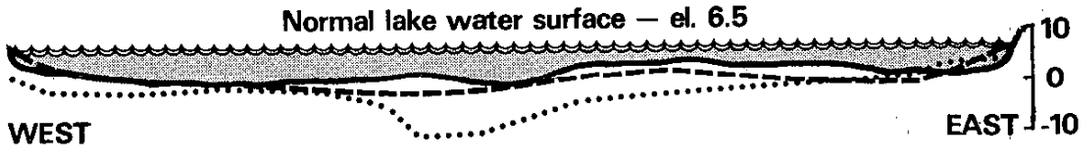
Based on information from previous studies and on new data, the consultant considered a number of alternative concepts for restoring the lake. The alternatives included:

- Dredge the upper basin to 1949 contours and provide a sediment trap in the middle basin
- Leave the upper basin in its existing state and provide a sediment trap in the middle basin
- No restoration action, allowing the lake gradually to revert to a tidal flat and river channel

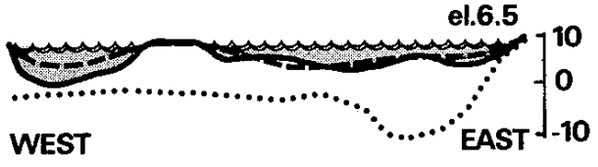
These alternatives and the recommended plan were analyzed for their cost, engineering feasibility and effectiveness, environmental impact, and compliance with established goals. The engineering considerations included:

Quantity of sediment to remove
Location of sediment removal
Disposal areas for sediment
Methods of sediment removal
Cost of sediment removal
Maintenance dredging considerations

1 Byrne, Patrick J. 1973. *Engineering investigation for rehabilitation of Capitol Lake, Olympia, Washington.* Two volumes. (Publication and plans).



SECTION-MIDDLE LAKE



City of Olympia datum
Elevation in feet-

SECTION-UPPER LAKE

LEGEND

- 1975 Bottom
- 1970 Bottom
- 1949 Bottom

SCALES

0 5' 10' 20' 30' 40' 50' VERT.

0 50' 100' 200' 300' 400' 500' HORIZ.

Sediment Deposition 4

The sediment-removal procedures evaluated were hydraulic suction dredging (16-, 12-, 8-, and 6-inch); excavation with a dragline and Sauerman bucket; and dewatering the lake and using conventional earthmoving equipment.

The recommended plan was chosen as the program which best satisfies the preceding requirements.

BENEFITS

The recommended plan of initial and maintenance dredging will produce many long-term benefits for the lake environment. Perhaps most important, the initial removal of silt will deepen parts of the lake and improve waterflow patterns. This will benefit water-based recreational activities, such as fishing, boating, and swimming, and restore much of the lake's original character.

Removal of accumulated silt by initial dredging may increase the lake's natural fish production by as much as 50 percent.[1] This increased production is expected to raise the value of sport and commercial catches of salmon by as much as $450,000 per year.

Future silt inflow will be caught in sediment traps for easier removal under the maintenance program. This process will reduce sedimentation in the rest of the lake, preserving the gains from initial dredging.

The construction of the single island and marsh in the upper basin will replace some habitat removed by dredging and create new habitat. The protective groin will shelter the City of Tumwater's park and boat ramp, as well as an archeological site, from erosion.

1 Washington Department of Fisheries, position memorandum of 18 November 1975.

ADVERSE IMPACTS

Disturbance of a portion of the marsh in the upper basin has some adverse impact. A temporary reduction in this aquatic habitat may affect waterfowl and fish, possibly reducing the variety of species now present in the basin. Some mammals, such as beaver and muskrat, which now populate the area in small numbers may temporarily migrate to other areas of the lake because of the disturbance and loss of food. This impact should be lessened by the planned buildup of the island in the upper basin.

Impacts on the manmade environment will not be significant. There will be temporary disruption of some recreational activities such as boating and fishing during the 13 to 15 months needed for initial dredging. Maintenance dredging would create a smaller disturbance for about 3 months every 2 years.

Noise from this equipment is not expected to add significantly to the lake's ambient noise level, which already draws from the sounds of I-5, a railroad marshalling yard, and motorboats. Since the equipment will operate 16 hours a day, care will be taken to avoid residential areas during sensitive hours. Likewise, activities at the disposal areas will be scheduled to minimize disturbance.

The only direct impact on land use will take place on the lakeshore. As materials are deposited along the shoreline in the middle basin, there will be an increase of shoreline access and a potential for additional recreational activities in that basin. Indirect effects on land use include increases in land value and a more satisfying aesthetic experience because of the improved lake environment.

Quantities of energy consumed by this project will be insignificant.