

ITEM	11
MANAGER'S REPORT NO.	14
COUNCIL MEETING	88/02/22

RE: DEER LAKE PARK
WATER QUALITY STUDY

MUNICIPAL MANAGER'S RECOMMENDATION:

1. THAT the recommendation as contained in the report from the Director Recreation & Cultural Services be adopted.

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1988 FEBRUARY 16

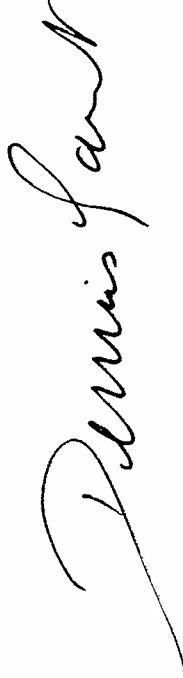
TO : MUNICIPAL MANAGER
FROM: DIRECTOR RECREATION & CULTURAL SERVICES
RE : DEER LAKE PARK - WATER QUALITY STUDY

RECOMMENDATION:

1. THAT this report be received for information purposes.

REPORT

At its meeting of 1988 February 17, the Parks & Recreation Commission received the attached staff report on the above subject and adopted the four recommendations contained therein.



DENNIS GAUNT
DIRECTOR RECREATION &
CULTURAL SERVICES

PAL:ps
Attach.

cc: Director Engineering
Director Finance
Director Planning & Building Inspection
Director Admin. & Community Services
Medical Health Officer
Chief Public Health Inspector

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RE: DEER LAKE PARK - W

RECOMMENDATIONS:

1. THAT the policy of the Commission be to maintain the water quality of Deer Lake to permit full contact recreation activity (swimming).
2. THAT the program for improvement to Deer Lake water quality as outlined in this report be approved.
3. THAT staff be directed to proceed to the next step of a study to determine design details and accurate costing for Phase I.
4. THAT a copy of this report be forwarded to Municipal Council for information.

REPORTBACKGROUND:

For approximately four years, water quality testing has been carried out in Deer Lake to provide information for decisions to be taken on action to clean up the lake waters.

The Health Department has been the prime agency involved in this work and attached is a report from the Chief Public Health Inspector outlining the Health Department's activities and recommending an action plan.

THE NEED FOR IMPROVED WATER QUALITY:

The need for improved quality can be divided into two general areas:

1. The need to have within the centre of an urban area a body of water that is aesthetically pleasing in the sense of being as clear and pure as is reasonable so that it is not offensive. This in turn makes walking, boating and fishing more pleasurable. In addition, it will encourage the presence of more and better quality game fish.
 2. To provide a water environment in which primary water contact recreation can take place, namely, swimming.
- There is a tradition of outdoor swimming in lake water in Burnaby which goes back for many tens of years within the memory of current Burnaby residents and probably back before that if the information were available.

It is considered desirable from a community point of view to preserve that opportunity for future generations. The results of the questionnaire from the Public Meeting which was held on the Development of Deer Lake would indicate that the majority of respondents concur.

On that basis, it is recommended that the Commission endorse a position of considering that water clean up to allow continued outdoor recreational swimming is a desirable objective and that it be pursued by the Corporation within the limits of the resources available to us to achieve the objective.

GENERAL APPROACH TO THE PROBLEM:

There are two main approaches to water quality improvement:

- a) treatment of the main body of lake water;
- b) treatment of the flow of incoming water.

At this time, we propose to proceed with Item (a) only - treatment of the main body of lake water.

With regard to Item (b) - treatment of the flow of incoming water, staff are continuing to assess different approaches to address this problem (e.g. first flush separators, interceptor tanks, etc.). In this way we will have immediate improved water quality albeit at a cost while the review of treating the incoming water to Deer Lake continues. The results of this review will be the subject of a subsequent report and a possible Phase II program.

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If lake treatment proves to be sufficient for our needs, we may not have to adopt incoming water treatment. This would be assessed and acted upon later if required as part of Phase II.

It will be noted that the attached report from the Chief Health Inspector comments in paragraph 5.0 (a) - that the final decanting pond could be converted into a permanent nutrient sink pond for treating Creek 3. This comment is based upon the Chief Health Inspector's perception that Parks and Recreation staff are desirous from a point of view of park development and aesthetics to create a pond in the permanent landscape. If such a pond is required, the conversion of a temporary decanting pond is one way of achieving the objective. It might then double as a permanent sink pond at a later date.

However, for purposes of this report, it is not a primary recommendation of either the Chief Health Inspector or the Director Recreation and Cultural Services and therefore is shown below as an option for Phase II.

TIMING:

It is proposed to spend two or three months during 1988 on the design and estimates of the Phase I proposals. If funds are available, work could commence in Fall 1988 and conclude in Spring 1989. We would then conduct two further years of water testing to establish pollution trends and ascertain how many years of good water quality can be anticipated from this initial treatment. The estimates run anywhere from 5 to 20 years.

At the end of two years or when water testing has established pollution trends, whichever comes first, a decision would be taken as to whether or not to proceed with treatment of incoming water or perhaps to have cyclical dredging (e.g. five years apart) to maintain a water quality that had been established as being suitable.

In the meantime, swimming and boating would continue during the years of testing, namely 1989 and 1990. Whether or not swimming will be allowed during the Summer of 1988 (i.e. pre-treatment) will be determined by the Health Department in the normal manner as part of its routine water quality testing throughout the season.

COSTS:

Funds to commission the engineering design and estimates are available in the Health Department's 1988 operating budget. This Study will provide detailed estimates for use in future capital budgeting.

The broad brush estimates prepared to date would indicate a cost in the vicinity of \$700,000. Depending on a source of budget funds, it could be considered for inclusion in the 1988 Recast Capital Budget. To protect this option, the Commission's recommended 1989 Capital Budget will contain an item of \$700,000 with funding indicated as "unknown". Revisions can then be made at Recast time and this item brought forward as appropriate.

CONTENTS OF PHASE I AND PHASE II:

The following is a list of the items proposed for Phase I, and for consideration in Phase II.

<u>Phase I - Immediate Program (1988-89)</u>	<u>Phase II - Future Consideration (1991 onwards)</u>
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|--|---|
| 1. Dredge both shallow and deep areas as described. | x |
| 2. Build retention ponds to hold and dewater the sludge. | x |
| 3. Truck away the residue - (needs more review, if desirable, could be done in 1989-1990). | |

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Phase I - Immediate Program (1988-89) Phase II - Future Consideration (1991 onwards)

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|---|---|--|
| 4. Lay bottom barrier. | x | |
| 5. Treat with alum. | x | |
| 6. Build permanent detention ponds (also called sink ponds) as permanent filters for incoming water. | x | |
| 7. Add domestic water by fountain or pipeline. | x | |
| 8. Add first flush separators which extract some of the pollutants from heavy storm water run off. | x | |
| 9. Divert first flush into sanitary sewer system. This takes the main flood waters from storms and diverts them into sanitary sewers. | x | |
| 10. Continue waterfowl removal program | x | |
| 11. Consider installation of interceptor tanks. | x | |

DEVELOPMENT OF DEER LAKE PARK:

The delay in concluding the water quality treatment and testing could also cause delays in the development of Deer Lake Park especially the western and southern segments.

It is proposed to continue with the planning and perhaps design of this development in so far as current data will allow including necessary public participation.

Out of this planning and design, capital projects for park development may be formulated and put forward for budget consideration during the period of water testing, depending on the speed with which the Commission's park development planning and design is completed.

DEVELOPMENT OF OAKALLA RESIDENTIAL AREA:

The reviews applicable to the impact of the Oakalla residential area on Deer Lake are progressing. A Consultant's report has been reviewed by staff and recommendations are now being discussed with the Provincial representatives.

Mitigating precautions will undoubtedly be taken to safe guard Deer Lake water quality for both the construction period and beyond. We do not believe that impacts from the Residential Study should in any way delay moving forward on the conclusions and recommendations contained in this report.

Further reports on the Residential Study will be coming forward for the attention of Municipal Council and the Commission at a future date.

Attach.

- C.C.
 Director Engineering
 Director Finance
 Director Planning & Building Inspection
 Members of the Technical Committee

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TO: DIRECTOR RECREATION & CULTURAL SERVICES 1987 DECEMBER 01
FROM: CHIEF PUBLIC HEALTH INSPECTOR
SUBJECT: DEER LAKE WATER QUALITY

RECOMMENDATION:

1. THAT should Deer Lake continue to be used for primary water contact recreation (swimming), the Recreation & Cultural Services Department implement a lake restoration program as outlined in this report.

1.0 INTRODUCTION:

In 1986 February, the Environmental Health Division's Consulting Limnologist submitted a report which detailed the continuing poor water quality of Deer Lake. Acting on the recommendations contained in the report, research was conducted on two lake restoration projects; a nutrient sink pond for incoming waters and lake dredging. This report details the findings of the research projects and final recommendations for a Deer Lake water quality restoration program.

2.0 CURRENT WATER QUALITY OF DEER LAKE:

During 1987 June 01 to 1987 September 30, the Environmental Health Division closed the Deer Lake swimming area for a period of seven weeks due to toxic algae blooms and high bacteriological coliform counts.

Deer Lake water quality has deteriorated to a level which is frequently in non-compliance with the recreational water quality standards of the Provincial Health Act.

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3.0 COLLECTION OF DEER LAKE WATER QUALITY DATA:

The Environmental Health Division has established a significant water quality data base for Deer Lake. The water quality assessment has focused on:

- Seasonal nutrient profiles of lake water.
- Seasonal analysis of metals in lake water.
- Nutrient profiles of lake bottom sediment.
- Analysis of metals in lake bottom sediment.
- Identification and study of tributaries in Deer Lake watershed.
- Study of ground water influences on lake water.
- Monitoring of total coliforms and faecal coliforms of all tributaries and eight lake sites.
- Evaluation of nutrient sink pond proposals, including hydrogeology of western marshland.
- Core samples of lake bottom (both shallow and deep samples).
- Biological quantification and identification of algal species found in lake.

All data is stored on the Environmental Health Division's water quality computer program.

4.0 REPORT ON LAKE RESTORATION PROJECTS:

4.1 NUTRIENT SINK POND TREATMENT

The continued assessment of Deer Lake water quality has identified Creek 3, located on the west side of Deer Lake as contributing to over 50% of the nutrient loading. In 1986 May, the Consulting Limnologist recommended a preliminary design study be undertaken of a nutrient sink pond for Deer Lake, Creek 3 drainage. The design study was completed in 1987 July.

The main conclusion of the study was that a nutrient sink pond would have an annual average of 50% efficiency for removing nutrients from Creek 3 drainage.

Both the Consulting Limnologist and Environmental Health Division staff have concluded that a 50% annual average for removing nutrients from Creek 3 will not have an immediate impact on the current water quality problems at Deer Lake.

4.2 DREDGING OF DEER LAKE:

The 1987 November, Consulting Limnologist's final report recommended lake dredging as the first step option to improve Deer Lake water quality and aesthetics.

Dredging would essentially rejuvenate the lake by removing sediments that have been deposited over many years. Removal of one meter of sediment represents 200 years of sediment deposition in Deer Lake. Although dredging will not remove the major source of phosphorus to Deer Lake (the major source being urban runoff from the watershed), it will increase the lake's ability to cope with the phosphorus load and will dramatically improve the lake's aesthetics.

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The Consultant's recommendations and rationale for dredging is summarized as follows:

a) Dredge the Shallow Regions Presently Occupied by Aquatic Plants

"Dredge the shallow regions presently occupied by macrophytes to a sediment depth of 1 metre. The macrophytes inhabit about 10 ha. (100,000 sq. metres or 24.7 acres) of the lake bottom extending from the shoreline of the lake to a water depth of 3 metres (about 10 feet). Major focus would be directed toward improving the beach area at the eastern end of the lake. A portion of the macrophyte bed would be retained for waterfowl and wildlife reserve.

Lay out a combination of sand and/or bottom barrier material on the sediments to prevent macrophytes from growing back, consolidate the exposed layer and provide an improved bottom surface for waders.

The rationale for removing this shallow layer of sediment and macrophytes is to remove the surface layer which contains a high concentration of nutrients and heavy metals. The removal of the aquatic rooted plants will remove a substantial in-lake source of phosphorus. Plants are efficient phosphorus pumps. They collect otherwise unavailable phosphorus from the deeper sediments and, upon dying, release the phosphorus into the water where algae can make use of it."

b) Dredge a Deep Hole in the Deep Region of the Lake

"Dredge a deep hole in the deep region of the lake. The hole would be about 100 metres in diameter and 3 metres deep. The hole is dredged to a depth that is significantly deeper than the mixing depth of storm events affecting the lake, producing a relatively quiescent zone where, once they enter, nutrient-containing particulates settle and are not further disturbed. The phosphorus which enters the hole is therefore trapped there and made unavailable to the upper waters.

The rationale for dredging a deep hole is to redistribute and remove surficial sediments along with phosphorus from the upper waters where plants will use phosphorus to proliferate. A more stable thermocline (temperature-density barrier) may establish, creating an effective barrier to nutrient mixing into upper layers. The hole may additionally provide a refuge for cold-water species of fish, as long as anaerobic conditions do not persist throughout the summer."

In order to dredge a portion of Deer Lake, a decanting pond system must be built to dewater the dredged sediments. Preliminary estimates for the size of the retention pond is approximately 10 acres.

5.0 ENVIRONMENTAL HEALTH DIVISION'S COMMENTS:

The Environmental Health Division has reviewed the Consulting Limnologist's report, discussed the recommendations with experts in lake restoration at the University of British Columbia and conducted an on site evaluation of a lake in Princeton, B.C., currently undergoing dredging for lake restoration purposes.

Taking into consideration information obtained from the above sources, we are recommending the following program for improving Deer Lake water quality:

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- a) Constructing a three stage decanting pond system. Staff are of the opinion that more than one decanting pond will be required. As mentioned in the Consultant's report, the dredging of Deer Lake in itself will not treat the incoming nutrients from the watershed. We are recommending that after completion of the dredging activity, the final decanting pond be converted to a nutrient sink pond for treating Creek 3. This will serve to remove a significant amount of incoming nutrients from Creek 3 and expand the length of time before redredging of the lake is necessary.
- b) Dredging Deer Lake and laying of bottom barriers as outlined in the Consultant's report.
- c) Treating the lake with alum after dredging has been completed. Treating Deer Lake with alum can be cost effectively conducted by using the dredging contractor. The same equipment used for dredging can be modified for applying of alum to the lake. Treating Deer Lake with alum after completion of the dredging activity will cause suspended material in the lake to settle to the bottom and prevent the introduction of phosphorus from the sediments.
- d) Continue program of removal of geese and ducks from the swimming area of Deer Lake to reduce the impact on waterfowl excretions on water quality.

6.0 COST ESTIMATE FOR LAKE RESTORATION PROJECT:

The Consulting Limnologist has provided an estimate of \$700,000. for the lake dredging, bottom barrier placement and construction of a decanting pond. The Environmental Health Division is of the opinion that the intricacies of the project require a firm cost projection and design criteria for the decanting pond system.

Should the Parks and Recreation Commission decide to implement a water quality restoration program for Deer Lake, the Environmental Health Division will proceed with implementing a consultant's report detailing the design criteria for the decanting ponds and costs for lake dredging, bottom barrier placement and lake alum treatment.

7.0 CONCLUSIONS:

Deer Lake is frequently in non-compliance with the requirements of the Provincial Health Act for primary contact (swimming), recreational use. Should Deer Lake continue to be recognized for primary contact recreational use, steps must be immediately taken to improve water quality.

Taking into consideration information contained in this report, the methods recommended for Deer Lake water quality restoration are:

- Construction of sediment removal pond.
- Dredging portions of Deer Lake.
- Placement of bottom barriers.
- Treating the lake with alum.
- Converting the final decanting pond into a nutrient sink pond for Creek 3.
- Continue the program for waterfowl removal from Deer Lake swimming area.

GVH/blp

cc: Director Administrative & Community Services
Director Engineering
Director Planning & Building Inspection
Medical Health Officer

George V Harvie

G.V. Harvie, C.P.H.I. (C)
CHIEF PUBLIC HEALTH INSPECTOR