71014 Addendum

LYCOTT ENVIRONMENTAL
RESEARCH, INCORPORATED
SOUTHBRIDGE, MA. 01550
617-765-0101

ADDENDUM
ELL POND
DIAGNOSTIC/FEASIBILITY
STUDY

SUBMITTED: AUGUST 23, 1985

BY
LYCOTT ENVIRONMENTAL RESEARCH, INC.
600 CHARLTON STREET
SOUTHBRIDGE, MASSACHUSETTS 01550

LYCOTT ENVIRONMENTAL
RESEARCH, INCORPORATED
SOUTHBRIDGE, MA. 01550
617-765-0101

August 23, 1985

Catherine Daly Woodbury,
Planning Administrator
City of Melrose
City Planning Office
City Hall
Melrose, MA 02176

Dear Ms. Woodbury:

This Addendum to the Ell Pond Diagnostic/Feasibility Study Final Report is provided as response to your letter of July 2, 1985 and our meeting of July 25, 1985. As indicated in our discussions on July 25, we have responded to the two remaining comments by DEQE regarding the presence of Canadian Geese on the pond and providing additional public information documentation.

The enclosed discussions should provide the requested information. However, if LYCOTT can assist in advancing the study and implementation of the recommended alternatives, please do not hesitate to contact us.

Sincerely,

Paul F. Sommer
Project Manager

PFS/bp
Attachments

LYCOTT ENVIRONMENTAL
RESEARCH, INCORPORATED
SOUTHBRIDGE, MA. 01550
617-765-0101

A.1 IMPACT OF WATER FOWL ON POND QUALITY

During the period of study a number of water fowl, including Canadian Geese and various species of ducks were seen on and around Ell Pond. A number of the geese appeared to be year-round residents of the pond. This occurs frequently in areas where residents regularly feed the geese. This is the case as towns-people feed the birds at the Main Street Park area and at residences along the south shore of Ell Pond. Clearly the positive impact of the water fowl in Ell Pond is the asthetic pleasure that the wild birds bring to the populace. Open areas and the wildlife which inhabits these areas clearly enrich the "urban experience".

However, a resident water fowl population often has a deliterious impact on the overall water quality of a pond. The fecal material of these birds is a source of nutrients and coliform bacteria. In the wild the water fowl feed on aquatic weeds and bordering vegetation. The nutrients are cycled within the aquatic system. In the urban situation, a substantial food source is imported by the populace feeding the birds. Thereby enriching the aquatic system with nutrients. In the Ell Pond watershed a certain amount of fecal material is deposited in the park area detracting from the usefulness of that area.

The water quality data collected during the study did not indicate that the water fowl have a significant impact on the overall water quality of Ell Pond. The mean concentration of phosphorus at the in-lake surface station was 0.093 mg/l and the outlet concentration had a mean of 0.107 mg/l (deleting the 10/11 value due to contamination). The increase is less than a 20% increase and in light of the EPA published desireable level of phosphorus of 0.03 mg/l for aquatic systems, the water fowl have little or no impact on the pond's limiting nutrient. Bacterial contamination is also minor compared to the measured inlet concentrations. The most significant negative impact of the water fowl population is the mess they make of the park area.

Several alternatives are employed in controlling a nuisance water fowl population. These include: trapping and release in another location, biological substitution, stringing rope just below the water surface, and hunting. The capture and release alternative may not be effective due to the mobile

nature of the animal. The birds tend to return to where they have learned there is free food. The introduction of Whistling Swans to a pond will help reduce the number of other water fowl. The swans are highly territorial and will chase away other birds. Another method of controlling geese is to string rope just under the surface of the water across the width of a pond. This has been used effectively in the small ponds at Ferncroft Country Club on the north shore. However, it is impractical on a pond the size of Ell Pond. The last alternative is hunting. This is obviously out of the question in an urban situation. Since the water quality impacts of the water fowl is not significant to the overall quality of Ell Pond, none of these alternatives has been recommended.

A.2 PUBLIC EDUCATION INFORMATION

During the project LYCOTT has been actively involved in providing information to the local press and to the populace through public meetings. In addition, the population residing within the watershed of Ell Pond should be made aware of the potential impacts of their general living habits. Although the major sources of pollution in the tributary system to the pond will be identified by the proposed storm sewer evaluation, the watershed residents can do their part in reducing the pollutant load reaching the pond.

The main source of water to Ell Pond is through the storm sewer system in the watershed. Any activity which would help increase the water quality running off the land surface into these systems will ultimately assist in helping Ell Pond.

Storm drain water total coliform data from three urban pond watersheds (Whitman's Pond, Weymouth; Spy Pond, Arlington; Indian Lake, Worcester) shows a mean concentration of 27,918 bacteria per 100 ml. These counts are derived from waste material washed off the land surface and into storm drains. A concientious effort to collect and remove pet fecal material would substantially reduce these levels. Also, increasing the asthetic nature of the neighborhoods. A source of nutrients to the watershed and ultimately is the improper use of garden and lawn fertilizers. Over-fertilization results in nutrient enriched water running off the lawn and into the storm water system. Lakeside residents should use a no-phosphorus type fertilizer. Another source of phosphorus is in the use of phosphate detergents in the watershed. Car washing for example will provide a pulse of this nutrient to the pond.

The disposal of oil or any toxic materials should be strictly prohibited. A local gas station will usually accept oil and the City DPW will dispose of turpentine, solvents or pesticides. Although one incident of pollution may not be significant, the combined effect of many such occurances can have an important deliterious effect on Ell Pond. If each individual in the watershed were to diligently follow these suggestions the ultimate impact can also have a real impact on the health or trophic state of Ell Pond.

The following is a general discussion of pond study and eutrophication (Division of Water Pollution Control 1980). This is provided for the general education of the public with regard to trophic status of ponds and lakes. Analysis of Ell Pond's trophic status indicates that the pond is highly eutrophic.

Missing Pgs 4 Thru 43

A NOTE ON LIMNOLOGY AND LAKE RESTORATION PROJECTS

INTRODUCTION

Limnology is the study of inland fresh waters, especially lakes and ponds (lentic water vs. lotic water for streams and rivers). The science encompasses the geological, physical, chemical, and biological events that operate together in a lake basin and are dependent on each other (Hutchinson, 1957). It is the study of both biotic and abiotic features that make up a lake's ecosystem. As pointed out by Dillon (1974) and others before him, in order to understand lake conditions, one must realize that the entire watershed and not just the lake, or the lake and its shoreline, is the basic ecosystem. A very important factor, and one on which the life of the lake depends, is the gravitational movement of minerals from the watershed to the lake. Yet the foremost problem affecting the lakes and ponds today is accelerated cultural eutrophication, which originates in the watershed and is translated into various non-point sources of pollution. A great deal of lake restoration projects will have to focus on shoreland and lake watershed management.

Hynes (1974) sums up the science well in stating:

> ...The conclusions...are therefore that any interference with the normal condition of a lake or a stream is almost certain to have some adverse biological effect, even if, from an engineering point of view, the interference results in considerable improvement. At present it would seem that this is little realized and that often much unnecessary damage is done to river and lake communities simply because of ignorance. It is of course manifest that sometimes engineering or water-supply projects have over-riding importance and even if they have not, the question of balancing one interest against the other must often arise. But, regrettably, even the possibility of biological consequences is often ignored. It cannot be emphasized too strongly that when it is proposed to alter an aquatic environment the project should be considered from the biological as well as the engineering viewpoint. Only then can the full implications of the proposed alteration be assessed properly, and a reasonable decision be taken. Obviously this will vary with the circumstances and the relative importance of the various consequences involved, but, at present, unnecessary and sometimes costly mistakes are often made because the importance of biological study is unknown to many administrators. Often, as for instance in drainage operations, it would be possible to work out compromises which would satisfy both engineering and biological interests.[1]

1 Hynes, H.B.N., 1974. The Biology of Polluted Waters. University of Toronto Press, Toronto, Ontario, Canada.

EUTROPHICATION

The term "eutrophic" means well-nourished; thus, "eutrophication" refers to natural or artificial addition of nutrients to bodies of water and to the effects of added nutrients (Eutrophication: Causes, Consequences and Correctives, 1969). The process of eutrophication is nothing new or invented by man. It is the process whereby a lake ages and eventually disappears. An undisturbed lake will slowly undergo a natural succession of stages, the end product usually being a bog and, finally, dry land (see Figure C). These stages can be identified by measuring various physical, chemical, and biological aspects of the lake's ecosystem. Man can and often does affect the rate of eutrophication. From a pollutional point of view, these effects are caused by increased population, industrial growth, agricultural practices, watershed development, recreational use of land and waters, and other forms of watershed exploitation.

It might also be mentioned that some forms of water pollution are natural. Streams and ponds located in densely wooded regions may experience such heavy leaf falls as to cause asphyxiation of some organisms. Discoloration of many waters in Massachusetts is caused by purely natural processes. As pointed out by Hynes (1974), it is extremely difficult to define just what is meant by "natural waters," which is not necessarily synonomous with "clean waters."

For restorative or preservative purposes of a lake and its watershed, it is important to identify both a lake's problem and the cause of the problem. Problems associated with eutrophication include nuisance algal blooms (especially blue-green algae), excessive aquatic plant growth, low dissolved oxygen content, degradation of sport fisheries, low transparency, mucky bottoms, changes in species type and diversity, and others. The pollutional cause is identified as either point or non-point in origin. A point source of pollution may be an inlet to the lake carrying some waste discharge from upstream. Or it may be an industrial, agricultural, or domestic (e.g., washing machine pipe), waste discharge which can be easily identified, quantified, and evaluated.

Non-point sources of pollution, which are the more common type affecting a lake, are more difficult to identify. They include agricultural runoff, urban runoff, fertilizers, septic or cesspool leakage, land clearing, and many more. They are often difficult to quantify, and thus evaluate.

An objective of a lake survey is to measure a lake's trophic state; that is, to describe the point at which the lake is in the aging process. The measure most widely used is a lake's productivity. Technically, this involves finding out the amount of carbon fixed per meter per day by the primary producers. Since it is a rather involved procedure to determine the energy flow through a lake system, the lake survey attempts to indirectly describe the lake's trophic state or level of biological productivity.

During the process of eutrophication, a lake passes through three major broad stages of succession: oligotrophy, mesotrophy, and eutrophy. Each stage has its characteristics (Table A). Data from a lake survey can be analyzed for assessment of the lake's trophic state. Although the level of productivity is

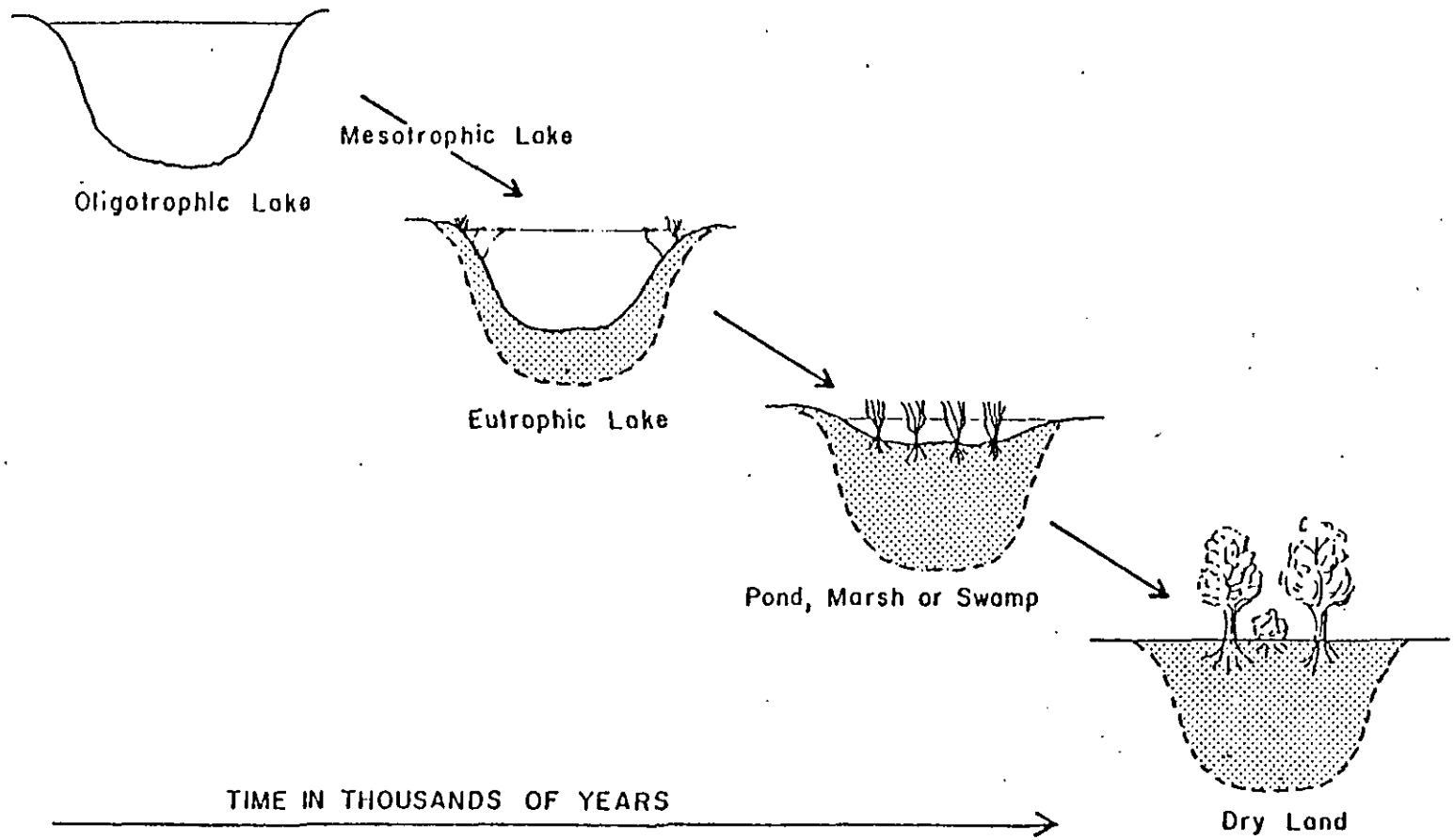
not quantified, the physical, chemical, and biological parameters measured go a long way in positioning the lake as to its trophic status. The perimeter survey helps locate and identify sources of pollution. It should be noted, however, that at the present time, there is no single determination that is a universal measure of eutrophication.

Figure D shows the various zones of a typical stratified lake. In addition to a lake's life history mentioned above, a lake also has characteristic annual cycles. Depending on the season, a lake has a particular temperature and dissolved oxygen profile (Figure D). During the summer season, the epilimnion, or warm surface water, occupies the top zone. Below this is the metalimnion, which is characterized by a thermocline. In a stratified lake, this is the zone of rapid temperature change with depth. The bottom waters, or hypolimnion, contain colder water. The epilimnion is well mixed by wind action, whereas the hypolimnion does not normally circulate. During the spring and fall seasons, these regions break down due to temperature change and the whole lake circulates as one body. In shallow lakes (i.e., 10 to 15 feet maximum depth) affected by wind action, these zones do not exist except for short periods during calm weather.

The summer season (July and August) is the best time to survey a lake in order to measure its trophic status. This is the time when productivity and biomass are at their highest and when their direct or indirect effects can best be measured and observed. The oxygen concentration in the hypolimnion is an important characteristic for a lake. A high level of productivity in the surface waters usually results in low oxygen concentrations in the lake's bottom. Low oxygen in the hypolimnion can adversely affect the life in the lake, especially the cold-water fish which require a certain oxygen concentration. Organic material brought in via an inlet can also cause an oxygen deficit in the hypolimnion. Hutchinson (1957) has amply stressed the importance of dissolved oxygen in a lake.

> "A skilled limnologist can probably learn more about the nature of a lake from a series of oxygen determinations than from any other kind of chemical data. If the oxygen determinations are accompanied by observations on secchi disc transparency, lake color, and some morphometric data, a very great deal is known about the lake."

Nitrogen and phosphorus have assumed prominance in nearly every lake investigation in relating nutrients to productivity (eutrophication). Some investigators (Odum, 1959) use the maximum nitrogen and phosphorus concentrations found during the winter as the basis of nutrient productivity correlation due to the biological minimum caused by environmental conditions. Others use data following the spring overturn as a more reliable basis for nutrient productivity correlation. In any event, considerable caution must be used in transporting nutrient concentration limits found in other lakes to the neighboring lakes.



EUTROPHICATION – the process of aging by ecological succession.

Source: Measures for the Restoration and Enhancement of Quality of Freshwater Lakes. Washington, D.C.: United States Environmental Protection Agency, 1973.

FIGURE C

TABLE A

LAKE TROPHIC CHARACTERISTICS

1. Oligotrophic Lakes

   a. Very deep, thermocline high; volume of hypolimnion large; water of hypolimnion cold.

   b. Organic materials on bottom and in suspension very low.

   c. Electrolytes low or variable; calcium, phosphorus, and nitrogen relatively poor; humic materials very low or absent.

   d. Dissolved oxygen content high at all depths and throughout year.

   e. Larger aquatic plants scarce.

   f. Plankton quantitatively restricted; species many; algal blooms rare; Chlorophyceae dominant.

   g. Profundal fauna relatively rich in species and quantity; Tanytarsus type; Corethra usually absent.

   h. Deep-dwelling, cold-water fishes (salmon, cisco, trout) common to abundant.

   i. Succession into eutrophic type.

2. Eutrophic Lakes

   a. Relatively shallow; deep, cold water minimal or absent.

   b. Organic materials on bottom and in suspension abundant.

   c. Electrolytes variable, often high; calcium, phosphorus, and nitrogen abundant; humic materials slight.

   d. Dissolved oxygen in deep stratified lakes of this type minimal or absent in hypolimnion.

   e. Larger aquatic plants abundant.

   f. Plankton quantitatively abundant; quality variable; water blooms common, Myxophyceae and diatoms predominant.

   g. Profundal fauna, in deeper stratified lakes of this type: poor in species and quantity in hypolimnion; Chironomus type; Corethra present.

TABLE A (CONTINUED)

h. Deep-dwelling, cold water fishes usually absent; suitable for perch, pike, bass, and other warm-water fishes.

i. Succession into pond, swamp, or marsh.

3. Dystrophic Lakes

a. Usually shallow; temperature, variable; in bog surroundings or in old mountains.

b. Organic materials in bottom and in suspension abundant.

c. Electrolytes low; calcium, phosphorus, and nitrogen very scanty; humic materials abundant.

d. Dissolved oxygen almost or entirely absent in deeper water.

e. Larger aquatic plants scanty.

f. Plankton variable; commonly low in species and quantity; Myxophyceae may be very rich quantitively.

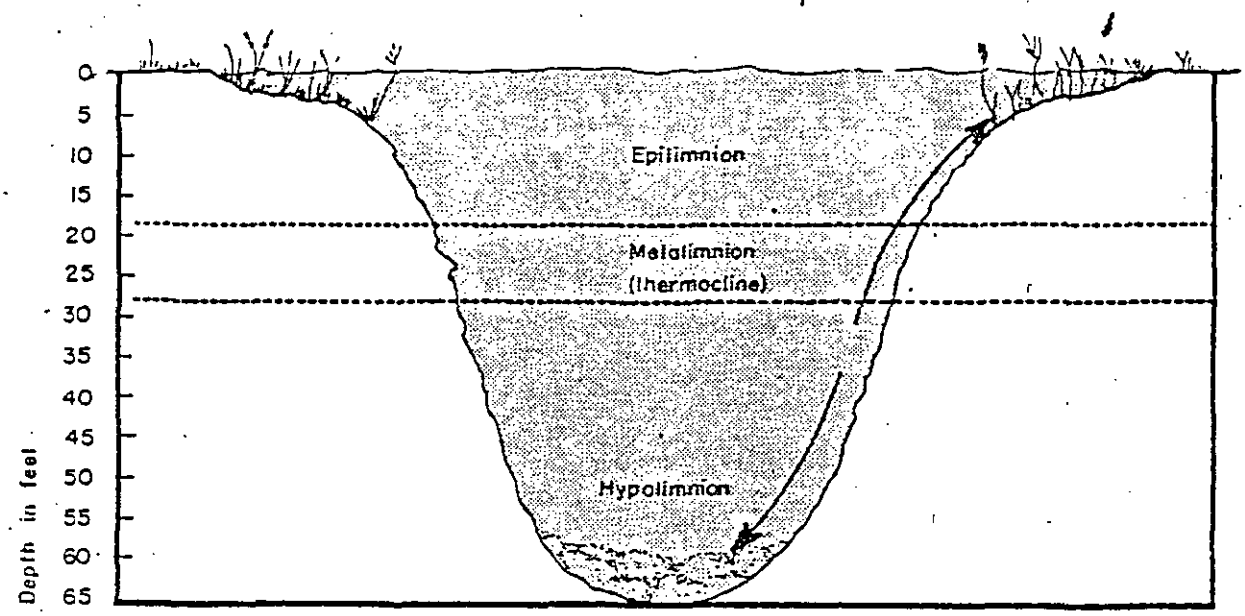
g. Profundal macrofauna poor to absent; all bottom deposits with very scant fauna; Chironomus sometimes present; Corethra present.

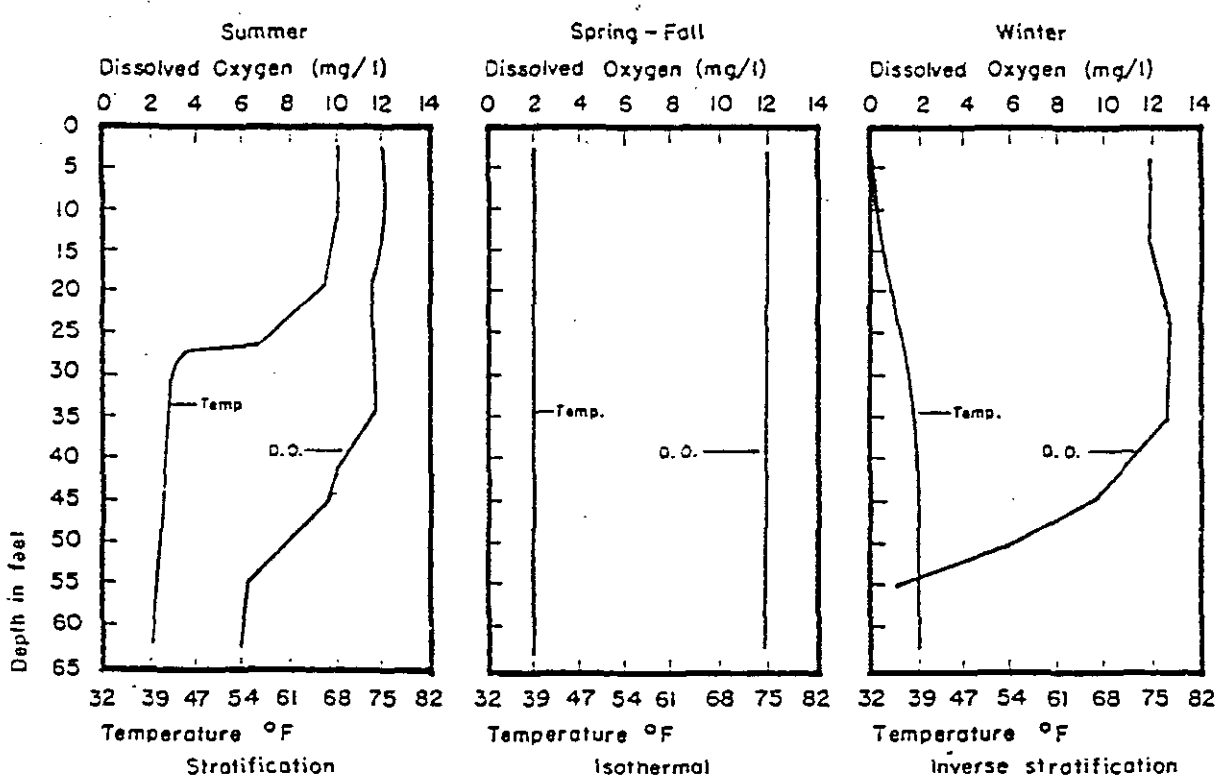
h. Deep-dwelling, cold-water fishes always absent in advanced dystrophic lakes; sometimes devoid of fish fauna; when present, fish production usually poor.

i. Succession into peat bog.

Source: Welch, P.S., Limnology, McGraw Hill Book Co., New York, 1952. (Reprinted with permission of the publisher.)

Diagrammatic sketch showing thermal characteristics of temperate lakes





Source: Measures for the Restoration and Enhancement of Quality of Freshwater Lakes. Washington, D.C.: United States Environmental Protection Agency, 1973.

FIGURE D'