LOWA LAKE MANAGEMENT PLAN

1. Purpose

The object of this plan is to record the elements of an on-going lake management plan for future use. The plan includes the total ecological make-up and assessment of ecological factors affecting the lakes and provides an ongoing plan for the management of the lakes.

2. B.O.D. Mission Statement for the Lakes

The main lake shall provide multi-purpose utilization (swimming, boating, skiing, fishing, etc.) while Keaton's Lake will be primarily fishing, boating, and swimming.

3. Background

Over the last decade, different groups have conducted several lake studies, for various reasons. Some of the studies produced valuable data and others produced less valuable data. Most of the studies were one goal oriented, i.e., a specific study for a specific problem or a specific reason. See Appendix A for a list of the known studies performed in recent years.

In 1998, LOWA began an organized development of an on-going five-year lake management plan for our two principal lakes. Unfortunately, due to various reasons the five-year aspect of the effort was not adhered to and only two Reports, Phase I- December 1998 and Phase Il-March 2000 were completed and submitted to LOWA management. It is indeed unfortunate that the five-year schedule was not completed, in view of the fact that the first two phases produced professional, usable results as a base for the Lake Management Plan.

4. Discussion

It goes without saying that our lakes are our most valuable asset at Lake of the Woods (LOW). In view of this, it is important that continuous effort be expended on lake management to protect and nurture the lakes. In order to assure their future we must understand their make-up, the ecological forces affecting them, and have a continuing plan for their management. The information provided in Phase I and II reports from GEM International should provide a sound base for the implementation of an ongoing lake management plan. To assure an on-going effort on a lake management plan, it must become a permanent line item in the annual LOWA budget so that it will get the appropriate attention each year and not get lost in the process as has been done in the past. Any budget items that may be scattered elsewhere in the budget, such as consulting fees, should be consolidated under “Lakes”.

A biologist or a company/firm that specializes in lake ecology should be located and put on a permanent annual retainer. This person/company would be an extension of the GM to become LOWA’s in house expert on lakes, make necessary recommendations and review outside consultant recommendations for actions that have to do with the lake ecosystems and general health. This entity would provide the continuity for lakes that is missing at the present time. Each time that a

GM or Maintenance Supervisor changes, all the knowledge that they have gained on LOWA leaves with them and we have to start over again at square one in many cases.

It cannot be emphasized strongly enough that in order to establish and administer a permanent ongoing Lake Management Plan, it is imperative that a main budget line titled “Lakes” be incorporated into the annual budget process replacing the present “Marinas, Lakes, Beaches” line. All other categories associated with “Lakes” would become sub-categories. Also, it is most important that the General Manager’s job description have a specific line item devoted to “lake management responsibilities”.

5. Scope of Plan

The scope of work should include, but not be limited to, the following:

A. Biological Procedures

(1) Monthly water chemistry gathering and analysis by Maintenance on a year round basis. See Appendix B for lake sampling procedures.

(2) Monitor the water flow through the drainage easements and ditches which empty into the lakes to control the rate of siltation deposits in accordance with the LOWA Storm Water Management Plan in order to develop strategies for addressing lake water quality.

(By LOWA Regulation, private owners are required to maintain these easements through their property, but only LOWA Maintenance may modify drainage easements to reduce the amount of siltation carried into the lakes.)

(3) An aquatic vegetation survey should be performed by a consultant on an annual basis. Use of controlled triploid grass carp for vegetation control and not chemical applications should be a priority. Specifically, develop a plan for on-going vegetation management utilizing triploid grass carp on a regularly scheduled basis and to utilize chemicals only after recognized expert consultants have indicated that it is the only solution to a specific problem. This should be the responsibility of M&E and Maintenance. See Appendix C for carp installation table.

(4) Current vegetative cover and outlook in the lakes will likely require the expertise of a consultant. This should be an M&E responsibility and spot checked annually.

(5) Waterfowl counts performed annually by maintenance staff.

(6) Fish population surveys should be performed by a consultant every other year. The GM and Maintenance should choose the consultant and work with them.

B. Water Management Tasks

(1) Utilize stream flow and gauging instruments to monitor input and output flows for both lakes. The equipment should not only measure water flow but should also monitor nutrients and sedimentation deposits. This effort would be monitored by Maintenance with assistance from M&E, if required. Initially the frequency of data capture would be on a daily basis until a baseline is established. After a baseline is established, the frequency may be adjusted.

(2) Hydrographic survey performed by a consultant every three years to accurately map the bottom contours of both lakes. This mapping enables monitoring of silt distribution, and understanding of various nutrient and flow dynamics. This should be an M&E and Maintenance responsibility.

(3) Using hydrographic survey maps, dredging can be scheduled in a more efficient manner. It is likely that current LOWA dredging equipment is inadequate. Finding satisfactory dredging equipment and establishing a dredging schedule should be a joint responsibility of M&E and Maintenance.

(4) The fish stocking program is handled by LUC on an annual basis. Choice of species to stock is determined by LUC, with input from the Virginia Department of Game and Inland Fisheries (VDGIF) and any other interested parties. Artificial structure should be added to the lakes only after surveys of existing structures have proven to be beneficial. LUC submits budget requirements to GM annually, and Maintenance obtains fish and stocks them with assistance from the LUC and any other interested parties.

(5) Fish habitat is determined by LUC with input from M&E and VDGIF. LUC submits budget requirements to the GM annually. Maintenance, Lake User Committee volunteers and other interested volunteers implement the installation of habitat. See Appendix D for Lake Habitat Plan.

(6) Data management should be a joint effort by M&E and Maintenance with advice from a consultant, when required.

Expansion of these elements into detailed work descriptions can be accomplished by review of past studies as identified in Appendix A.

6. Continuity of Long Term Lake Management Plan

Because management of aquatic systems is a long-term process, and activities begun today may not produce results for several years, establishment and continuity of a long-term lake management program is essential. Continuity of this plan is the responsibility of each Board and General Manager. Since there are many elements of lake management where we may not have the needed expertise, we will need the guidance of consultants to keep up with technology and not risk future problems. Implementation of the plan is the responsibility of LOWA Maintenance Department under the guidance of the GM with volunteer help from Maintenance & Ecology Committee, Lake User's Committee, Fishing Club, Ski Club, Sailing Club, etc. A budget line item designated Lakes

should replace the current budget line called Marinas, Lakes, Beaches. Sub-categories under Lakes would be Lake Management Plan, Consulting, Beaches, Marinas, Boat Registrations, Slip Rentals, etc.

7. Consulting

There are many tasks that LOWA may not have the expertise to accomplish. Any consultant, under contract, should report to the General Manager. Any contact, by LOW members, with the consultant, will only be made with the prior consent of the General Manager. Following are some, but not all, of the activities that would be appropriate for the consultant/s/ to be tasked to accomplish:

Map the lake bottom to determine extent and location of sedimentation. Recommend the method(s) to get rid of sedimentation. Advise of government regulations that apply. Offer recommendations on sources of funds other than from LOWA.

Review the results of the water analysis accomplished by LOWA personnel and make recommendations on improving the quality, if required. This includes identification of the pollution and ways to correct/improve the situation. Document the watershed and determine the source of pollutants, if found, in the lakes.

Provide assistance in recommending stocking of fish types. Provide recommendation on the quantity of grass carp to be put in the lake every year based on a physical survey of aquatic vegetation and the carp population size and age.

Periodically survey the lake fishery health by doing population surveys. This could be done with electroshock, diving, netting, creel surveys, etc.

Recommend kinds of artificial habitat for placement in lakes and location deemed to be the most productive for spawning and for fishing.

Make any other recommendations considered necessary/prudent to aid in accomplishing the objectives of the Lake Management Plan.

APPENDIX A Prior Studies

1. 1977 Environmental Status Report (Dr. Goodell UVA)
2. 1990 George Mason University
3. 1997 George Mason University (Dr. Kelso)
4. 1997 ESS Water Quality Analysis
5. 1998 Dewberry and Davis
6. 1998 GEM International (Draft)
7. 1999 GEM International Lake Management Plan (Final)
8. 2000 GEM International (Final)
9. 2000 Virginia Inland Game and Fisheries
10. 2001 AEM Lakes Survey
11. 2001 Bill Mason Memo “Next Actions on Lake Management”
12. Undated LOW Lake Management Plan

APPENDIX B

LOW LAKE SAMPLING AND SAMPLE ANALYSES PROCEDURES

INTRODUCTION

This report documents procedures used during 1989, 1999 and 2000 in sampling the water quality of the two lakes in Lake of the Woods and, this document is provided as guidelines for future water sampling and analysis. The sampling has two distinct parts: (1) obtaining field observations and collecting water samples, and (2) defining chemical and physical characteristics of the lakes waters through "laboratory analyses".

LAKE SAMPLING

Before beginning any sampling operations, each individual should read available manuals and become familiar with the equipment and instruments. The following comments are intended as supplemental suggestions based upon sampling experience.

FIELD OBSERVATIONS AND WATER SAMPLING

During the period described in the introduction, field observations at the 10 sampling sites on the Main Lake commonly required about 3 hours to accomplish. The 8 sites on Keatons Lake require about 2 1/2 hours. Two people are an adequate crew, however 3 people eases the effort.

Observations are done most efficiently and safely from a pontoon or deck boat, but a stable mono-hull or a catamaran would suffice.

PREPARATION

PROCEDURES

Before leaving for the boat check to see that all instruments are present. If needed extra batteries should be obtained for the T/DO meter (6 AA Alkaline batteries).

EQUIPMENT

Boat with motor and anchor (at least 100 feet of line)

- Seichi Disk - with attached line marked in meters

- Depth Finder or plastic measuring tape - with weight attached

- Temperature \Dissolved Oxygen (T\DO) meter YSI model 55D with 50 foot cable. Sensor probe is kept in moist compartment on the side of the meter

- LaMotte Water Sampler Model JT-1 with attached line marked in meters

- Numbered plastic sample bottles (12)

- Clipboard with pre-printed data recording forms in the clip and maps showing the sampling sites on each lake.

On the boat at the dock unpack the equipment. Turn on the T\DO meter (it takes about 15 minutes to stabilize). Keep the probe in the moist chamber on the side of the meter. Secure the anchor line to boat.

Sampling is done in the order of the numbers and at the locations shown on the maps. Using either the depth finder or the plastic measuring tape, the deepest location is found near the channel at the number marked on the maps. Anchor the boat. Record all observations on the pre-printed forms as soon as the readings are taken. Also add to the forms the current weather conditions (cloud cover, temperature, wind, etc) and any other observations that may be of interest(bird counts, dead fish, unusual lake conditions, lake activity, etc.). A reading of the water surface elevation should be included. There are gauges at the dam and at Flat Run but the gauge at the dam is the most accurate.

TEMPERATURE\DISSOLVED OXYGEN MEASURING

Using the YSI Model 55 dissolved oxygen meter proceed with taking temperature and dissolved oxygen at intervals as shown on the recording form (The number of measurements depends upon the depth of the site). If bottom is reached with the instrument the dissolved oxygen level will fall rapidly. Do not use this value.

At some locations only two measurements may be taken. At sites 9 and 10 in the Main Lake, because the water is shallow, only one measurement is taken about halfway to bottom. Between sites leave the meter turned on and make sure that the probe is In the moist chamber.

The temperature shown on the meter will stabilize quickly. The dissolved oxygen (in Milligrams per liter, shown as mg\l) requires some time to stabilize, as the process used is osmosis through a membrane. Take the reading when the rate of changing values slows. To also observe the percent of saturation, press the mode button and read the value shown immediately. Note: If the readings become erratic or the meter shows "low bat. " the batteries need to be replaced as soon as possible, certainly before the next outing. Indications inside the battery chamber show the correct placement of the batteries.

WATER SAMPLING

If a thermocline (sharp change in temperature and dissolved oxygen) is present dividing the water column, a water sample is taken about midway in each regime. If temperature and dissolved oxygen readings are roughly uniform from surface to bottom, only one sample needs to be taken at about mid-depth.

Water samples are obtained with the LaMotte Water Sampler, Model JT-1. Some practice may be required to prepare the sampler for use.

Squeezing the handle of the sampler raises two pins In the handle. The cables that extend from the ends of the sampler are pulled out one at a time and the loops on the ends are placed over these pins as the cups (or plugs) are pulled out of the tube, one at a time. The elastic on the cups should be extended far enough so that the nylon washer at the end of the cup rests against the edge of the tube. The sampler is lowered to the predetermined depth and the brass traveler is allowed to slide down the line to close the sampler. A slight jerk will be felt. Raise the sampler to the boat. To empty the water sampler into a sample bottle, tilt the sampler to almost vertical with the small water release tube pointing down. With a sample bottle below this, allow the water to flow by slightly opening the upper rubber cup. This will allow the water to flow from the release tube. Use a bottle numbered to agree with the site number. If an additional bottle is needed, use a number that does not correspond to a sampled site. Record the bottle number on the data form, circled, next to the appropriate depth.

SEICHI DISK

The Seichi Disk (Black and White circle) is used to obtain a measure of the clarity of the lake waters. It should be lowered in the shadow of the boat and observed without sun glasses. It is lowered until it is no longer visible. This depth is noted. the disk is raised until it becomes just visible. This depth is averaged with the other to obtain the recorded reading.

NOTE: The box containing the Instruments should be allowed to dry completely before being closed for storage between sampling outings.

LABORATORY ANALYSES

During the testing period five chemical and physical characteristics of each water sample were defined by a "laboratory analysis". Acidity(pH) was determined with the Oakton pH testr2 instrument that directly observes pH when inserted into the sample. The other four constituents (Nitrate, Phosphate, Alkalinity and Turbidity) were defined using the 975MP ANALYST Instrument produced by Orbeco-Hellig Company. The instrument defines water sample characteristics by comparing changes in a light beam passed through a "blank" sample and through a treated sample. Preparation of the treated sample requires adding selective chemicals, mixing and awaiting reaction time.

A complete laboratory analysis is time consuming. At least 18 minutes is requires for each Nitrate determination and at least 12 minutes is required for each Phosphorus determination, although 10 minutes of each analysis is spent waiting for a chemical reaction in the sample.

To facilitate the work, it is common practice to analyze the four constituents concurrently. The work begins by (1) Mixing ingredients for the Nitrate test, (2) Mixing chemicals for the Phosphate test, (3) Mixing the Alkalinity sample, (4) While awaiting the Nitrate and Phosphate reactions use the 975 MP ANALYST to define the Turbidity and Alkalinity values, (5) Read the pH meter, and (6) Analyze the Phosphate and Nitrate samples. Each water sample requires 45-60 minutes of laboratory time. Step by step details of the analyses procedures follow:

1. Plug in "ANALYST" or put batteries in unit.

2. Fill 3 glass sample tubes (cells) to the 10 ml mark with the lake water sample. Two of these tubes will be used to mix chemicals for the Alkalinity and Phosphate tests. The third will be used as a "blank" for the Alkalinity, Nitrate and Phosphate Tests. This third tube will also be reused as the lake sample for the Turbidity test. Finally, fill a glass tube to the 10 ml mark with distilled or de-ionized water to be used as the "blank" for the Turbidity test. This tube of distilled water should be retained, to be used, if additional or multiple samples are to be analyzed.

3. Fill the plastic Nitrate Reduction Tube, to the 20 ml mark with the lake sample water, Add a level spoonful (spoon attached to container handle) of RT 124 and one RT 125 Nitrate No. 1 tablet . Cap and shake for 1 (one) minute. Let the tube stand for one minute. Invert tube gently 4 (four) times to confirm mixing and flocculating and let this set for 2 (two) minutes or more.

4. During the wait in step 3, place one Phosphate RT 140 tablet (No. 1) in the Phosphate test glass tube, which contains 10 ml of sample water1 crush the tablet and stir until it is mostly dissolved. Then for later use place 1 (one) RT 141 Tablet (No.2) In it's wrapper on the table behind the glass tube.

5. For later use place 1 (one) Nitrate RT 126 tablet (NO. 2), in Its wrapper behind the empty Nitrate test tube.

6. Place 1 (one) Alkalinity tablet RT 104 into the glass tube, containing lake sample water, that was set aside to test for alkalinity.

7. Carefully wipe the upper inside part of the plastic Nitrate Reduction tube with tissue. Pour 10 ml of this fluid into the empty Nitrate test tube.

8. Crush with a clean rod, the No.1 Phosphate tablet in the Phosphate tube and then add and crush the No. 2 Phosphate tablet there may be an un-dissolved residue). Stir, do not shake.

9. Crush with a clean rod the No 2 Nitrate tablet In the Nitrate tube (There may be a residue). Stir, do not shake.

10. **SET TIMER FOR 10 MINUTES**

11. Crush an Alkalinity tablet in the cell with a clean rod – do not shake. This tablet will dissolve completely.

12. Proceed with the Alkalinity test and the Turbidity test. Repeat through machine 6 (six) times and record.

13. To use the Photometer set the test number and check and set the wave length setting on the dial on the side of the machine as Indicated. The machine will indicate the correct setting for that particular test.

14. Repeat the Nitrate and Phosphate tests through the meter 3 (three) times each and record the readings.

15. Empty the sample collection bottle 50%. Turn on Ph meter and stand it in the plastic sample bottle approximately 1 minute - jiggle then read

16. Rinse all cells well with tap water after each series of sample tests except for the one filled with distilled water (this one is used for the turbidity test). Pay particular attention to wiping out the Nitrate Reduction Tube---Some of the metal powder may stick to the sides or top.

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D. Thomas
February 2000
LOW\smpltst

APPENDIX C Grass Carp Stocking Program

Draft Policy provided to GM/Maintenance July 2003

APPENDIX D Lake Habitat Plan

- Do not purchase/install any additional Berkley habitat at the present time.
- Move existing Berkleys that can be located and that are not productive, to areas considered to have more potential. Add some Berkleys to the existing "reef" structure. All moved/relocated Berkleys to have hardwood brush inserted as possible. Maintenance would assist in this effort.
- Add five structures made of hardwood "pallets" in a teepee format, with brush, for evaluation. These to be added adjacent to existing marker buoys in areas considered potentially productive. Maintenance would assist in this effort.
- Add cedar brush to the "reef" as this seems to work very well in attracting/holding panfish-sunfish, bluegill and crappie.
- Record, using GPS, each moved/added habitat for future reference. Maintenance would assist in this effort.
- Prepare a map that shows location of known added habitat and pass these maps out to individuals as they get their boat decals. Add cautionary notes on the maps as considered appropriate.
- Fishing Club to prepare an article for "Highlights" offering encouragement to lakeside property owners to add habitat as approved by LOWA management to their docks and offering Fishing Club member assistance in adding such habitat.
- Continue to monitor and record fish populations on various types of habitat. Add habitat as determined to be effective in areas of the lake considered appropriate, i.e. around/adjacent to buoys and other locations as considered potentially productive and consistent with multi-use mandate for the lake.