Feasibility Study
of Raising Water Levels on Coon Lake (2-42)
Anoka County, Minnesota

Minnesota Department of Natural Resources
Waters

February 1, 2000

Contents

Introduction

Minnesota Laws of 1999, Chapter 231, Section 5, Subdivision 3, directed the Department of Natural Resources (DNR) to complete a "...feasibility study of raising the control elevation of Coon Lake in Anoka County," and earmarked $20,000 of DNR Waters' base budget for the study. The legislation directed the DNR to complete the study by February 1, 2000. A Coon Lake location map is shown on the following page.

Ideas on the content and form of this report were solicited from several people inside and outside the DNR. Those consulted outside the DNR included the Board of Water and Soil Resources, the Anoka Soil and Water Conservation District, and the Coon Lake Shoreliners. Because no new dollars were provided for the study, DNR Waters staff were assigned to complete the technical work, including the collection of field data and the hydrologic and hydraulic analysis. An outside consulting firm was hired to conduct the shoreland owners' opinion survey.

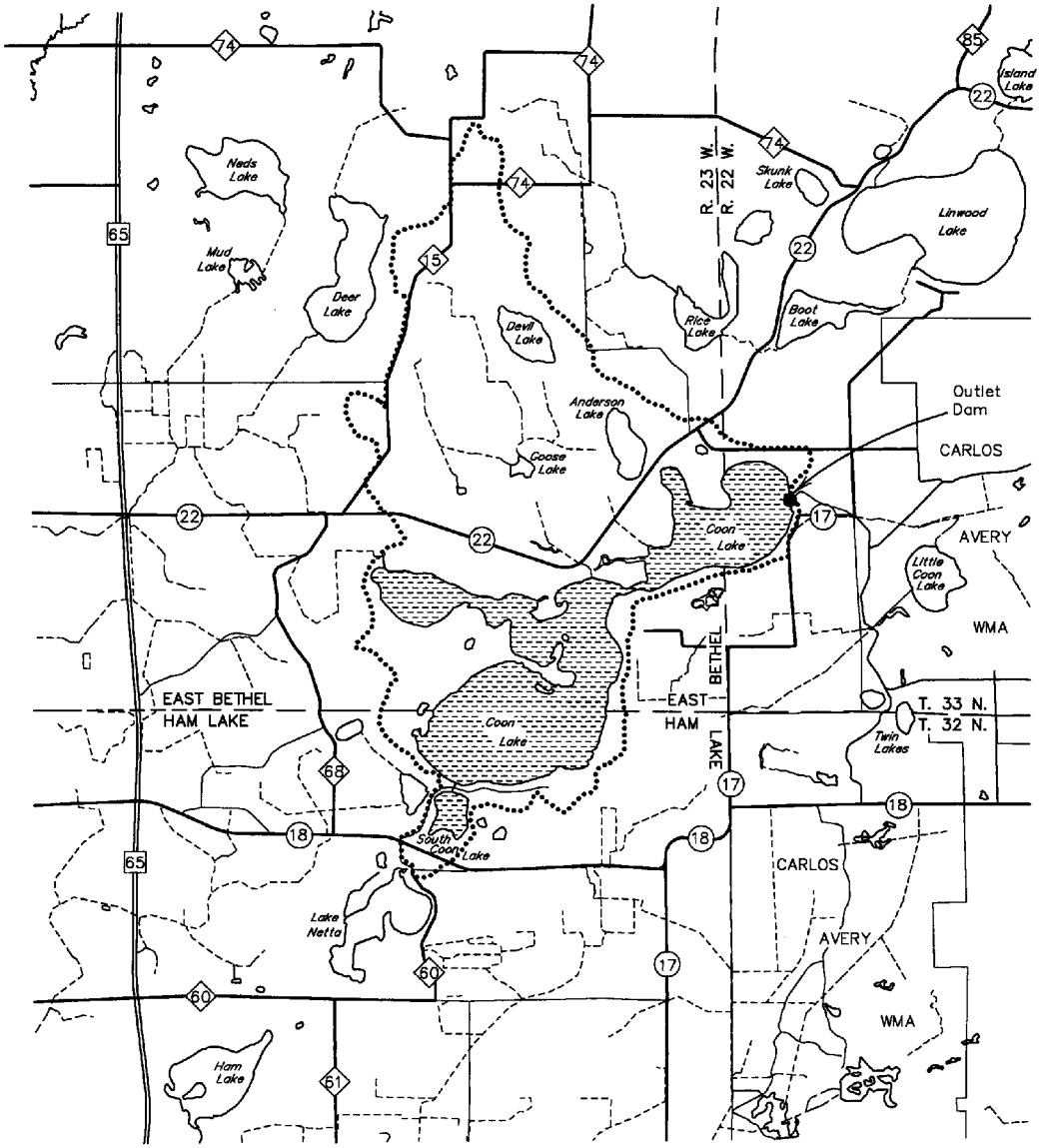
Estimated Cost of this Report:	DNR staff cost	$19,946
[Minnesota Statutes, Section 3.197]	Consultant contract	$ 4,999
	Total	$24,945

Historical Background

Beginning in 1934, concerns over low levels on Coon Lake were expressed to the DNR (at that time called the Department of Conservation) by lakeshore owners and local sporting groups. The east outlet (South Branch Sunrise River) had been ditched, and combined with the effects of the worsening drought, Coon Lake had dropped several feet. Local interests made repeated requests for a project to divert water from other nearby lakes, notably Neds and Deer, into Coon Lake to raise its level. Neds and Deer Lakes combined are much smaller than Coon Lake, and were also quite low due to the drought. The DNR made many investigations into the proposed diversion, but found that there was not enough water available in the neighboring lakes to make a diversion project feasible.

After several years of requests to divert water into Coon Lake, and some tampering with the primary lake outlet (which was a narrow channel through a scrub/shrub wetland on the east end of the lake), the Commissioner agreed to conduct a public hearing. Hearings were conducted on June 12, 1947 and June 23, 1947 to consider "a proposal to stabilize and control the levels of Coon Lake and Little (South) Coon Lake." Eight individuals testified or offered statements at the hearings. Participants in the hearing included the Division of Water Resources and Engineering, the Division of Game and Fish, the Attorney General's Office, the Coon Lake Improvement Association, and the Coon Lake Sportsman's Club.

Location Map



BOUNDARY OF COON LAKE WATERSHED

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0 1 2

Approximate Scale in Miles

On August 8, 1947, Deputy Commissioner E.V. Willard ordered that the ordinary high water level (OHW) of Coon Lake is at elevation 906.5 (904.75, NGVD-1929[1]), that the lake be maintained by construction of a solid weir crest dam with its elevation 905.2 (903.45, NGVD-1929), and that no person shall, under any circumstances, tamper or interfere with the outlet channel or control structure of Coon Lake.

The outlet dam was funded by the Division of Game and Fish, and built by a DNR Fisheries construction crew. Work was completed on November 3, 1948. The roadway to the dam was funded and constructed by the Coon Lake Sportsman's Club.

Minnesota experienced a period of very wet conditions in the mid-1980's, resulting in high lake levels in many parts of the state, including the metro area. Coon Lake reached its highest recorded level of 905.11 on May 16, 1986. In response to high water complaints, the DNR Waters field survey crew investigated the Coon Lake outlet in November 1986. They noted the presence of several "high spots" in the outlet channel downstream of the dam, and accumulations of sediment, debris, and vegetation between the lake and the dam, but found that the crest of the outlet dam was still acting as the lake's runout. (The "runout" is the lowest point at which surface water will flow out of a basin.)

Climatic conditions changed dramatically over the following two years, and late in the drought year of 1988, water levels on Coon Lake dropped to their lowest recorded elevation of 900.27, and remained low through 1989. Water levels rose in the years 1991 through 1995, resulting in renewed complaints about high water.

In early 1996, Anoka County applied for and received a permit for maintenance excavation in the channel from the open-water portion of Coon Lake to the dam, through a heavily vegetated fringe of cattails and sparse shrubs. The channel dimensions were to be 25' wide by about 3' deep by 350' long with 1:1 sideslopes. A ditch extending about 1500' downstream of the dam also was to be cleaned as part of the project, but it was not under the regulatory jurisdiction of the DNR. The work was completed before ice-out in the spring of 1996.

Over the summer of 1996 water levels dropped about one foot. In response to local concerns, the DNR Waters survey crew checked elevations on the outlet dam and reported in a September 19, 1996 memo that the "...dam is essentially at the same elevation as when it was completed on November 3, 1948. The dam is in good condition and shows no signs of settling or heaving...".

Twelve parties, all Coon Lake landowners, brought an action in Anoka County District Court entitled David and Donna Koenig, et al. v. The County of Anoka, et al., naming the County and the State as defendants. The action alleged claims and damages arising out of the 1996

[1]The elevations stated in the August 8, 1947 Commissioner's Order were based upon a benchmark set by a DNR engineer in 1941: "railroad spike in the notched southwest root of a 25" lone elm tree at the east outlet elevation 908.50, project datum". In January 1975 the DNR Waters survey crew ran looped levels from MnDOT BM "1380 B1 1969" to the railroad spike and found it to be at elevation 906.75, NGVD-1929 (National Geodetic Vertical Datum), or 1.75' lower than project datum. All elevations stated in this report are based on NGVD-1929.

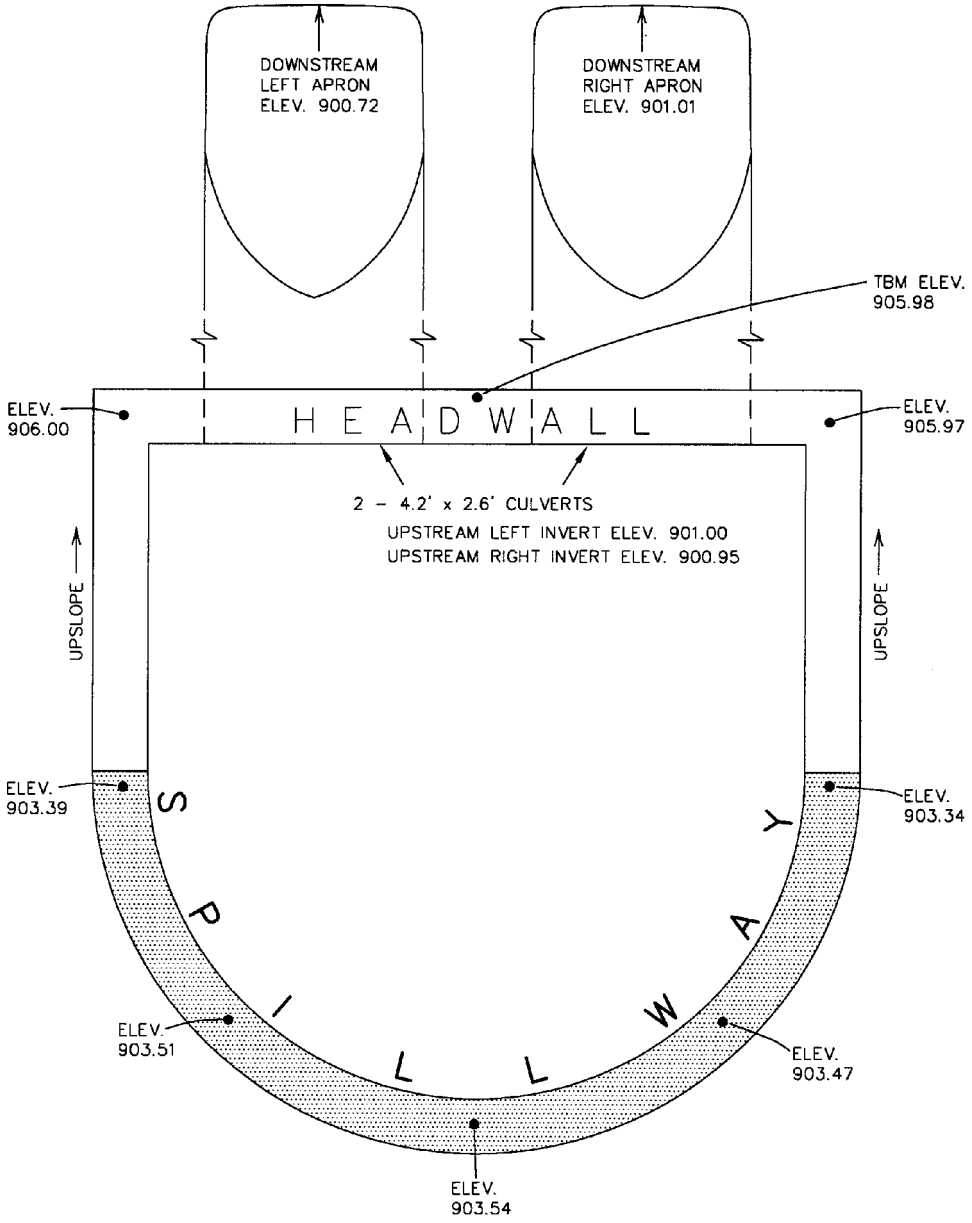
channel maintenance work. With a September 1999 trial date set, the parties involved in the suit agreed to attempt mediation to settle the issues. A mediation session was held on October 23, 1998, and an agreement was reached in which the plaintiffs agreed to dismiss the action without prejudice. The plaintiffs were advised to work with local governments, in particular, the Sunrise River Watershed Management Organization (WMO) to study lake level adjustments. The DNR and County agreed to assist the groups.

Field Survey of Lakeshore

To support this study, the DNR Waters survey crew spent parts of five days investigating the physical character of Coon Lake and gathering elevations at various sites around the lake. The results are summarized here, and the complete survey reports and drawings are on file at both the DNR Waters central office and the metro regional office.

September 23,1999
Elevations were obtained along the primary outlet channel, from upstream of the outlet dam to downstream of the county park entrance road. A September 1998 photograph of the outlet dam looking downstream is shown below. The average elevation of the concrete spillway of the outlet dam based on five shots was 903.45 (see Figure 1).

Coon Lake Outlet Dam - 1998



AVERAGE SPILLWAY ELEVATION = 903.45, NGVD 1929
SURVEY DATE: SEPTEMBER 23, 1999

Figure 1. Plan View of Existing Outlet Structure

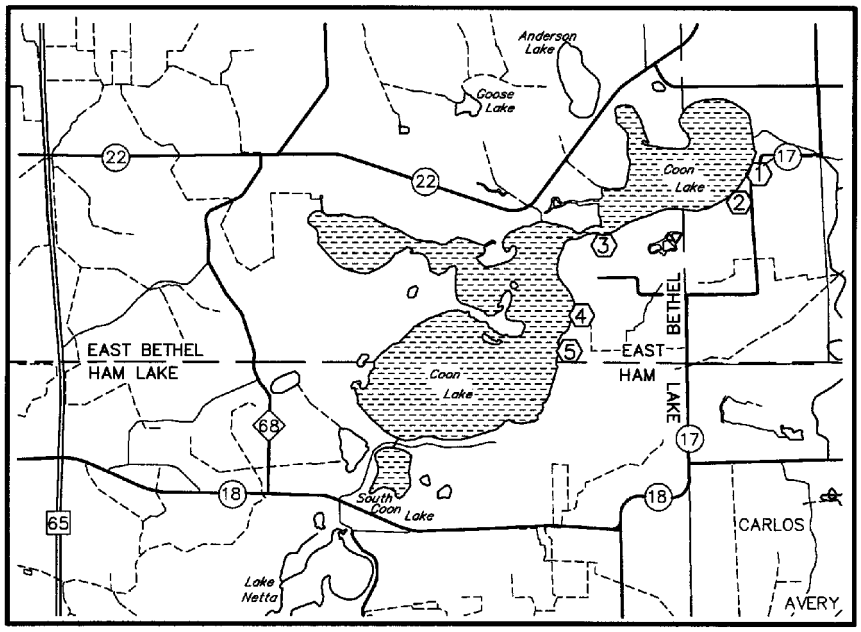


Figure 2. Location of Road Top Profiles

1. Lexington Avenue (Co. Rd. 17)
2. 190th Street
3. Lake Shore Drive
4. Cedar Street
5. Cedar Street

October 5-6, 1999
Road top profiles were obtained at five locations that were reportedly affected by high lake levels prior to the 1996 channel maintenance (see Figure 2 on preceeding page).

The entire shoreline was viewed by boat, and approximate lowest floor elevations were obtained at twelve residences (see Figure 3), with cross sections taken at four of those residences (Figures 4 and 5 show two of the cross sections).

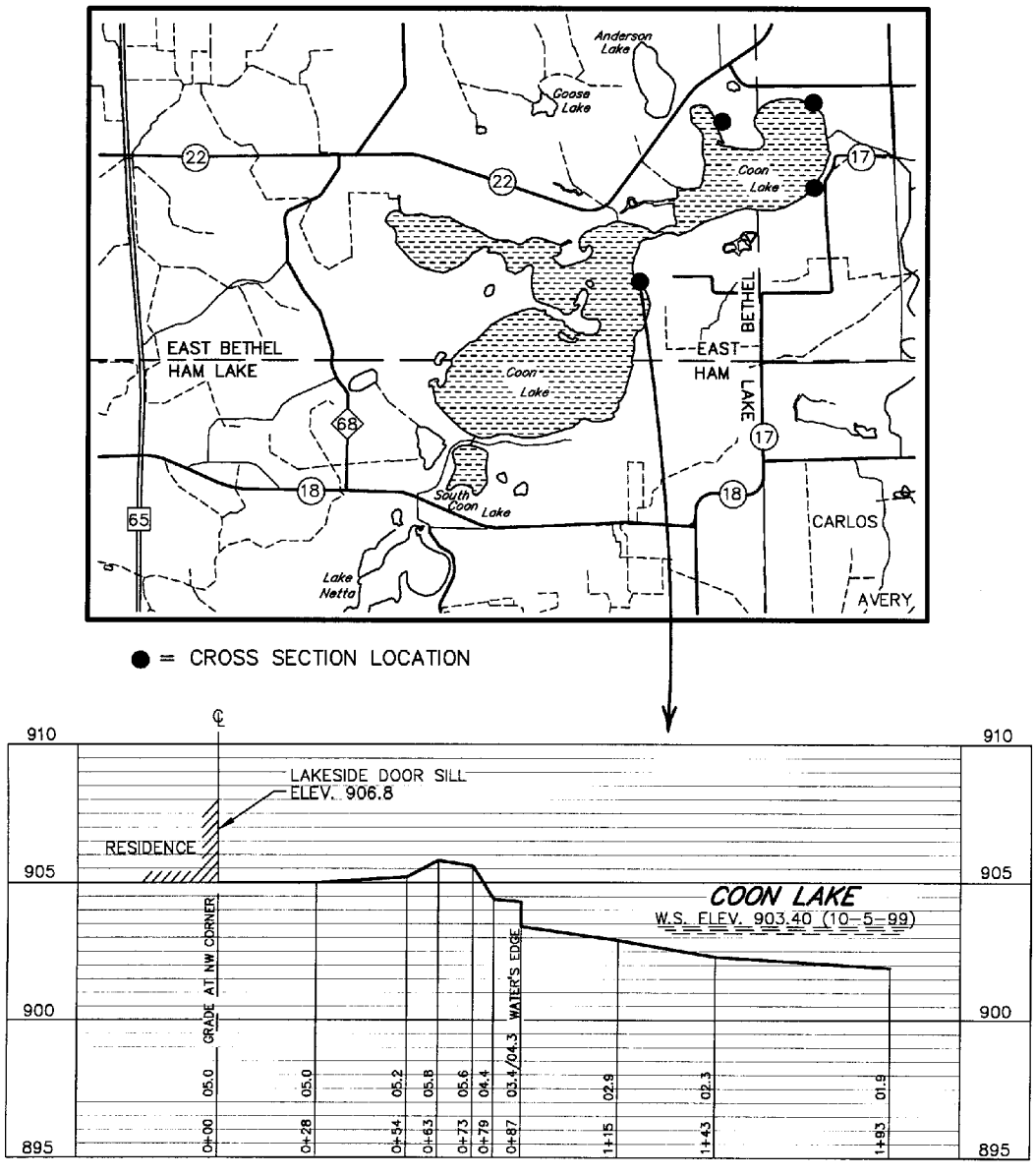
December 13, 1999
Runout elevations were obtained at three secondary high water outlets (see Figure 6).

January 6, 2000
The runout elevation at a fourth secondary high water outlet (County Ditch 38) was obtained (see Figure 6); along with additional elevations along the primary outlet downstream to Lexington Avenue.

Figure 3. Lowest floor elevations of selected structures.

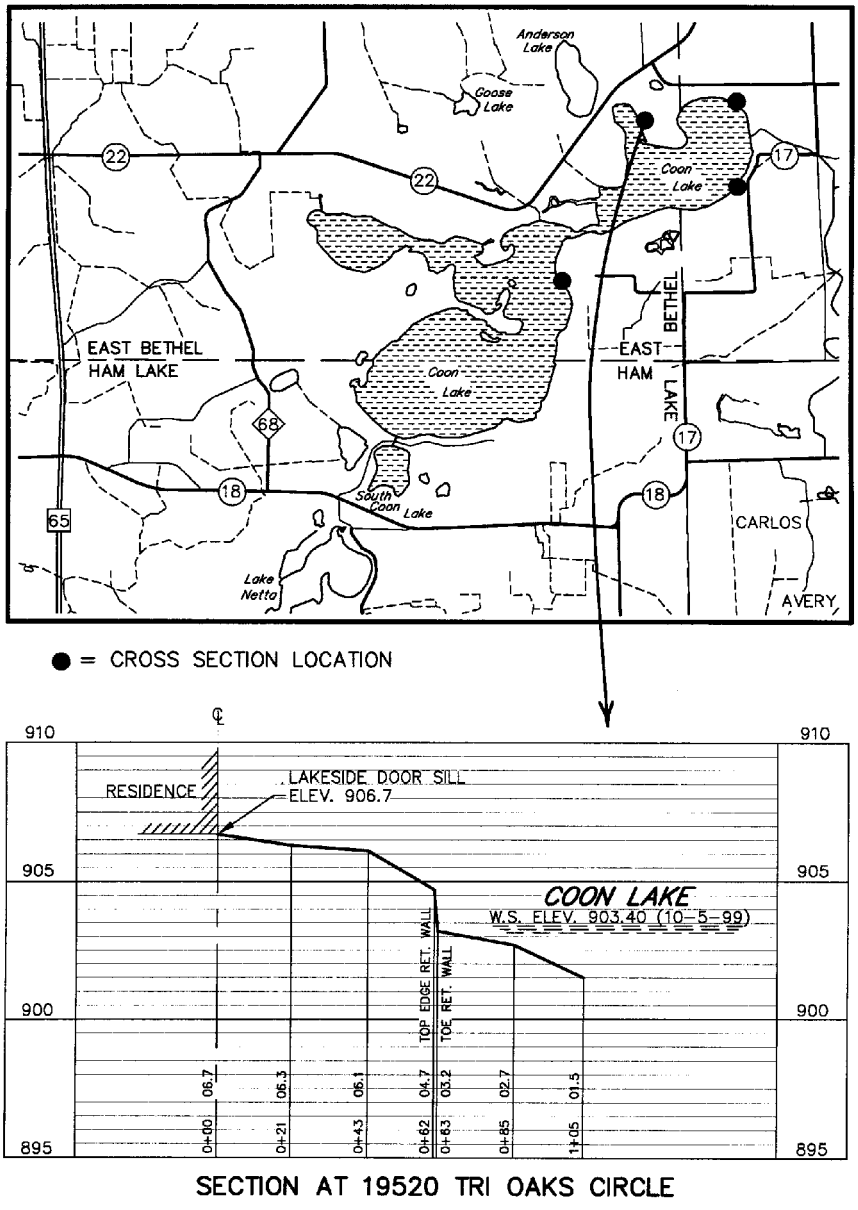
Address/Location	Approximate Lowest Floor Elevation
1) 428 Aspen Street*	906.8
2) no address-1st cabin NW of 428 Aspen Street	906.6
3) 2nd cabin NW of 428 Aspen Street	906.1
4) 3rd cabin NW of 428 Aspen Street	906.3
5) 19520 Tri Oaks Circle*	906.7
6) 19419 Tri Oaks Circle	908.2
7) 5332 197th Avenue*	908.2
8) 5334 197th Avenue	908.2
9) 5327 190th Street*	907.0
10) 2nd cabin east of 3557 Interlachen Drive NE	906.0
11) 17666 Oakland Drive NE	906.0
large storage bldg. separate from house	905.9
12) 18617 1/2 Lakeview Drive (new home under construction)	908.2

*cross sections obtained at these locations



SECTION AT 428 ASPEN

Figure 4. Cross Section at 428 Aspen Street



SECTION AT 19520 TRI OAKS CIRCLE

Figure 5. Cross Section at 19520 Tri Oaks Circle

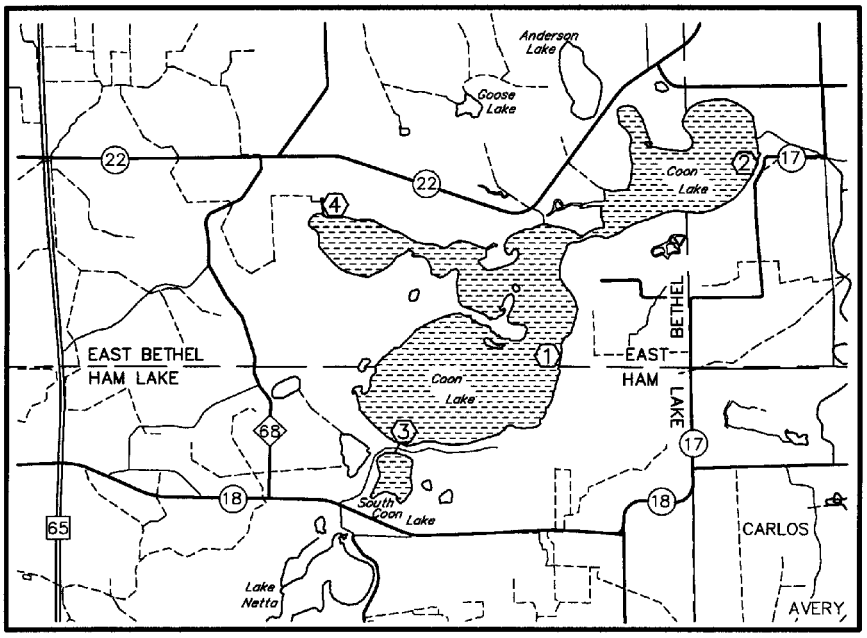


Figure 6. Location of Secondary High Water Outlets with Runout Elevations

(1) Cedar Street, elev. 903.9
(2) Lexington Avenue (Co. Rd.17), elev.904.0
(3) Netta Lake, elev. 904.2
(4) County Ditch 38 – no direct surface connection

Hydrologic and Hydraulic Analysis

A Coon Lake hydrologic and hydraulic analysis was performed to characterize the lake's hydrologic response and provide a tool for simulating the effects that alternative proposals for raising or otherwise modifying the outlet dam would have on future water levels. The Corps of Engineer's Hydrologic Engineering Center's River Analysis System model (HEC-RAS) was used to model the outlet channel conditions. DNR Waters' Water Budget model (WATBUD) was used to simulate lake levels. WATBUD combines the effects of outlet hydraulics from HEC-RAS with climate variables to simulate lake level changes. Climate variables include precipitation, watershed runoff, and evaporation. Precipitation and temperature data from East Bethel were used in the analysis.

Historic Lake Levels

Recorded lake levels date back to 1938 (see Figure 7). Over the period of record, lake levels most often were between 903 and 904. Pronounced periods of low levels in the late1970's and late 1980's are evident, as are high levels in the mid 1980's. The peak levels in 1986 may have been exacerbated by beaver dams, which were removed by DNR following high water complaints. In 1996, following several years of high levels, outlet channel maintenance was performed. Since 1996, Coon Lake and other nearby lakes have shown a decline (see Figure 8).

The nearest DNR observation well is Ob Well #02014, which is located near 176th Avenue NE and Swedish Drive in Ham Lake. Water levels in this observation well also have shown a decline since 1996 (see Figure 9).

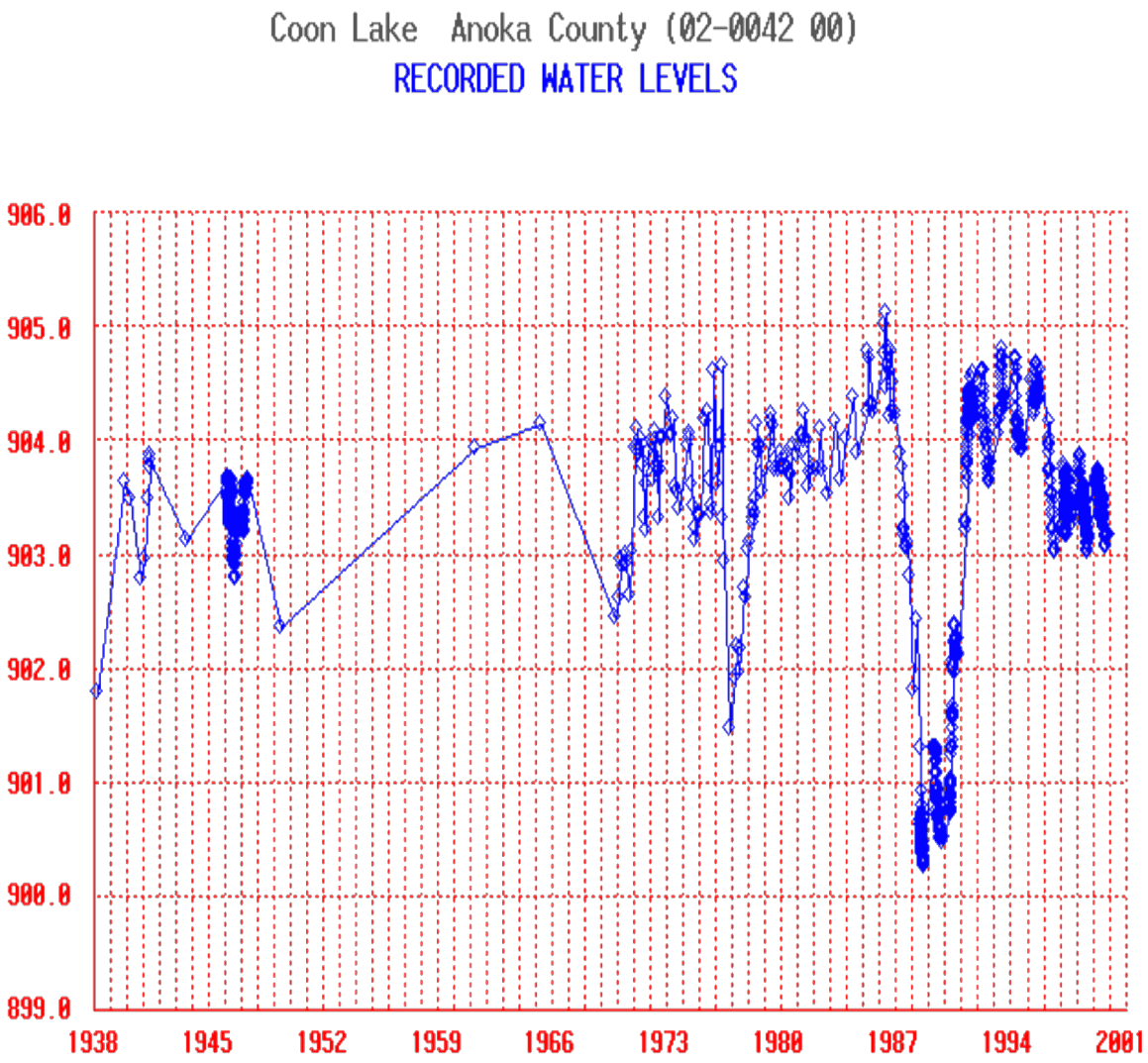


Figure 7. Recorded Coon Lake Water Levels (")

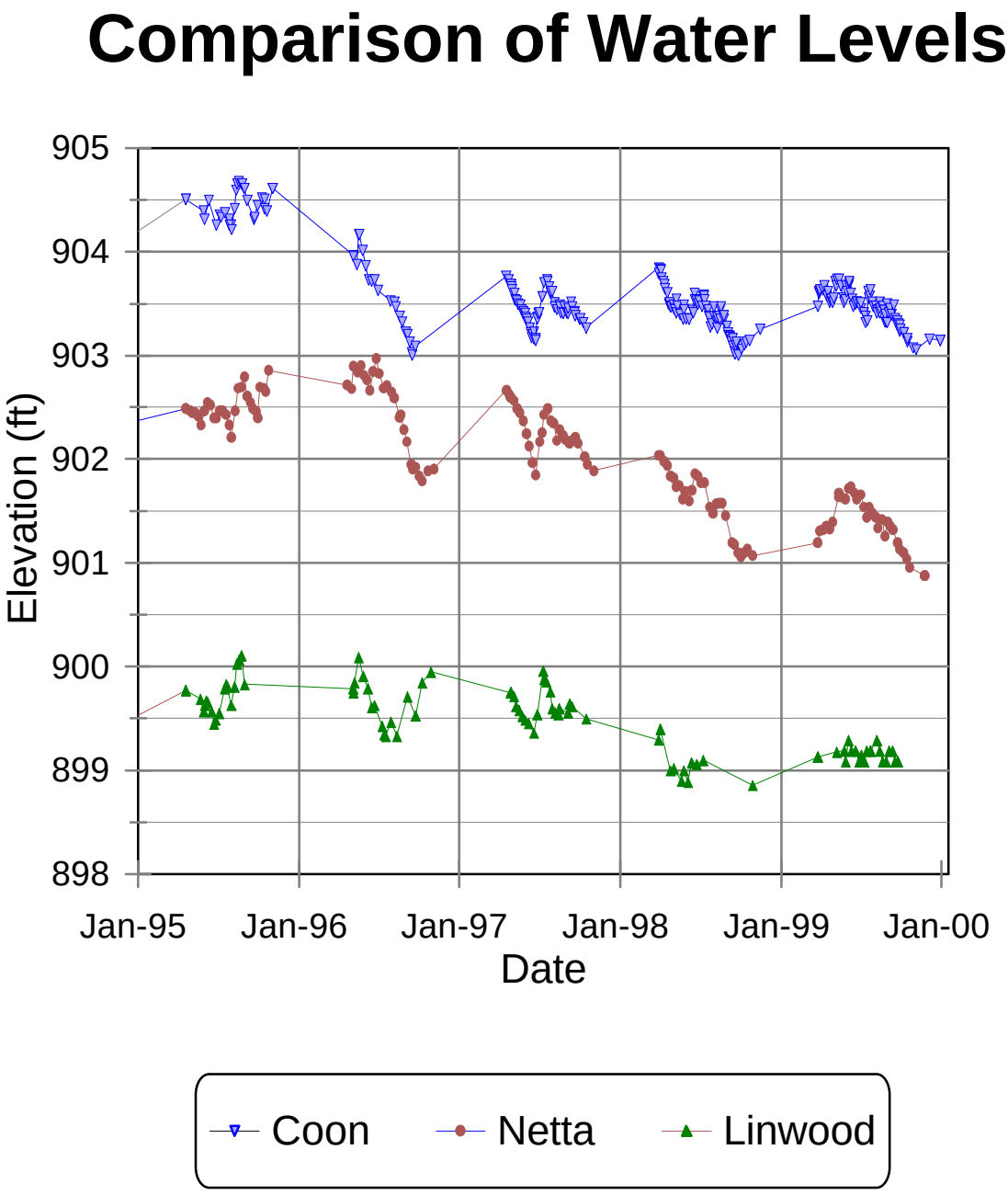


Figure 8. Coon Lake Levels Compared to other Lakes

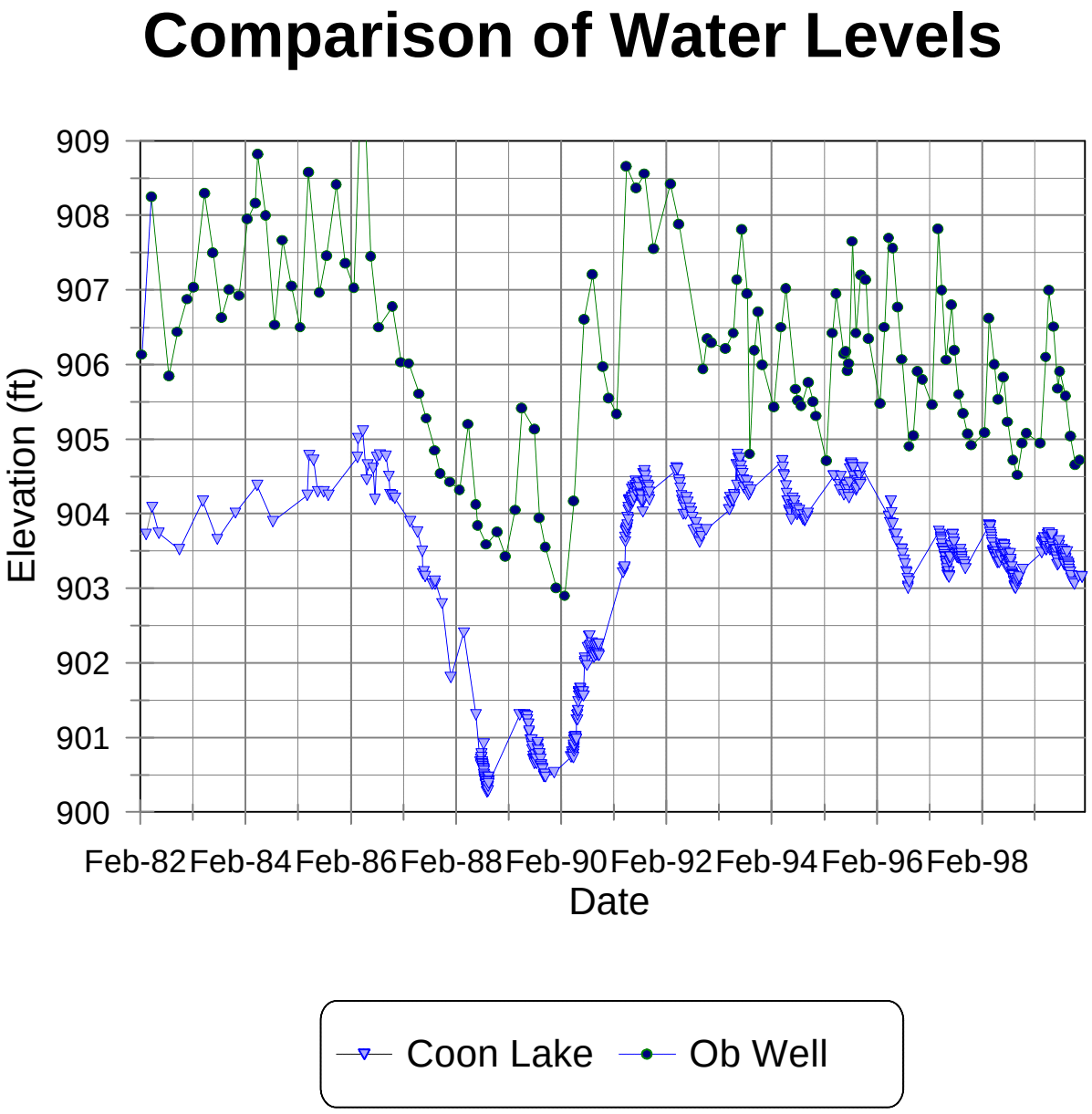


Figure 9. **Coon Lake Levels Compared to Observation Well #02014 Levels**

Climate

Levels of all lakes tend to follow precipitation trends. High levels occur during or following periods of high precipitation, and low levels follow periods of low precipitation. High or low annual precipitation at Coon Lake is a strong indicator that generally high or low lake levels will result. Daily precipitation will result in a lake level increase of essentially the same amount. Precipitation occurring over a period of several consecutive days will result in wet watershed conditions and additional increases in lake levels due to surface water runoff from the lake's watershed.

Evaporation also impacts lake levels by removing water from the lake. While the daily impact of evaporation is small compared to what may occur due to precipitation, evaporation occurs every day as opposed to intermittently and the cumulative effect is significant.

Ground Water

Ground water levels are also dependent on climate and are very important to Coon Lake levels. Coon Lake is dependent on ground water as a foundation. As long as that foundation stays in the normal to high range, Coon Lake level fluctuations are principally impacted by the outlet dam and outlet channel conditions. When ground water levels fall significantly, as they did in the late 1980's, Coon Lake levels and other area lake levels will also fall significantly. During these periods, the outlet dam and outlet channels have no immediate impact on lake level fluctuations. For levels to rise above the outlet crest following such a condition, ground water levels also have to rise.

Watershed Area

The size, slope, land use and soil characteristics of the watershed effect the volume of surface runoff flowing to the lake. The Coon Lake watershed was re-delineated and determined to be 5,590 acres, or about 8 3/4 square miles (see Location Map on page 2).

Lake Surface Area

The surface area of Coon Lake is reported in several sources, and each one states a different area. DNR's National Wetlands Inventory geographic information system indicates a lake area of 1,694 acres. A lake area of 1,700 acres was used in the analysis performed for this report.

Watershed to Lake Area Ratio

This ratio is approximately 4 to 1. DNR Waters' experience is that ratios of 5 to 1 or less usually indicate a lake that will often recede significantly below its runout elevation. Coon Lake follows this general rule. It dropped below its runout elevation in each decade where recorded levels are available (see Figure 7).

Outlet Dam

The outlet dam consists of a semicircular concrete drop inlet weir of approximately 6 foot radius, with a total weir length of approximately 20 feet. The overflow weir is connected to a concrete head wall containing twin 4.2 feet wide by 2.6 feet high corrugated metal arch culverts. The

lowest elevation of the overflow weir is 903.34 feet, and the average weir elevation is 903.45 feet (see Figure 1). The weir and culverts act as a fixed, well-defined control structure. Under current conditions, the dam is the principal factor in controlling the amount of flow leaving through the outlet channel when lake levels are above the runout elevation.

Outlet Channel

The size and slope of the outlet channel, and the amount of vegetation in the channel upstream and downstream of the outlet dam, impact the flow characteristics in the channel and the outlet structure. This impact will change over time, and especially so in the case of a ditched outlet channel like the one at Coon Lake. A channel that gradually fills with sediment and vegetation will gradually lose flow capacity. When the Coon Lake outlet channel is restricted, high lake levels cannot recede as quickly as they can under a less restricted channel condition.

Secondary Lake Outlets

When Coon Lake levels exceed approximately elevation 904, surface outflow can occur at as many as four locations in addition to the primary outlet channel. The lack of defined channels and control structures at these secondary outlets make it difficult to accurately estimate the outflow rates at these locations.

Lake Level Model (WATBUD) Development and Calibration

The WATBUD computer model computes a water budget for a lake. Measured rainfall and climate data are the primary input parameters. The model computes, on a daily basis, various components of the water budget, including surface runoff, evaporation, snowmelt, outflow and the ground water contribution. The model output are daily-computed lake levels, which are compared against recorded lake levels. Model parameters are adjusted until a good fit is obtained between the computed and recorded lake levels. WATBUD can be used to compute water levels over whatever period of time data are available.

The most difficult component to quantify in the water budget model is the ground water contribution or loss. Before starting a simulation, it is generally not known whether ground water is contributing water to the lake, or the lake is recharging the surrounding aquifer, for any particular time period. Following many runs of the WATBUD model for Coon Lake, it was found that good results could be obtained for most periods where measured lake level data were available by assuming a constant ground water input to the lake of 1.5 acre-feet per day. This assumption worked well for normal to wet climatic conditions, but not for drought conditions.

Two WATBUD models were initially developed. The first model simulated existing outlet conditions for the period April 1996 to the fall of 1999. The second model simulated conditions for the period May 1992 to November 1995. Using the above assumption for ground water contribution, all parameters in the WATBUD models could be set identically, except for outlet channel conditions.

For the existing conditions model, HEC-RAS was used to develop a lake level-channel outflow relationship using the channel and dam geometry recently surveyed by DNR Waters. Using this outflow relationship, excellent results were obtained with the WATBUD model for the existing conditions period, as shown in Figure 10.

The channel geometry in the HEC-RAS model was then modified to simulate restricted channel conditions. This outflow relationship was further adjusted during WATBUD calibration runs to obtain a best fit between simulated lake levels and recorded lake levels. Excellent results were obtained for the 1992 to 1995 period, as shown in Figure 11.

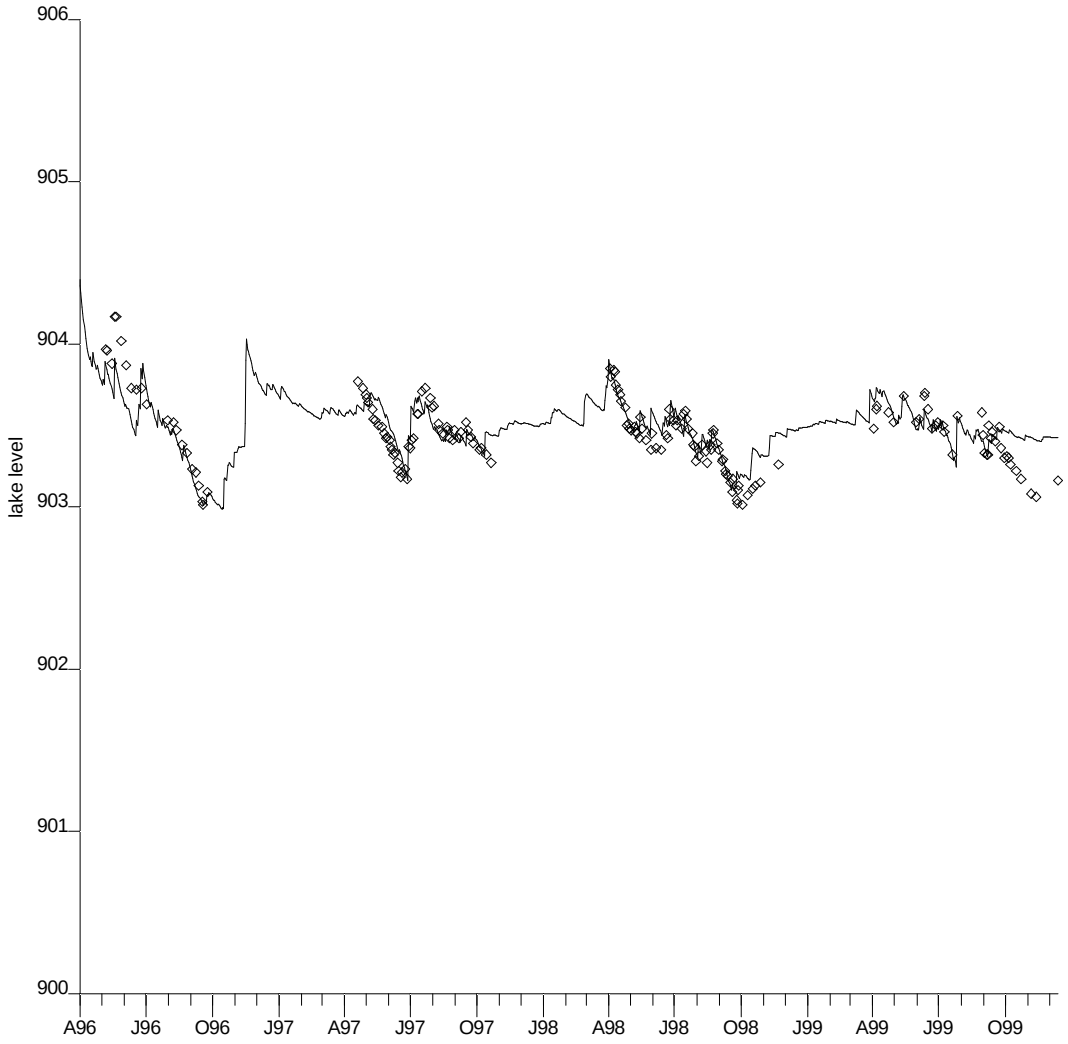
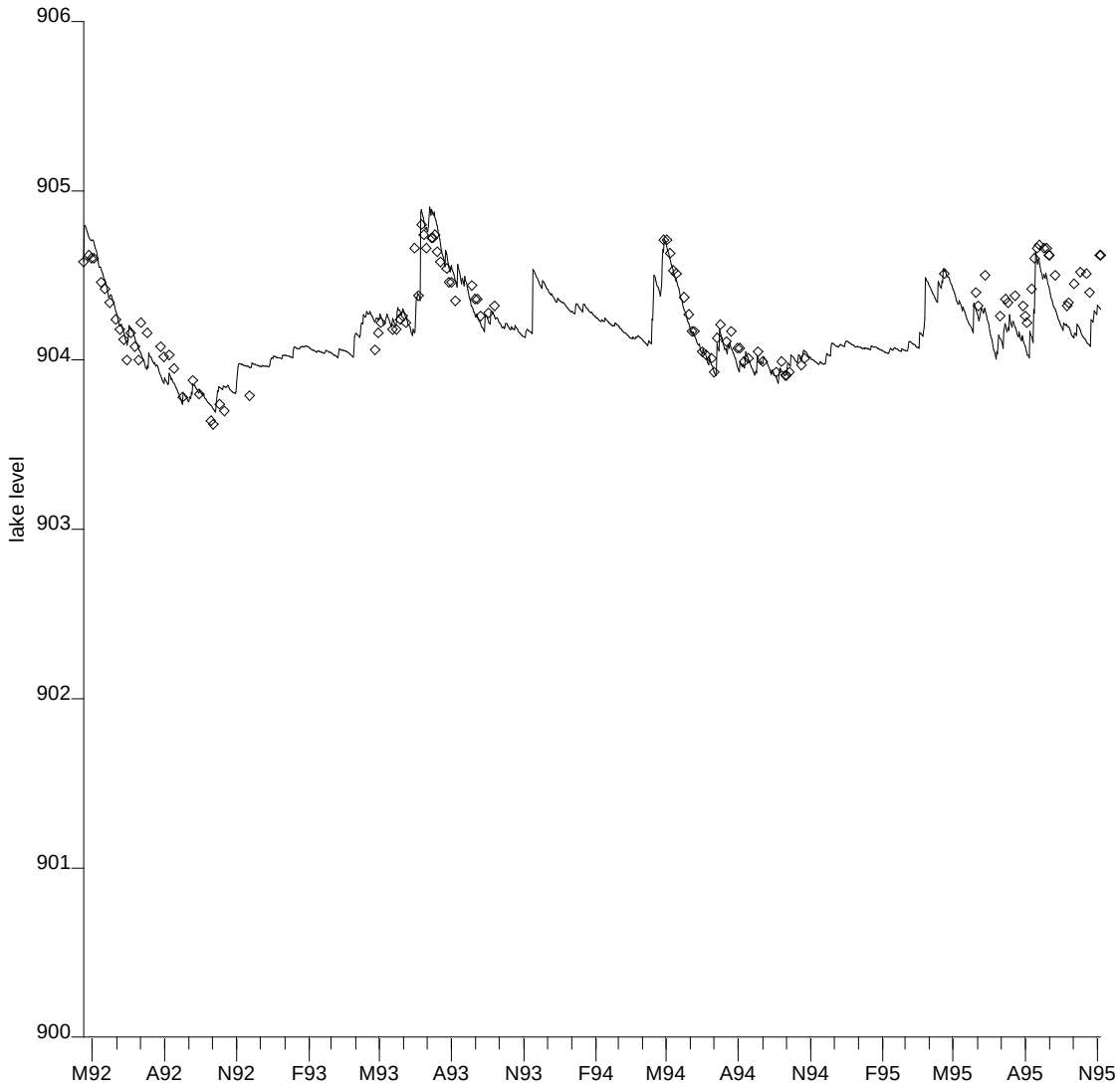


Figure 10. Existing Conditions Model of Simulated Lake Levels (solid line) Compared to Recorded Lake Levels (") April 1996 to December 1999



COON LAKE 020042 mod: COONLK96_8 ts: WL020042

Figure 11. Restricted Outlet Conditions Model of Simulated Lake Levels (solid line) Compared to Recorded Lake Levels (") May 1992 to November 1995

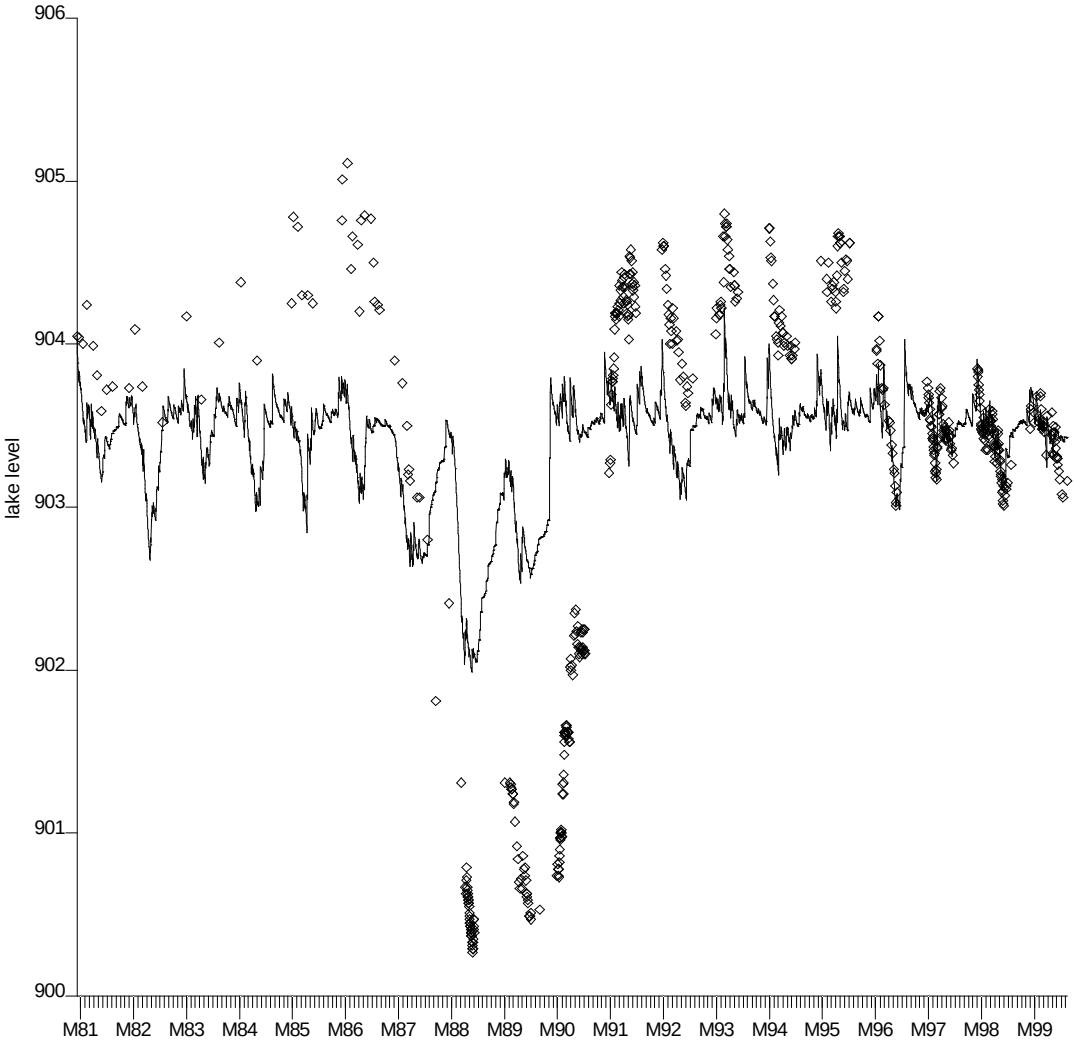
Simulating Lake Levels to Compare Existing and Restricted Outlet Conditions

The two initial WATBUD models calibrated very well to the recorded water level data for their respective time periods. The next step was to run each model without any additional parameter changes for a longer period. 1981 through 1999 was chosen because it included the very wet conditions of the mid-1980's as well as the drought conditions of the late-1980's.

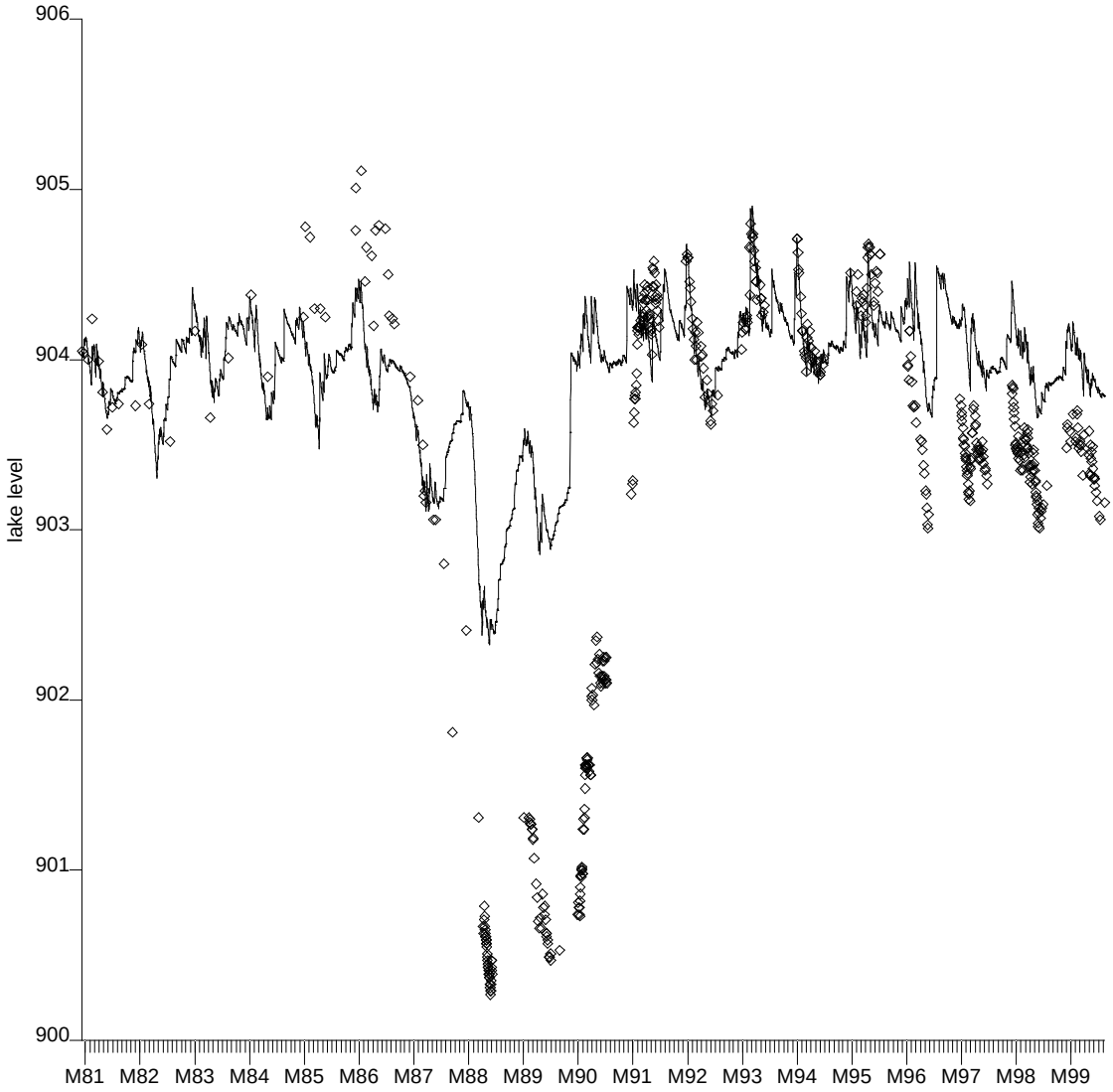
Figure 12 shows the results of the simulation using the existing conditions WATBUD model. The results for the late-1980's drought period are poor due to the assumption of constant ground water contribution to Coon Lake. For the remainder of the period, the resulting simulated water levels are consistently below recorded lake levels.

Figure 13 shows the results of the simulation using the model with restricted outlet conditions. Again, the results during the late-1980's drought period are poor due to the assumption of constant ground water contribution to Coon Lake. Also, the high recorded levels in 1985-1986 may have been affected by beaver dams in the outlet channel. For the 1996 through 1999 period, the resulting simulated water levels are consistently above the recorded lake levels.

This simulation exercise suggests that outlet channel conditions have a significant impact on Coon Lake water levels. If periodic maintenance of the outlet is not performed, the flow capacity of the outlet would be expected to again become restricted and prevent the outlet from maintaining the regime of water levels intended in the 1947 Commissioner's order.



<u>Figure 12.</u> Simulated Lake Levels for Existing Outlet Conditions (solid line) - Compared to Recorded Lake Levels (") 1981 to 1999



COON LAKE 020042 mod: COONLK96_8 ts: WL020042

<u>Figure 13.</u> Simulated Lake Levels for Restricted Outlet Conditions (solid line) - Compared to Recorded Lake Levels (") 1981 to 1999

Comparing Alternative Outlet Management Scenarios

Additional analyses were performed to simulate the impact of alternative outlet management scenarios on Coon Lake water levels. The alternatives analyzed included:

1A. No Change to Dam - Perform Periodic Outlet Channel Maintenance
1B. No Change to Dam - Allow Outlet Channel to Revegetate
2. Raise Dam Runout 3 Inches - Perform Periodic Outlet Channel Maintenance
3. Raise Outlet Dam 6 Inches - Perform Periodic Outlet Channel Maintenance
4. Raise Outlet Dam 10 Inches or More - Perform Periodic Outlet Channel Maintenance
5. Restrict Dam Spillway Capacity - Perform Periodic Outlet Channel Maintenance

The WATBUD model was used to calculate median lake levels, and the HEC-1 model was used to calculate anticipated peak lake levels following 10-year and 100-year storm events. A summary of the results is shown in the Table 1 below. The pros and cons of the alternative outlet management scenarios from the perspective of raising lake levels are discussed in the "Conclusions" section of this report.

It is important to understand that raising the dam runout by any amount will increase the median lake level, and the 10-year and 100-year peak levels.

Table 1. Summary of Anticipated Lake Levels for Six Outlet Alternatives

Outlet Alternative	Runout Elevation	Median Elevation	10-Year Peak Elevation	100-Year Peak Elevation
1A. No Dam Raise-Channel Maintenance	903.45	903.37	904.12	904.71
1B. No Dam Raise - No Channel Maintenance	903.45	903.80	904.62	905.20
2. Raise Dam 3 Inches	903.70	903.60	904.34	904.90
3. Raise Dam 6 Inches	903.95	903.83	904.55	905.11
4. Raise Dam 10+ Inches	904.28+	904.12+	904.93+	905.43+
5. No Dam Raise - Restrict Dam Capacity	903.45	903.75	904.61	905.13

Environmental Impacts

The following individuals were consulted as to their views on the environmental effects of raising levels of Coon Lake: Jon Christensen, Anoka County Environmental Services; Don Anderson, City of Ham Lake Building Official; Randy Anhorn, Metropolitan Council Environmental Services; Steven Heiskary, Minnesota Pollution Control Agency; Chris Lord, Anoka Conservation District; Dave Zappetillo and Rick Walsh, DNR Fisheries; Bob Welsh, DNR Wildlife, and Scott Kelling, DNR Trails and Waterways.

Water Quality

Very little data is available on individual sewage treatment systems surrounding Coon Lake. Due to the lack of information, the Anoka Soil and Water Conservation District is proposing a study to gather septic system data.

It is estimated that 20 to 25 percent of the septic systems on parcels riparian to Coon Lake in the City of Ham Lake have been replaced since 1987. The City has no concerns about the integrity of recent installations. The effectiveness of the older systems is unknown. Failed systems may be detected during local ordinance compliance inspections. Several mound systems have been constructed due to the lack of separation distance from mottled soil or lack of space to site a new conventional drainfield. It is assumed that the situation is similar in Columbus Township and the City of East Bethel.

There have been instances of cesspools (an underground pit into which raw household sewage or other untreated liquid waste is discharged and from which the liquid seeps into the surrounding soil; MN Rules, Part 7080, Subpart 11) and holding tanks being used on some parcels adjacent to the lake. Failed systems can be considered inadequate at any water level. A higher sustained water level on Coon Lake has the potential to increase septic problems. The septic system study proposed by the Anoka Soil and Water Conservation District would help quantify the scope of any potential problems.

The Minnesota Pollution Control Agency reports that increased shoreline erosion is a concern with elevated water levels. If water levels are raised to a point where aquatic plant growth is diminished, erosion may be accelerated by the loss of rooted plants that aid in the stabilization of many shorelines. Fortunately, the water transparency is good in Coon Lake, making additional depth less of a factor in sunlight reaching submerged plants.

If lake levels were raised considerably, the most significant change in water quality would likely result from increased erosion along susceptible shorelines (assuming any inadequate septic systems were corrected). If lake levels could be raised without increasing shoreline erosion, it is reasonable to anticipate that no significant impacts to water quality would result.

It is anticipated that a small increase in water levels would not result in measurable changes to water quality. The Metropolitan Council limnologist stated that Coon Lake has fairly good water

quality, receiving a grade of “B” when it was last monitored in 1997.

Public Access and Boating

The Trails and Waterways Division of the DNR plans to improve boat access on Coon Lake in the summer of 2000. The proposed improvements include adding overflow parking, limiting street parking at the existing Thielen Boulevard DNR site, and developing the county park site with a new boat ramp and parking lot.

Public input was solicited on proposed improvements. Most comments came from homeowners on Coon Lake. Many believed that the lake’s recreation potential (based on acreage) was exaggerated because a sizable portion is shallow and has abundant vegetation. Many homeowners contended that the usable lake surface has reached its saturation point, and no more public access should be made available. However, shallow water, riparian and public users, and diverse recreational uses have all been factored into the formula by which access is considered adequate by the DNR (one car/trailer parking space provided for each 20 acres of surface water on metro lakes). That guideline will be attained after the work is completed at the two sites.

Higher water levels would improve boating on Coon Lake. More areas of the lake become accessible to boats as the water depth increases and launching ramps would function better with deeper water. However, significantly higher lake levels could increase shoreline erosion from boat wakes and waves, and increase damage from ice push against shoreline riprap and retaining walls.

Fish and Wildlife

It is anticipated that a moderate increase in lake levels would not significantly impact fish and wildlife habitat. Greater increases could affect aquatic vegetation and shoreline erosion. Coon Lake has a great deal of undeveloped shoreline that supports wetland vegetation. Increased inundation of these areas would likely affect the vegetation. As water elevations rise, areas of reed canary grass and shrubs would tend to experience more dominance by cattails, and cattail dominated areas would be replaced by floating leaf and submerged aquatic vegetation. The lake also has a significant area of offshore cattail stands, bulrush stands, and waterlily beds. These can all be affected by higher water as the type of vegetation changes to those more suited to the resulting water level regime. However, due to the lake’s good water clarity, it is anticipated that a small increase in water levels would not substantially affect rooted aquatic macrophytes.

Another consideration is the differing nature of the east and west basins. The west basin is much shallower than the east. Raising the water level may tend to homogenize the habitat by making the west side more like the east. There were noticeable differences in fish populations between the east and west basins in 1998. For example, the black bullhead gillnet catch was 46 per set in the west basin, but only 5 per set in the east basin.

No significant change in winterkill of fish would be anticipated with an increase in lake levels due to aeration in the winter, which provides fish a refuge from excessively low oxygen levels. An aerator is maintained and operated by the County Department of Parks and Recreation.

From a wildlife perspective, any loss of emergent vegetation means loss of habitat for over-water nesting birds like American bitterns, marsh wrens, common yellowthroats, red-winged and yellow-headed blackbirds; and loss of hunting grounds for herons and egrets. The impacts of a change in water levels on wildlife would depend largely on the change in emergent vegetation. If there were a no-net-loss of emergent vegetation, there would likely be no significant impact to wildlife populations.

Social Factors

Lake level issues are typically contentious. On lakes with a large number of shoreland owners and differing shoreland uses, opinions will vary widely about what water levels are most desirable. Attempts to solve one person's problem can create problems for someone else. In general, the DNR encourages lakeshore owners to adapt to a lake's natural fluctuations, and discourages proposals to modify or manipulate lake outlet control structures.

DNR Waters engaged *Primary Alliance*, a private consulting firm, to survey the opinions of Coon Lake shoreland owners regarding lake levels. A complete copy of the Survey Results Report is attached as **Appendix A**. *Primary Alliance* received 512 reponses out of 833 surveys for a 61% response rate. The survey revealed that:

* nearly 9 out of 10 respondents believed that the channel maintenance performed in 1996 lowered lake levels, and about 2 out of 3 believed that the lower levels caused negative impacts

* about 3 out of 4 agreed that lake levels should be raised, but about 1 out of 10 strongly disagreed

* about 1 out of 4 expressed a willingness to help pay for a project to raise lake levels, but about 1 out of 5 would expect to be compensated for damages associated with higher levels

* about 1 out of 3 would want their property evaluated for potential damages, if a project to raise lake levels would go forward

* about 5 out of 10 reported that they have owned property on Coon Lake for more than 15 years

The survey results indicate that a project to raise lake levels would be very popular with most Coon Lake shoreland owners, as long as they would not be expected to pay for it. About 10% of shoreland owners strongly opposed higher lake levels, and about 36% expressed concern about potential negative impacts of higher water levels and would want their property evaluated, if any project to significantly raise lake levels went forward.

Costs

Outlet Structure Modification

The existing outlet structure appears to be in good structural condition. The elevation of the fixed concrete weir appears to have remained relatively stable since it was constructed in 1948, according to state and county surveys. There is convenient access to the structure via county park property. The existing concrete weir could be modified to change its control elevation and/or its hydraulic characteristics. The work would be easiest to perform in a low water period when there is no flow over the dam. Several options are available for modifying the weir, including reforming the weir in concrete or adding steel on the top of the existing weir. The cost is estimated to range from $5,000 to $10,000 depending on the design, construction method, and materials used.

Easements or Consents

Whenever a manmade change is made to the outlet of a lake, the potential exists for real or perceived damage to riparian properties, both upstream and downstream. Obtaining flowage easements is a prudent way to avoid damage claims. The costs of obtaining easements or consents cannot be estimated until a specific project is proposed. Based on results of the shoreland owner survey, it is possible that many riparian owners may be willing to donate easements or sign consent forms. However, 174 of the respondents indicated that they would want their property individually evaluated for potential damages. The administrative costs for making such determinations may be considerable, depending on what change is proposed.

Other Costs

The opinion survey showed that about 10% of the owners strongly oppose changes to the outlet dam. This indicates a potential for litigation and additional legal costs.

There may be ways to mitigate the adverse impacts of raising the control elevation, such as installing shore protection measures or raising the levels of affected roadways. The cost of such other measures can only be determined by a detailed engineering investigation.

Permit Requirements

Depending on the nature of change to the outlet of Coon Lake, various permits and approvals may be needed. However, the primary regulatory authority over the outlet is the DNR. The DNR has previously advised proponents of raising the control elevation that the most appropriate unit of government to undertake such a task is the Sunrise River WMO. The requirements listed below are mostly set forth in MN Rules, Part 6115.0220, Subpart 5, and Part 6115.0221, item 3.

1) A permit application may be submitted by the riparian owner of the land on which the project is proposed (Anoka County) or a governmental unit which assumes responsibility for operation and future maintenance of the outlet (probably the Sunrise River WMO);

2) If the proposed change would cause damage to any riparian properties, purchase or donation of flowage easements or consents from owners of all land riparian to the lake (and any connected lakes and backwaters that would be affected) would be required;

3) It must be shown that the proposed runout (elevation at which water begins to flow out of the lake) is reasonably consistent with natural conditions, or is at essentially the same control elevation as a long-standing legal outlet, will further public interests in water-based recreation, propagation of fish or wildlife, or other beneficial public uses of the water, and is not proposed solely to satisfy private interests;

4) A detailed hydrologic and hydraulic study would be needed to document anticipated changes to lake levels and all downstream impacts (much of this information is contained in this report), and the proposed structure must be designed by a registered professional engineer;

5) Surveys would be needed to show all shoreland and existing development that would be impacted by the proposed change. These surveys must identify compliance with shoreland ordinance standards for both the existing and proposed runout in terms of lot size, structure and sewer system setbacks, and structure and sewer system elevations above the highest proposed water elevation (some of this information is contained in this report);

6) An Environmental Assessment Worksheet would be required to document, among other things, impacts to wetland habitat, fish spawning areas, waterfowl and songbird nesting areas as well as strategies to address shore erosion due to wave action and winter ice push;

7) The proposal must be consistent with water and related land management plans and programs of local and regional governments, principally in this case, the Sunrise River WMO. The WMO plan may need to be amended to specifically address the issues involved in a permanent change in the water level control structure on Coon Lake; and

8) Permit decisions will be made after complete information is provided by the applicant and will be consistent with the rules, statutes, and local and regional management plans.

Conclusions

As is usually the case, there is no simple answer to the question of whether it is feasible to raise the control elevation of Coon Lake. Although the majority of lakeshore owners would prefer a higher normal lake level, about 1 out of 6 is opposed to raising the control elevation. One positive aspect of the situation on Coon Lake is that no lakeshore cabins or residences appear to have their lowest floors below the 100-year flood elevation. Any lakeshore property damages associated with higher water levels would largely be restricted to shoreline erosion, loss of trees and other landscaping, septic problems, etc. A 1998 shoreline photo is shown below.
The existing outlet conditions fulfill the intent of the 1947 Commissioner's order establishing the

Coon Lake Shoreline Photo - 1998

control elevation. To allow any change in the runout, the DNR would have to find that the change furthers the overall public interest.

Whenever a lake level control structure is raised or restricted, some parties will invariably blame any subsequent flooding damages on the change made to the outlet. Even if it can be demonstrated through technical analysis that the outlet alteration was not responsible for the

flooding damages, a great amount of time and cost can be involved in defending damage claims. One of DNR's responsibilities is to limit these potential liabilities for Minnesota taxpayers. Any project to raise water levels would need to meet all permitting requirements, including the acquisition of necessary easements from affected landowners. DNR would need to determine whether a particular project proposal requires easements based on its impact on water levels and the potential for damage claims. DNR's easement for the existing dam does not allow for any raise in the control elevation, and DNR does not have statutory authority to condemn easements.

The matrixes below describe six alternative scenarios for managing Coon Lake water levels, and the main pros and cons of each from the perspective of raising lake levels.

1A. No Change to Dam - Perform periodic maintenance of the outlet channel both upstream and downstream of the outlet dam to maintain existing outlet conditions.

PRO	CON	Water Level Impacts
- Adverse high water impacts greatly reduced - No easements needed - Help prevents shoreline erosion - Provides the most protection against inundating sewer systems - No change in outlet structure needed - No additional permits required	- Not popular with the majority of riparian owners - Lawsuit against County and DNR may be reactivated - Next channel maintenance project may trigger new lawsuit - Does not improve recreational use of the lake - DNR would have to approve the maintenance work lakeward of the dam, which would be controversial	Runout = 903.45 Median lake level = 903.37 10-year peak level = 904.12 100-year peak level = 904.71

1B. No Change to Dam - Allow sediment to accumulate in the outlet channel, and allow the channel to revegetate, so that outflow conditions again become restricted.

PRO	CON	Water Level Impacts
- Adverse high water impacts reduced temporarily - No easements needed - This is the lowest cost alternative, assuming no litigation - No change in outlet structure needed - Those who sued over the channel cleanout may eventually be satisfied - No permits required	- Failure to maintain the outlet channel could trigger future lawsuit by those affected by adverse high water impacts - Time required for channel to return to a significantly restricted condition is not known	Runout = 903.45 Median lake level = 903.80 10-year peak level = 904.62 100-year peak level = 905.20

2. Raise the Dam Runout Elevation by 3 Inches -Perform periodic maintenance of the

outlet channel.

PRO	CON	Water Level Impacts
- Would cause minor improvements in recreational use of the lake - Would be somewhat popular among a majority of the riparian owners - As the least impact raising, it may have the best chance of being implemented	- Likely to be opposed by about 17% of shoreland owners - Would not go far enough in satisfying the desire for higher water levels among about 75% of shoreland owners - Lawsuit against the dam owner may result - Flowage easements or consents would be needed - A sponsor for the outlet project would need to be found - May slightly increase shoreline erosion and septic system problems	Runout = 903.70 Median lake level = 903.60 10-year level = 904.34 100-year level = 904.90

3. Raise the Dam Runout Elevation by 6 Inches -Perform periodic maintenance of the outlet channel.

PRO	CON	Water level Impacts
- Would improve recreational use of the lake - Would be more popular than a 3" raise among a majority of the riparian owners	- Likely to be opposed by about 25% of shoreland owners - Lawsuit against the dam owner may result - Flowage easements or consents would be needed - A sponsor for the outlet project would need to be found - May increase shoreline erosion and septic system problems	Runout = 903.95 Median lake level = 903.83 10-year level = 904.55 100-year level = 905.11

4. Raise the Dam Runout Elevation by 10 Inches or More - Perform periodic maintenance of the outlet channel.

PRO	CON	Water Level Impacts
- Would substantially improve recreational use of the lake - Would be supported by a majority of the riparian owners	- Likely to be opposed by about 40% of shoreland owners - Lawsuit against the dam owner may result - Flowage easements or consents would be needed, and may be difficult and expensive to obtain - A sponsor for the outlet project would need to be found - May adversely impact fish and wildlife habitat - May increase shoreline erosion and septic system problems -Would require secondary high water outlets to be addressed	Runout = 904.28 or more Median level = 904.12 or more 10-year level = 904.93 or more 100-year level = 905.43 or more

5. Modify the Dam Spillway to Restrict Outflow Capacity Without Raising the Dam Runout Elevation - Perform periodic maintenance of the outlet channel.

A design which employs a "V" shaped outlet with 1:3 side slopes was used for this analysis. The bottom of the "V" was set at the runout elevation and the rest of the 20' weir was raised about 1 foot. Many design options would be possible to produce the desired impact on water levels.

PRO	CON	Water Level Impacts
- Would improve recreational use of the lake under average conditions - Would have fewer shoreline erosion and septic system problems than alternatives 2, 3 & 4	- Likely to be opposed by about 20% of shoreland owners - Flowage easements or consents would be needed - A sponsor for the outlet project would need to be found - May increase shoreline erosion and septic system problems	Runout = 903.45 Median lake level = 903.75 10-year level = 904.61 100-year level = 905.13

Lakeshore Owners' Survey
Coon Lake, Anoka County
Requested by
Minnesota DNR Waters

Survey Results Report

January 2000

Prepared by

Joan Autrey

Primary Alliance

16710 22nd Avenue North

Minneapolis, MN 55447

(612) 473-8545

Introduction

Primary Alliance was engaged in October 1999, to conduct a survey of the lakeshore owners of Coon Lake in Anoka County. The purpose of the survey was to gather input regarding adjustments to the elevation of the outlet control of the lake.

Scope of the project

The mailing list for the survey was provided by the Anoka County GIS office (Geographic Information Systems). The names and addresses were taken from the county's tax records. The DNR asked for a list that included all landowners who owned land abutting (riparian to) Coon Lake. The DNR was provided with maps that had parcel boundaries on them. All parcels surrounding Coon Lake that had land that abutted the ordinary high water level were included. This included the properties around South Coon Lake since the two are connected below the ordinary high water level.

The exception was the parcels in the Coon Lake Beach subdivision. They were included because many of them have dock spaces on the lake and there is some uncertainty as to the legal status and rights of these dock space holders. The DNR felt that it would be better to err on the side of including landowners that did not actually own riparian land than to omit those that did.

The project consisted of a written, 1-page survey. A letter describing the forthcoming survey and encouraging each respondent's participation preceded the survey and was mailed in early November. The survey and cover letter were mailed the week of November 22, 1999, with a return deadline of December 8, 1999. Most surveys were returned by the deadline. However, they continued to arrive until mid-December. All surveys received are included in the results.

A copy of the letters and survey are included with this report.

Response Rate

Of the 880 surveys that were mailed, forty seven (47) of the original letters were returned to us with "Unable to Forward" marked on them. After checking with the Post Office to make sure that they were truly undeliverable, the mailing labels were pulled from the list. These 47 addresses were not sent surveys, leaving the total number of surveys that were sent out at 833. We received 512 surveys, reflecting a 61% response rate. This is an excellent response rate. We expected a high return rate, anticipating it to be around 50%. A response rate of 61% exceeds our expectations by 11%. We also received letters or comments from 18 respondents and one respondent sent pictures. These were provided to DNR Waters but are not included in this report.

Summary of Results

The results of the survey are examined on a question by question basis below.

Question 1

1. As a result of the 1996 outlet channel clean-out project, I believe that lake levels on my property were (please check one):

1. Not affected	11.9%
2. Somewhat lower	21.4%
3. Considerably lower	26.3%
4. Unacceptably lower	40.4%

It's clear that lakeshore owners noticed a drop in lake levels following the 1996 channel clean-out project, and believed the drop was the result of the clean-out project. When answers 2, 3 and 4 from question one are combined, the percentage of respondents who noticed a drop in lake levels is 88.1%. The percentage of those who noticed lake levels to be considerably and unacceptably lower is 66.7%.

Question 2

2. As a result of the 1996 outlet channel clean-out project, I believe the impact to my property has produced (please check one):

1. Significant benefits	7.6%
2. Some benefits	9.6%
3. Neither benefits nor problems	18.7%
4. Some problems	19.9%
5. Significant problems	20.9%
6. Unacceptable problems	23.3%

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Question 2 – Re-grouped

1. Benefits (1 + 2 above)	17.2%
2. Neither benefits nor problems	18.7%
3. Problems (4 + 5 + 6 above)	64.1%

Along with a drop in the lake levels apparently lakeshore owners realized or perceived associated problems. Respondents listed the severity of the problems somewhat evenly: some problems at 20%, significant problems at 21% and unacceptable problems at 23%. The second chart reflects all those respondents who reported benefits (17%) compared to those who reported problems (64%).

Question 3

3. With regard to proposals to raise lake levels by any amount (please check one):

1. I strongly agree that lake levels should be raised.	60.6%
2. I agree that lake levels should be raised.	12.9%
3. It makes no difference to me if lake levels are raised or not.	8.9%
4. I disagree that lake levels should be raised.	6.9%
5. I strongly disagree that lake levels should be raised.	10.7%

The percentage of those who strongly agree that lake levels should be raised is 60%. The comparison is more compelling when you consider those who simply agree (1 + 2 = 73.5%) with those who simply disagree (4 + 5 = 17.6%). Only 9% of respondents were neutral about raising lake levels with the clear majority being those who would like to see lake levels raised.

Question 4

4. If lake levels could be raised without causing damage to lakeshore property, I believe they should be raised:

1. Not by any amount	16.9%
2. 2" – 4"	7.8%
3. 4" – 6"	7.8%
4. 6" – 8"	7.4%
5. 8" – 10"	9.5%
6. 10" – 12"	16.7%
7. 12" – 14"	17.7%
8. Over 14"	16.1%

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Question 4 - Re-grouped

1. Not by any amount	16.9%
2. 2" – 8" (2 + 3 + 4 above)	23.0%
3. 8" – 14" (5 + 6+ 7 above)	43.9%
4. Over 14"	16.1%

The percentage of respondents indicating that the lake should not be raised by any amount is 16.9%. The majority (83.1%) indicated how much they thought the lake should be raised in the amounts listed in responses 2-8 above. The table below provides response percentages for various combined ranges of preferred lake level increases.

Raise By:	% Responding	Raise By:	% Responding
Not by any amt.	16.9%	Not by any amt.	16.9%
2" – 6"	15.6%	4" – 8"	15.2%
6" – 10"	16.9%	8" – 12"	26.2%
10" – 14"	34.4%	12" – 14"+	33.8%
6" – 14"	51.3%	4" – 12"	41.4%
10" – 14"+	50.5%	8" – 14"+	60%
6" – 14"+	67.4%		

A challenge for the DNR lies in determining the potential negative impacts and legal risks of raising lake levels.

Question 5

5. Even though the costs of a project to raise the lake levels have not been estimated, please check the statement below that best describes your situation. If a project to raise lake levels goes forward:

1. I would be willing to help pay for the project.	24.9%
2. I would neither be willing to pay nor expect to be compensated for the project.	55.3%
3. I would expect to be compensated for actual damages to my property.	19.8%

The majority of respondents (55%) would neither expect to be paid nor expect to be compensated if lake levels are raised. In fact, 25% would be willing to help pay for the project. The remaining 20% would expect to be compensated for damages to their property as a result of raising lake levels.

Question 6

6. If a project goes forward to alter the outlet control structure to raise lake levels, would you be interested in having your property evaluated for potential adverse impact?

1. Yes	35.9%
2. No	64.1%

This question closely relates to question 5. If lakeshore owners expect to be compensated for damages, it follows that an evaluation would be needed to determine damages. While 20% would expect to be compensated (see question 5), according to the responses here, 36% would be interested in an evaluation. The number of lakeshore owners who would be interested in an evaluation AND expect to be compensated lies most likely somewhere between 20% and 36%.

Question 7

7. If you marked **"Yes" OR** if you'd like to provide your name and address please do so below.

Provided names and addresses (311)	61%
[No Phone Number]	7%
[No Address]	2%

A graph is unnecessary for question 7. A complete list of the names and addresses were provided to DNR Waters but are not included in this report.

Question 8

8. How long have you owned property on Coon Lake?

1. 1-5 years	17.4%
2. 6-10 years	18.3%
3. 11-15 years	13.0%
4. More than 15 years	51.3%

The percentage of lakeshore owners who have owned their property longer than 10 years is 64.3%. These lakeshore owners have a reasonable amount of time to have experienced a range of natural, annual changes to lake levels along with what they perceive to be "normal," tolerable lake levels. This lends credibility to the quality of their survey responses.

Minnesota Department of Natural Resources

500 Lafayette Road
St. Paul, Minnesota 55155-40__

November 15, 1999

Dear Coon Lake Lakeshore Owner:

As you may know, the 1999 legislature directed the Minnesota DNR to undertake a feasibility study of raising the control elevation of Coon Lake in Anoka County. An important part of the study is to gather input from shoreland owners regarding adjustments to the elevation of the outlet control.

DNR Waters has retained an outside consulting firm, *Primary Alliance*, to conduct a survey of shoreland owners' attitudes about the water levels of Coon Lake. *Primary Alliance* will gather and compile the survey responses independently of the DNR. The survey will be mailed out on or about November 24, 1999.

When you receive your survey, I strongly urge you to fill it out and return it by the deadline indicated.

This is an excellent opportunity to express your views concerning water levels on Coon Lake. It is very important that you provide your input by completing the survey because the opinions and desires of affected lakeshore owners will have a significant influence on future lake level decisions.

Thank you in advance for your time and careful consideration of this issue.

Sincerely,
DNR WATERS

Kent Lokkesmoe
Director

PRIMARY
ALLIANCE

November 18, 1999

Dear Coon Lake Lakeshore Owner,

The 1999 legislature directed the Minnesota DNR to undertake a feasibility study of raising the control elevation of Coon Lake in Anoka County. As a result, Primary Alliance has been retained by the Minnesota DNR to conduct a survey of the shoreland owners' attitudes about the water levels of Coon Lake.

This is an opportunity to contribute your views concerning water levels on Coon Lake. The information from the surveys is very important and will be used to help determine future lake level decisions.

Please complete the enclosed survey and return it in the envelope provided by:

December 8, 1999

Thank you very much for your time and careful consideration when completing the survey. We look forward to receiving your response.

Sincerely,

Joan E. Autrey
President
Primary Alliance

612.473.8545
FAX 449.3146
autrey@bitstream.net

16710
22nd Avenue
North

Minneapolis
Minnesota
55447

COON LAKE SHORELAND OWNERS SURVEY

Please return your completed survey by December 8, 1999.

As you complete the survey, please keep in mind that periods of very dry weather or very wet weather can cause significant variations in water levels, regardless of any changes in the outlet dam.

1. As a result of the 1996 outlet channel clean-out project, I believe that lake levels on my property were (please check one):
   ____ Not affected
   ____ Somewhat lower
   ____ Considerably lower
   ____ Unacceptably lower

2. As a result of the 1996 outlet channel clean-out project, I believe the impact to my property has produced (please check one):
   _____ Significant benefits
   _____ Some benefits
   _____ Neither benefits nor problems
   _____ Some problems
   _____ Significant problems
   _____ Unacceptable problems

3. With regard to proposals to raise lake levels by any amount (please check one):
   _____ I strongly agree that lake levels should be raised.
   _____ I agree that lake levels should be raised.
   _____ It makes no difference to me if lake levels are raised or not.
   _____ I disagree that lake levels should be raised.
   _____ I strongly disagree that lake levels should be raised.

4. If lake levels could be raised without causing damage to lakeshore property, I believe they should be raised:
   _____ Not by any amount
   _____ 2" – 4"
   _____ 4" – 6"
   _____ 6" – 8"
   _____ 8" – 10"
   _____ 10" – 12"
   _____ 12" – 14"
   _____ Over 14"

5. Even though the costs of a project to raise the lake levels have not been estimated, please check the statement below that best describes your situation. If a project to raise lake levels goes forward:
   _____ I would be willing to help pay for the project.
   _____ I would neither be willing to pay nor expect to be compensated for the project.
   _____ I would expect to be compensated for actual damages to my property.

6. If a project goes forward to alter the outlet control structure to raise lake levels, would you be interested in having your property evaluated for potential adverse impact?
   _____ Yes _____ No

7. If you marked "**Yes**" **OR** if you'd like to provide your name and address please do so below.
   Name _____ Phone # (_____) _____
   Street _____
   City _____ State _____ Zip _____

8. How long have you owned property on Coon Lake?
   _____ 1-5 years _____ 6-10 years _____ 11-15 years _____ More than 15 years

Please return your completed survey by December 8, 1999.