ITEM 5.1.

Memorandum

TO: **PLANNING COMMISSION**

FROM: **STEPHEN ROHLF, BUILDING & ZONING ADMINISTRATOR**

DATE: **MARCH 24, 1998** SR

SUBJECT: **LAKE ORONO IMPROVEMENT PROJECT CU-98**

BACKGROUND

Lake Orono is basically a wide spot in the Elk River first created in the 1850s to provide mechanical hydropower to run saw mills. The lake was then enlarge to its current configuration in 1915 when a new dam was constructed to generate electricity from hydropower.

Lake Orono has an extremely large watershed to lake ration at 12,000 to 1. The Elk River Watershed drains 40% of Benton County and 70% of Sherburne County. Approximately 400,000 acres of watershed drain into a lake of less than 300 acres with an average depth of little more than 5 feet.

The residency time for water entering the lake, or time water remains in the lake, is also extremely short at 3 or 4 days. These are factors that need to be understood when considering a lake improvement project.

The Lake Orono Improvement Association, an organization made up of lake owners, has been concerned about the water quality and sedimentation in Lake Orono for a number of years. In May of 1995, the Lake Orono Sedimentation Task Force was established to look at the concerns regarding the lake. The Task Force is made up of members from the lake association with city staff support.

It was decided that additional expertise was needed to really understand the issues and Wenck and Associates out of Maple Plain were hired in June of 1996 to aid in conducting a formal lake study. The Lake Orono Sedimentation and Water Quality Study was completed in October of 1997 with Wenck's help.

In December of 1997 the Lake Orono Sedimentation Task Force presented the lake study to the Elk River City Council. The task force also requested a lake improvement project based on the conclusions and recommendations in the study (pages 16 & 17 of the attached study). The improvement project is what triggers the conditional use permit process.

REQUEST

The City of Elk River is requesting a conditional use permit to excavate approximately 115,000 cubic yards of sediment from Lake Orono and dispose of it on sites adjacent to the lake.

A conditional use permit is required for the described work by Section 900.31 of the City of Elk River Code of Ordinances titled, Excavation, Grading and Filling. Subsection 5 of the referenced ordinance requires a conditional use permit to excavate in any wetland that encompasses more than one parcel. In addition, the extraction of materials in the floodway and the disposal of more than 1,000 cubic yards of material in floodfringe also requires a conditional use permit (Section 902 of the City of Elk River Code of Ordinances titled, Floodplain Management Ordinance).

ATTACHMENTS

- Lake Orono Sedimentation and Water Quality Study, October, 1997.
- Lake Orono Improvement Project Environmental Assessment Worksheet (EAW).
- Map #1 - sediment deposits as determined by aerial photos taken in October of 1997 with the lake water level lowered. Map #1 also shows the proposed excavation areas.
- Map #2 - lake map identifying areas of the lake consider for improvement.
- Map #3 - vicinity map of the proposed disposal sites.
- Map A- Wapiti Park Camp Ground disposal site.
- Map B - Bickman property disposal site.
- Map C - Hartman property disposal site.
- Map D - Orono Cemetery disposal site .
- Map E - Island View Property disposal site.
- Figure #1 - estimated project cost
- Figure #2 - Proposed project time frame.

LAKE STUDY FINDINGS

Water Quality

Contaminates - Sediment samples were analyzed for heavy metals, pesticides, herbicides, PCBs, semi-volatile organic compounds and other substances (see page #3 of the attached study). No significant levels of these materials were found in the sediment of the lake. This is significant both as a public health issue and as far as the disposal of the material proposed to be dredged from the lake.

Phosphorus - Phosphorus levels in Lake Orono are fairly high when compared to other lakes, but they are not high for a river system. The phosphorus levels observed are not surprising for a hardwood forest river like the Elk River. Leaves falling into the river and lake alone can significantly raise the phosphorus level.

Phosphorus is a nutrient. Too high of levels of phosphorus are not desirable because it stimulates algae bloom or "dog days" in July and August. Phosphorus levels in the lake can be reduced by limiting the man-made sources. It is especially important to work watershed wide on this issue because of the extremely large watershed to lake ratio previously discussed.

If all of the man-made sources of phosphorus entering the lake and watershed were eliminated the lake will still experience algae bloom and dog days. However, the intensity and duration of the algae blooms can be reduced. The lake improvement project proposed will not significantly reduce the level of phosphorus in Lake Orono. The task force will be addressing this issue by other means. For details on phosphorus see page #13 of the study.

Fecal coliform - Fecal coliforms are bacteria associated with waste matter and are of concern regarding diseases transmission. The city's waste water treatment plant has the ability to test for fecal coliforms and aided in the sampling of Lake Orono. In the summer of 1997, the city began routine monitoring for fecal coliforms at Orono Beach and found significantly high levels.

The city undertook efforts to track the source of this contamination. Water born fecal coliform is relatively short lived (1 to 2 days) so the search for possible sources did not have to be conducted very far upstream. Because most of the area in the immediate vicinity of Orono Beach is served by city sewer, city staff became suspicious of the findings.

It is theorized and it stands to reason that fecal coliforms of animal origin are not as great of a health threat to humane as fecal coliforms of humane origin. Staff did fecal streptococci analysis and fecal coliform analysis simultaneously and compared their ratio. It was determined that the high fecal coliforms were of animal origin. It is theorized that geese are the likely source.

The city will conduct weekly monitoring of fecal coliform levels at Orono Beach during the swimming season. Page #15 of the attached study contains the fecal coliform test results.

Sedimentation

Suspended sediment - Inlet and outlet monitoring revealed that more suspended sediment is leaving the lake than is entering it. This is not surprise considering the granular nature of the materials upstream of the lake. This finding did not consider inlake generated suspended sediment formed from decaying organic matter agitated into suspension by boat traffic, but none the less, suspended sediment is not a major issue. For additional details on suspended sediment see page #10 of the study.

Bedload - Bedload is the heavier coarser fraction of the sediment load transport to the lake from the river; the sand moving along the bottom. The estimated rate of bedload entering Lake Orono from the Elk River is 3,000 cubic feet peer year. This is not a high rate. The banks of the Elk River are fairly protected with stabilizing vegetation. These vegetative buffers must be protected by working with the Elk River Watershed Board.

However, even at this relatively low rate, given time the lake will revert back to a river. The delta of bedload from the river has made navigation in the western most lobe of the lake nearly all but impossible. It is estimated that within 50 years the next lobe of the lake, just north of the Highway 10 bridge, will be equally effected. Bedload is the real issue that the lake improvement project is addressing. For more details on bedload see page #11 of the attached study.

PROPOSED LAKE IMPROVEMENT PROJECT

The city is proposing to remove and/or grade approximately 115,000 cubic yards of sediment to improve Lake Orono. The Lake is proposed to be drain in early August for the project. The sediment will be bulldozed into windrows, loaded into off-road trucks with backhoes, and disposed of on sites adjacent to the lake. The Elk River, which will continue to flow through the lake during the project, is proposed to be redirected away from construction activities. The project is proposed to be completed by October 31st and the normal water level of the lake will be restored shortly afterward, prior to freeze-up. Question #6 (Description) in the attached EAW gives a detailed account of the proposed project.

Sediment Removal

In October of 1997, the lake was incrementally lowered and aerial photos were taken so that the sediment deposits could be delineated (see Map #1 attached). The Sedimentation Task Force reviewed fifteen areas within the lake for possible improvement or sediment removal. The fifteen areas reviewed are designated as "A" through "O" on Map #2 attached.

The areas selected for improvement were based on overall functioning of the lake (keeping the lake from reverting back to a river), navigation and safety. The areas recommending for improvement in descending order of priority are as follows:

- **Area L** - Area "L" is the western most lobe of the lake. The waters of the Elk River slow enough in this area to deposit bedload. The bulk of the sediment removal will be from this area to restore it to its original navigable depth and act as a basin for future sedimentation.

- **Area N** - Area "N" is the portion of the Elk River immediately upstream of Lake Orono. Creating a sedimentation basin in this area was looked at to limit the amount of sediment finding its way to Area "L". Because it is difficult to go deep enough and/or wide enough in this area to significantly slow the river water, Area "L" was ruled out as a location for a sedimentation basin.

  Material in Area "N" that will quickly deposit in the lake after sediment is removed from Area "L" will be excavated as part of the project. Removal of this sediment also allows for better access up river. A combined total of 90,000 cubic yards is proposed to be removed from Areas "L" and "N" with the bulk of material coming from Area "L".

- **Area K** - This area is basically a sand bar jetting out from Boy Scout Island that is a safety hazard for boating. This area is proposed to be made a minimum of 3 feet deep by the removal of 3,500 cubic yards of material.

- **Area C** - For boating safety, like is the case with Area "K", 13,500 cubic yards of material is proposed to be removed, making this area a minimum of 3 feet deep. Erosion on adjacent Cemetery Point is proposed to be corrected as part of the project.

- **Area I** - A small access channel 3 feet deep and 48 feet wide is proposed in the extreme northwest corner of this area. Sediment from an adjacent storm sewer outlet will also be taken. Approximately 2,000 cubic yards of material is proposed to be removed from Area "I".

- **Area J** - This is an optional area. Creating a minimum 3 foot depth in areas of the lake that get a lot of watercraft traffic was one of the rationales used to determining where sediment should be removed. Except for the portions of this area that are in close proximity to islands, the area has little for sediment deposits that are shallower than 3 feet. However, there are some high spots in this areas and it gets a lot of boating traffic. Removal of the sediment from this area is difficult due to the need to cross the river channel running through the lake. Leveling the high spots in this area and leaving the material in the lake has been proposed as an alternative (approximately 6,000 cubic yards of grading).

Disposal Sites

Map # 3 shows the general location of the disposal sites. Areas adjacent to the lake were selected as disposal sites to avoid the cost of reloading the sediment into on-road trucks and trucking the material away.

Maps A through E show the grading of the disposal sites. The altered drainage of the disposal sites has been well addressed in these plans as have the erosion control

measures. No work, other than 20 foot wide access roads from the lake, is proposed to take place within the 50 foot shore impact zone.

Top soil will be removed from the disposal sites, the bearing capabilities of the soil remaining will then be verified and documented, the sediment will then be placed on the sites according to the plans, top soil replaced, and the sites will be immediately seeded and mulched. The sediment placed on the Bickman, Hartman and Wapiti Park sites will contain 2% or less organic matter because they have the potential for development.

The city is responsible for dealing with drainage and odor complaints as well as the placement and maintenance of erosion control measures for the first year. The sediment has been tested and does not contain contaminates of concern.

Map "B", the Bickman Disposal site, shows a potential stockpile of material in the southeast corner. Mr. Bickman is willing to take this material and offer it for sale. This is why it has been left adjacent to the roadway for access. It is unlikely that there will be a need for the stockpile, but it should be considered as part of the city's request.

Environmental Concerns

The attached EAW explains in detail the environmental issues and mitigation measures associated with the proposed project. These issues will not be reiterated in this memo. The Planning Commission is encouraged to review the EAW. The comment period for the EAW ends on March 25, 1998 so it is anticipated that all comments will be available for the Planning Commission meeting.

In addition, the city has had the Minnesota Department of Natural Resources (DNR), Minnesota Pollution Control Agency (MPCA), United States Army Corps of Engineers (USACE), Minnesota Board of Water and Soil Resources (BSWR), and Sherburne County Soil and Water Conservation District (SWCD) involved with the project for over two years. The concerns of the referenced agencies have been including in the project's design. The project has also been explained to Sherburne County and the Elk River Watershed Board.

Shoreland Ordinance

The City's Shoreland Ordinance identifies considerations and conditions for grading in a wetland and Shoreland District; most notably Sections 904.08 3. B. iv. a. and 904.08 7. A. & B. You may note on the attached disposal plans (Maps A through E) that none of the work proposed is within the Shore Impact Zone and erosion control measures are detailed. The project as proposed clearly meets the standards and conditions set forth in the Shoreland Ordinance.

Floodplain

The Lake Orono Improvement Project will obviously involve work within the floodway limits of the lake and river. Floodway is that portion of the floodplain where obstruction that may impede flood waters are not allowed. Section 902 4.D.iii of the Elk River Code of Ordinances does allow an exception for the temporary storage of dredge spoils that assures removal of materials from the floodway based on flood warning time available.

August through October was picked as the time period for the project partly because of typical low rain fall. The flood potential is extremely low during this period of the year. The material that will be temporarily stored with in the floodway limits come from the lake in the first place and will not limit the lakes potential to store runoff. In addition, the lake will be drain during the project, further adding to its potential holding capacity for flood waters.

The only foreseeable issue is that the river diversion at the mouth of the Elk River could possibly impede flood waters. In the unlikely event that there is a flood hazard during the time period that the project is conducted, the river diversion can be quickly altered to avoid obstructing flood waters, thus meeting the exception in Section 902 4.D.iii.

Project Cost Estimate

Figure #1 attached details the estimated project costs, the total of which is approximately $750,000. The project is proposed to be paid for by assessments to lake owners and general tax funds. The proposed project time frame included in Figure #1 outlines the assessment process.

Recommendation

Lake Orono is a aesthetic, recreation, and economic resource for the entire community. Keeping the lake as a resource is consistent with the Master Park Plan and the City of Elk River's Comprehensive Plan. The design of the project more than adequately addresses any environmental concerns and meets the standards in the City of Elk River Code of Ordinances (Shoreland, Floodplain, Excavation, and Conditional Use Permits). The Lake owners are apparently willing to pay for a major portion of the cost of this project at this time and appropriate lands adjacent to the lake are currently available for the disposal of sediment. Now is the time to do this project.

However, no permits can be issued for the project prior to the completion of the environmental review process. If after reviewing the comments received during EAW process the City Council finds the request has the potential for significant environmental impacts, the project should be modified to address the issues raised and an Environmental Impact Statement (EIS) must be prepared. Staff does not anticipate this happening.

Staff is recommending approval of the described Lake Orono Improvement Project under the following stipulations:

1. The approval of the city's conditional use permit is contingent on the City Council finding that the EAW process did not identify the potential for significant environmental impacts and making a negative declaration on the need for an EIS..

2. The city's approval is contingent on the issuance of the following other permits:

    - Protected Waters Permit by the DNR
    - Water Appropriation Permit by the DNR
    - Individual USACE Permit
    - Water Quality Certification (401) by MPCA
    - State Disposal System Permit by MPCA
    - National Pollutant Discharge Elimination System Permit by MPCA

Lake Orono Sedimentation and Water Quality Study

Wenck File #0598-01

Prepared for:

CITY OF ELK RIVER
13065 Orono Parkway
P.O. Box 490

Prepared by:

WENCK ASSOCIATES, INC.
1800 Pioneer Creek Center
P.O. Box 428
Maple Plain, Minnesota 55359-0428
(612) 479-4200

October 1997

Wenck

Table of Contents

Table of Contents (Cont.)

I. Introduction

A. BACKGROUND INFORMATION

Lake Orono is a 254 acre lake with a mean depth of approximately 5 feet. Lake Orono is also identified as Minnesota Department of Natural Resources (DNR) Protected Water 71-13P. The lake was created when the Elk River Dam was constructed in 1915. The Elk River Dam is located approximately 1.1 miles above the confluence of the Elk River with the Mississippi River, in the City of Elk River, Sherburne County, Minnesota (Figure 1). Drainage from the 388,000-acre Elk River watershed flows through Lake Orono, dominating the lakes water quality (Figure 2).

B. SCOPE OF INVESTIGATION

The City of Elk River hired Wenck Associates, Inc. in June 1996 to perform a sedimentation study for Lake Orono. The study is a cooperative effort with Sherburne County and the Lake Orono Improvement Association. The scope of the project included review of the watershed and development and implementation of a monitoring plan. Major inflows and the outflow from Lake Orono were monitored 18 times over a one year period, and sediment and phosphorus loads were calculated for these. Minor inflows to Lake Orono were monitored during three storm events. Lake sediment was sampled and chemical and physical analyses performed. Lake Orono was remapped by the DNR in 1996 and lake volume comparisons were made with a map prepared by the DNR in 1970. Additional lake and river monitoring was also conducted for fecal coliform and fecal streptococci contamination. The monitoring, analysis and findings of the investigation are documented in this report. Recommendations for managing Lake Orono are also provided.

II. Description of Investigation and Results

A. LAKE SEDIMENT SAMPLING

1. Sediment Sampling Procedures

Four sediment sampling locations were identified in cooperation with the Minnesota Pollution Control Agency (MPCA) to characterize sediment within Lake Orono in preparation for anticipated future dredging activities. Sampling locations are indicated on Figure 3. Per the MPCA's suggestion, samples from the upper 6-inches of sediment were obtained with a Ponar dredge at each of the four sampling locations. Sediment cores were also collected to a depth of 4 feet by two methods described below.

Sediment coring was completed using a modified Wildco K-B stainless steel core sampler. This core sampler collected sediment samples that were 2 inches in diameter and 20 inches in length. The K-B sampler utilized clear cellulose acetate butyrate (CAB) core liners and eggshell-type core catchers. The sampler was manually lowered into the water and penetrated the sediments by either the force of its own weight or by being pushed or driven as dictated by sediment consistency. After the sampler reached maximum penetration, it was carefully retrieved and disassembled. The filled liner was then removed from the core tube, capped and labeled. The core sampler was then cleaned using a non-phosphate detergent solution and deionized water rinses and reassembled with new liner tube.

Sediment samples were also collected utilizing a modified 3-inch stainless steel AMS bucket auger. A 4-inch diameter PVC casing was first driven into the sediment. The bucket auger was then utilized to manually bore into and collect the sediment from within the PVC casing. The

sediment collected in the auger was placed in a covered stainless steel bowl and thoroughly composited. The bucket auger, extension rods and PVC casing were all cleaned between sample locations using non-phosphate solution and deionized water. Sediment samples were placed on ice in a cooler and transported to the analytical laboratory within 24 hours of sampling. Samples were also transported to the soils engineering testing laboratory.

2. Chemical Analyses

Samples collected from the upper 6-inches of sediment were analyzed for the following "Tier I" parameters: moisture content, ammonia nitrogen, kjeldahl nitrogen, total phosphorus, and total organic carbon (TOC). Total organic carbon and kjeldahl nitrogen were analyzed within 48 hours and the results evaluated by the MPCA to determine at which sampling sites "Tier II" analysis was required. "Tier II" parameters include metals, cyanide, phenol, pesticides, herbicides, polychlorinated bi-phenyls (PCBs), and polyaromatic hydrocarbons (PAHs). A complete list of MPCA selected "Tier II" parameters is included in Appendix A along with the lake sediment chemical data and the MPCA evaluation letter.

Upon review of the "Tier I" data, the MPCA selected sampling locations #2 and #3 for additional "Tier II" analysis. Sediment from sampling locations #2 and #3 had the highest TOC concentrations of the four sampling locations and therefore the highest potential for containing contaminants of concern.

Samples collected for "Tier II" analysis were composited from sediment collected at depths between 0-4 feet. No organic parameters were detected at either sampling location #2 or #3. A number of inorganic "Tier II" parameters were detected at both sampling locations, within the normal background range for sediment. The MPCA has indicated that they have no concerns with the quality of the sediment sampled as long as it was disposed of on an upland site.

3. Physical Analyses

Sediment samples were also classified by a soil engineering testing firm and grain size distribution performed on sediment from the four sampling locations. In-place cores of the top 20-inches of sediment as well as composites of sediment collected at depths between 0-4 feet were analyzed. The above analyses are contained in Appendix B. The surface cores are denoted as T-1, T-2, T-3, and T-4 as samples contained in tubes. The composite samples are denoted as B-1, B-2, B-3, and B-4 as samples contained in bags. The sediment samples varied in composition from approximately 30 to 90 percent sand and gravel and approximately 10 to 70 percent silt and clay.

B. WATER QUALITY MONITORING

1. Suspended Solids and Phosphorus Monitoring

Water quality monitoring was conducted on the major inflows and the outflow from Lake Orono. Grab samples were collected a minimum of 18 times over a one year period from the Elk River at County Road 15 bridge (ERCR 15), Tibbits Brook at a point downstream from the County Road 35 bridge below County Ditch 28 (TBCR 35), and the outflow of Lake Orono at the dam. During the spring flooding period it was necessary to sample Tibbits Brook directly from the County Road 35 bridge (April 9th, 16th, and 23rd). See Figure 3 for the location of the monitoring stations. The sum of the drainage areas upstream of the two major inflow monitoring stations constitutes approximately 98 percent of the total Lake Orono drainage area of 388,000 acres (Figure 2). Total suspended solids (TSS), total phosphorus, and ortho phosphorus were analyzed for each sampling event. Volatile suspended solids (VSS) were analyzed for the last eleven sampling events. Monitoring at the Elk River and Tibbits Brook stations was conducted by the Sherburne Soil and Water Conservation District by the following methodologies: grab samples were collected from the top one foot of water using a polyethylene gallon jug which had

been cleaned with distilled water. The jug was rinsed twice with stream water prior to collecting each sample. The sample was collected from flowing water in the center of the streams. Samples were stored in a cooler for transporting to Environmental Protection Laboratories in St. Cloud for analysis. Stream flow was measured for Tibbits Brook and for County Ditch 28 for 11 of the sampling events using a General Oceanics model 2030 flow meter. A rating curve was developed using the combined discharge of Tibbits Brook at the County Road 35 bridge and Ditch 28 where it exits the culvert beneath Country Road 35. For Tibbits Brook, three separate velocity measurements were made for each sampling event and an average velocity was calculated. When water depths were greater than 2 feet, measurements were taken at two depths for each of the three measuring points corresponding to approximately 20 percent and 80 percent of the total water depth. For Ditch 28, one flow measurement was made. The discharge was then calculated using the cross sections for each stream. For each sampling event, the water level in Tibbits Brook was measured from a point on the County Road 35 bridge for use in developing the rating curve and for estimating discharge when it was not measured directly. Monitoring at the Lake Orono Dam was conducted by the Lake Orono Improvement Association. See Table 1 for a summary of the water quality data. Water quality monitoring data are contained in Appendix C.

In addition, minor inflows to Lake Orono were monitored during three storm events. See Table 2 for a summary of the monitoring data. Water quality monitoring data are contained in Appendix C. Grab samples were collected at five locations in total. These locations are culverts under Islandview Drive and Highway 10, and stormsewer outfalls located near 189th and Concord, Orono Road and Mississippi Road, and Orono Road at City Hall. Samples were collected at each location during selected sampling events. Stream flow measurements were made and stream flows estimated at these locations at the time of sample collection. Storm event monitoring was conducted by Wenck Associates, Inc. After sample collection, samples were immediately placed on ice in a cooler and were transported to the laboratory within 24 hours of collection.

2. Suspended Solids and Phosphorus Loading

The water quality and flow data were used to calculate sediment and phosphorus loading rates. The calculations were done for TSS, VSS, TSS-VSS, (i.e., non-volatile suspended solids), total phosphorus, and ortho phosphorus.

Samples for total phosphorus, ortho phosphorus, and TSS were collected between August 27, 1996 and August 5, 1997. Samples for VSS were collected only during the time interval April 9, 1997 through August 5, 1997. The VSS data for the remaining period were estimated from known values of TSS using a curve fitted through the observed data (see Appendix D).

The stream inflow data were obtained for two locations: ERCR 15 and TBCR 35. The stream outflow data were obtained at the Lake Orono Dam.

The flowrates at ERCR 15 were obtained from the U.S. Geological Survey (USGS), Minnesota District (see Appendix E). The USGS considers flow data to be "provisional" until eventual official publication.

The flowrates at TBCR 35 were monitored by the Sherburne Soil and Water Conservation District. Flowrates for 11 of the flow measurements were based on stream gauging data collected in the field. Flow rates for the other seven monitoring events were calculated through interpolation on a rating curve developed for the station (see Appendix E).

The flowrate at the dam was assumed to be the sum of the flowrates at ERCR 15 and TBCR 35.

Concentration data (mass/volume) were multiplied by the average flowrate (volume/day) for the dates samples were collected to obtain the mass inflow rates at ERCR 15 and TBCR 35 (mass/day) and the mass outflow rates (mass/day) at the dam (see Appendix D).

3. Fecal Coliform and Fecal Streptococci Monitoring

Grab samples were collected from four locations on the Elk River and two locations in Lake Orono (see Figure 3). The samples were collected to verify reported elevated bacterial counts at the municipal swimming beach on Lake Orono as well as to identify potential bacterial source locations. The samples were collected using sterile Whirl-Pack sample containers. The Whirl-Packs were attached to a 15-foot pole to allow the samples to be collected away from the river bank. The containers were filled approximately 6-inches below the water surface. Upon filing, the Whirl-Packs were carefully sealed leaving approximately 25 percent of the container capacity as an airspace. The samples were immediately placed on ice in a cooler and were transported to the laboratory within four hours of collection. See Table 3 for a summary of the fecal coliform and fecal streptococci data. Water quality monitoring data are contained in Appendix C.

C. COMPARISON OF 1970 AND 1996 DNR LAKE SURVEYS

Based on fieldwork completed on May 5, 1970, the Minnesota Department of Conservation (now the DNR), mapped the depth to sediment and produced a lake map for Lake Orono. At the request of the City of Elk River, Lake Orono was remapped on August 28, 1996, for the purpose of comparing the two surveys such that any changes in lake depth could be observed for the 26-year time period between surveys (see Appendix F).

The 1970 survey was scanned into a computer and, using the computer-aided design package Intergraph, the 1970 survey was compared to the 1996 survey electronically and the volume differential computed. To compare the two surveys in the above manner, the following adjustments were made to the survey data:

1. The lake outlines on the two surveys were drawn from two different aerial photographs taken 28 years apart. The later survey omitted the very shallow upper portion of the lake; as a result the areas were approximately 10 percent different, and the lake outlines between the two surveys varied and could not be directly compared. During the analysis, the volumetric comparison was based on only the lake area included in both surveys and does not include lake area upstream of the limits of the 1996 survey. To normalize the lake outline differences, the 1996 lake outline was utilized due to its higher level of detail.

2. The two lake surveys do not reference the same benchmarks. The survey benchmarks were investigated and the surveys adjusted to account for the varying lake elevations on the two survey dates. Benchmarks referenced in both surveys were surveyed together and it was confirmed that their relative elevations are correct. The 1970 survey references two benchmarks. Benchmark #2 is a brass monument on top of the concrete wingwall on the south side of the Lake Orono Dam west of Main Street. The benchmark was established in 1970 by the National Geodetic Survey, formerly the U.S. Coast and Geodetic Survey, as benchmark S-257. The elevation for benchmark #2 if 874.43 as provided by the Minnesota Department of Transportation Geodetic Unit. The water surface elevation of Lake Orono was therefore approximately 871.83 feet (874.43 - 2.6 = 871.83) on May 5, 1970.

The 1996 survey references a gage located at the outlet dam on the southeastern shore of Lake Orono. The elevation of Lake Orono is obtained by adding the gage reading to elevation 870.0 as documented in the 1982 Operation and Maintenance Manual for the Elk River Dam. The gage reading was documented as being 2.2 feet on August 28, 1996. In reviewing this reading, it became apparent that it was in error because a 2.2 foot gage reading represents 0.9 feet of

head above the weir crest at elevation 871.30. The resulting flow over the dam would be approximately 360 cubic feet per second (cfs).

$Q = 3.087\ L\ (H)^{3/2}$

L = 136 feet

H = 0.9 feet

Q = 358 cfs

The USGS flow record for the Elk River at ERCR 15 indicates flow between 66-111 cfs for a two week period around August 28, 1996 and 82 cfs on August 28, 1996 (see Appendix E). In addition, the daily operations log for the dam was obtained and it indicates a lake elevation reading of 871.6 which corresponds to a gage reading of 1.6 feet (see Appendix F). The above gage reading is consistent with the USGS flow record.

The above investigation concluded that the Lake Orono elevation was approximately 0.23 feet higher on May 5, 1970 than on August 28, 1996 (871.83 - 871.6 = 0.23 feet). The volumetric analysis comparing the 1970 and 1996 DNR lake surveys takes this difference into account.

III. Sedimentation and Water Quality Analyses

A. SEDIMENTATION RATES

Sedimentation rates were calculated by the following two methodologies described below:

- Volumetric comparison of 1970 and 1996 DNR lake surveys
- Sediment loading analysis based on monitoring data and literature values

1. Volumetric Comparison of 1970 and 1996 DNR Lake Surveys

The following results were calculated as accurately as the available data allow. However, due to the level of detail associated with the surveys (especially the earlier one), the analysis has only a limited ability to observe small changes in lake volumes. The calculated sedimentation volumes and rates should not be viewed as being accurately quantified, but instead providing an indication of whether or not there have been significant lake volume changes over the 26.3-year time period between surveys.

The volume comparison implies a net fill within Lake Orono of 181,000 cubic yards. This represents an annual deposition of approximately 6,900 cubic yards. Spread evenly over the 254-acre lake, it represents a deposition rate of 0.017 feet/year for a total deposition of 0.44 feet over the 26.3-year time period between surveys. These results correspond to low deposition for a lake and a reservoir.

2. Sediment Loading Analysis

The sediment and phosphorus mass flowrates were used to calculate the net annual loadings of the sediment and phosphorus. The calculations were done for TSS, VSS, TSS-VSS, phosphorus, and ortho phosphorus. Mass inflows were calculated at ERCR 15 and TBCR 35, and mass outflows were calculated at the Lake Orono dam. The calculations are shown in Appendix D. The calculation procedure is explained below:

a. The average inflow rate (mass/day) for the time interval between two consecutive sampling events was calculated by adding the two inflow rates, and then dividing the sum by two. Similarly, the average outflow rate (mass/day) for the time interval between two consecutive sampling events was calculated by adding the two outflow rates, and dividing the sum by two.

b. The mass inflow for the time interval was calculated by multiplying the average inflow rate (mass/day) by the time duration between the sampling events (days). The mass outflow for the time interval was calculated by multiplying the average outflow rate (mass/day) by the time duration between the sampling dates (days).

c. The mass inflows for all the time intervals were added to get the annual mass inflow. The mass outflows for all the time intervals were added to get the annual mass outflow.

d. The annual mass inflow and the annual outflow were divided by the number of days (365 days) to get the average mass inflow and outflow rates (tons/day) respectively.

e. The inflow of bed load was calculated as a percent of the inflow of suspended load. No bed load was assumed for the outflow.

f. The total inflow was calculated as the sum of the suspended load and the bed load.

g. The total annual outflow was subtracted from the total annual inflow to get the annual loading.

The fraction of bed load depends on the characteristics of the stream bed material, texture of suspended material, and the suspended sediment concentration. The bed load correction factors given in Table A-3 (Design of Small Dams, Bureau of the Reclamation, Department of the Interior 1987) were used to estimate the percent bed load in terms of suspended load. For concentrations less than 1,000 mg/l, the table gives a bed load correction factor of 25 to 150 percent of suspended load for sandy stream bed material.

The trap efficiency of the lake was also calculated assuming different bed load concentrations (Appendix D). The trap efficiency of the lake is the percent of the total sediment inflow that is deposited in the lake

The trap efficiencies calculated were compared with Brune's trap efficiency curve (Brune, "Trap Efficiency of Reservoirs" June 1953) (Appendix D). Brune's curve gives trap efficiencies of normal ponded reservoirs as a function of detention time (lake volume divided by the annual inflow). Lake Orono has a volume of about 1,249 acre-ft. The annual inflow rate into the lake based on 1996 data is 222, 410 acre ft/yr (USGS data for Elk River near Big Lake). This gives a detention time of 0.0056 years. The corresponding trap efficiency per Brune's curve is in the range of 15-40 percent. This is comparable to the calculated values with bed loads of 50-100 percent of suspended load. Total sediment deposition was calculated to be between 880 and 2,500 tons per year assuming bedload contribution in the above range. Based on bedload at 75 percent of the total suspended load, net deposition is approximately 1,700 tons, or approximately 1,700 cubic yards, per year in Lake Orono. Spread evenly over the lake's 254 acres, it represents a deposition rate of 0.004 feet/year. This is about one fourth of the deposition rate previously calculated by comparing the 1970 and 1996 DNR lake surveys. The sediment deposition is, however, likely to occur primarily in the upper portions of the lake and is probably not evenly distributed over the whole lake. Sedimentation in Lake Orono consists of primarily the coarser

bed load fraction of the Elk River's sediment load. Monitoring data collected during the study found a net export of total suspended solids out of Lake Orono.

Total suspended solids loadings calculated during the Elk River study can be compared to suspended sediment yields calculated by the USGS. The USGS conducted suspended sediment sampling at ERCR 15 from 1975 - 1981. The USGS data was analyzed and documented in USGS Suspended Sediment in Minnesota Streams Water Resources Investigations Report 85-4312, 1986. The USGS study involved collection of 178 suspended sediment samples and sediment yields were calculated based on a 14-year stream flow record.

The USGS report documents two sediment load values. The average annual sediment yield was calculated to be 3.7 tons/day and the median sediment discharge was calculated to be 11.1 tons/day. The total suspended solids discharge calculated in the Elk River study was 9.2 tons/day.

B. WATER QUALITY ASSESSMENT

1. Suspended Solids and Phosphorus

Flow- and time-weighted averages were calculated for total phosphorus, ortho-phosphorus, TSS, VSS and TSS-VSS at monitoring stations: ERCR 15, TBCR 35, and the Lake Orono Dam (see Appendix D). Average total phosphorus and TSS concentrations were 0.12 milligrams per liter (mg/l) and 9 mg/l at ERCR 15, 0.15 mg/l and 9 mg/l at TBCR 35, and 0.11 mg/l and 11 mg/l at the Lake Orono Dam. The MPCA has developed a water quality database from monitoring minimally impacted streams from various ecoregions across Minnesota. (Selected Water Quality Characteristics of Minimally Impacted Streams from Minnesota's Seven Ecoregions, February 1993.) The Elk River watershed is within the North Central Hardwood Forest (NCHF) ecoregion. "Typical" values for total phosphorus and TSS, within the NCHF ecoregion, range

from 0.06 - 0.15 mg/l and 4.8 - 16 mg/l respectively. The above average concentrations are all within the "typical" ranges provided by the MPCA. The average total phosphorus concentration monitored at TBCR 35 is on the high end of the "typical" range for total phosphorus and is 25 percent higher than the average total phosphorus concentration monitored at ERCR 15.

Storm event monitoring of minor tributaries to Lake Orono overall showed reasonably low total phosphorus and TSS concentrations (See Table 2). Due to the very small local drainage contribution to Lake Orono, the lake's water quality is dominated by the Elk River flow.

In-lake total phosphorus and TSS concentrations in Lake Orono are very high compared to minimally impacted lakes within the NCHF ecoregion. "Typical" summer values for total phosphorus and TSS, within the NCHF ecoregion, range from 0.023 - 0.050 mg/l and 2-6 mg/l respectively. (Minnesota Lake Water Quality Assessment Report, Second Edition, 1990.) Average summer values for total phosphorus and TSS in Lake Orono, based on five summer samples collected as part of this study, were 0.171 mg/l and 27 mg/l respectively. Based on total phosphorus data Lake Orono is classified as hypereutrophic. Poor water quality in Lake Orono is largely due to a very high watershed drainage area to lake volume ratio resulting in average residence times of only three days. Total phosphorus removal efficiencies within Lake Orono were calculated to be less than 10 percent. This is much lower than lakes with longer residence times where removal efficiencies can be on the order of 90 percent.

2. Fecal Coliform and Fecal Streptococci

The City of Elk River collected fecal coliform samples at the Lake Orono City Beach during ten sampling events in July - September 1997. Results indicated fecal coliform concentrations between 200 and 4,600 organisms/100 milliliters (ml), in many cases significantly above the National Public Health Association Guideline of 200 organisms/100 ml (see Table 3). Additional sampling was conducted on August 19, 1997 at various locations along the Elk River and at the Lake Orono City Beach. Results indicate very high concentrations of fecal coliform

and streptococci bacteria for an inflow to Elk River at Wapiti Campground and an inflow to Lake Orono from a subdivision sedimentation pond with adjacent lands containing recently spread straw mulching. The straw mulch may have been used as bedding for livestock. The concentration of fecal coliforms at the Lake Orono Beach was 70 organisms/100 ml. Other samples collected by the City between August 18, 1997 and September 8, 1997 were in the 200 - 400 organisms/100 ml range.

By monitoring both fecal coliform (FC) and fecal streptococci (FS) concentrations and evaluating the ratio of FC/FS, information regarding the origin of the fecal contamination can be obtained. The FC/FS ratio for domestic animals is less than 1.0, whereas the ratio for human beings is more than 4.0 (Wastewater Engineering Treatment/Disposal/Reuse, Metcalf and Eddy, Inc., 1979). The data show low FC/FS ratios indicating fecal material from non-human sources.

FC/FS ratios from "Lake Orono City Beach" and "Inflow to Lake Orono from Subdivision" are 1.17 and $\geq$ 2.86 respectively. This could indicate a differential die-off of indicator organisms where the fecal streptococci die off more rapidly than the fecal coliforms. High fecal coliform concentrations at Lake Orono City Beach may be due to a high goose population in and around the beach, or it may be related to precipitation events flushing fecal coliforms into the Elk River from an upstream source. Additional monitoring next year is required to better evaluate the source of the fecal coliform contamination.

IV. Conclusions

1. Sedimentation rates within Lake Orono appear to be in the range of 1,700 to 6,900 tons per year, equivalent to 0.004 to 0.017 feet per year over the whole lake area.

2. Sedimentation in Lake Orono consists of primarily the coarser bed load fraction of the Elk River's sediment load. There appears to be no net deposition of total suspended solids within Lake Orono.

3. Total phosphorus and total suspended solids concentrations in the Elk River are within the typical range for minimally impacted streams within the same part of the state.

4. Total phosphorus concentrations in Tibbits Brook are 25 percent higher than in the Elk River and are on the high end of the typical range for minimally impacted streams within the same part of the state.

5. In-lake total phosphorus concentrations in Lake Orono are very high compared to minimally impacted lakes within the same part of the state. Based on total phosphorus data Lake Orono is classified as hypereutrophic.

6. Poor water quality in Lake Orono is largely due to a very high watershed drainage area to lake volume ratio, resulting in average water residence times of approximately three days.

7. Monitoring in the swimming area of the city beach indicated high levels of fecal coliform bacteria above national public health association guidelines.

V. Recommendations

1. Develop a lake management plan, with rough cost estimates, for dredging parts of the lake based on usage.

2. Dredge an in-lake sedimentation basin where the Elk River enters Lake Orono to provide a reservoir for coarser fraction of the river's sediment load to be deposited in.

3. Develop a local water quality action plan to address
   - fecal coliform contamination in Lake Orono
   - on-going water quality monitoring in Lake Orono
   - best management practices within the City of Elk River

4. Work with the watershed board and the comprehensive water plan committee to develop a water quality action plan to address
   - best management practices within the Elk River watershed
     - inclusive of policies to maintain natural buffers
   - water quality goals for the Elk River watershed

VI. References

Brune, "Trap Efficiency of Reservoirs," June 1953.

Design of Small Dams, Bureau of the Reclamation, Department of the Interior, 1987.

Hydrologic Engineering Methods for Water Resources Development, Volume 12, Sediment Transport. The Hydrologic Engineering Center Corps of Engineers, U.S. Army Davis, California, June 1977.

Minnesota Lake Water Quality Assessment Report, Second Edition, A Practical Guide for Lake Mangers, Minnesota Pollution Control Agency, 1990.

Selected Water Quality Characteristics of Minimally Impacted Streams from Minnesota's Seven Ecoregions, Minnesota Pollution Control Agency, February 1993.

Suspended Sediment in Minnesota Streams, U.S. Geological Survey Water-Resources Investigations Report, 85-4312, 1986.

Wastewater Engineering Treatment/Disposal/Reuse, Metalf and Eddy, Inc., 1979.

Tables

Table 1
Water Quality Data
City of Elk River

Sample Site	Sample Date	Total Phosphorus mg/l	Ortho-Phosphorus mg/l	Total Suspended Solids mg/l	Volatile Suspended Solids mg/l
Elk River @ CR 15	8/27/96	0.132	0.022	23.2	-
	10/1/96	0.087	0.023	16	-
	10/18/96	0.076	0.021	7.6	-
	11/13/96	0.06	0.01	4.8	-
	12/10/96	0.055	0.033	2.6	-
	3/27/97	0.106	0.064	16.4	-
	4/3/97	0.178	0.105	14	-
	4/9/97	0.117	0.069	3.3	1
	4/16/97	0.067	0.035	2.6	1
	4/23/97	0.11	0.017	16	7.1
	4/30/97	0.096	0.01	12.4	7
	5/14/97	0.07	0.01	10.2	5.2
	5/28/97	0.075	0.01	12.6	5.6
	6/11/97	0.075	0.01	12.6	6.8
	6/25/97	0.105	0.049	13	7.8
	6/30/97	0.161	0.058	5.8	2.6
	7/23/97	0.241	0.06	26	14
	8/5/97	0.165	0.117	5.4	2.6
Tibbets Br @ CR35	8/27/96	0.126	0.112	2.5	-
	10/1/96	0.332	0.298	3	-
	10/18/96	0.126	0.096	4.3	-
	11/13/96	0.074	0.062	2.9	-
	12/10/96	0.071	0.057	4.1	-
	3/27/97	0.134	0.1	9.4	-
	4/3/97	0.13	0.083	5.6	-
	4/9/97	0.093	0.053	5.1	1
	4/16/97	0.07	0.056	5.4	2
	4/23/97	0.274	0.231	5.8	2.2
	4/30/97	0.162	0.143	4.2	2.2
	5/14/97	0.069	0.03	4.4	1.6
	5/28/97	0.359	0.226	13.6	6.6
	6/11/97	0.174	0.14	5.2	3.2
	6/25/97	0.248	0.2	10.6	7.4
	6/30/97	0.202	0.194	10.1	7
	7/23/97	0.268	0.122	22	15.2
	8/5/97	0.103	0.078	4.4	2.6
Elk River @ Dam	8/27/96	0.212	0.046	52	-
	10/1/96	0.039	0.01	17.1	-
	10/18/96	0.082	0.01	17.4	-
	11/13/96	0.057	0.01	7.1	-
	12/10/96	0.051	0.033	1	-
	3/27/97	0.066	0.041	2.3	-
	4/3/97	0.131	0.081	10.6	-
	4/9/97	0.141	0.083	12.5	4.1
	4/16/97	0.072	0.037	4.4	1
	4/23/97	0.092	0.038	11.9	4.8
	4/30/97	0.081	0.021	17	9.8
	5/14/97	0.067	0.01	14.9	6.6
	5/28/97	0.101	0.01	25.6	9.6
	6/11/97	0.124	0.01	19	8.3
	6/25/97	0.111	0.022	20.1	12
	6/30/97	0.151	0.01	23	13
	7/2/97	0.115	0.01	24	13.8
	7/23/97	0.227	0.033	33.2	20.8
	8/5/97	0.154	0.1	8.4	4.6

Figures

Table 3
Fecal Coliform and Fecal Streptococci Data
City of Elk River

Sample Site	Sampled By	Sample Date	Fecal Coliform[1] (# organisms/100ml)	Fecal Streptocci (# organisms/100ml)	Ratio FC/FS	Precipitation[2] (inches)
		7/1/97				0.00
		7/2/97				2.08
		7/3/97				0.11
		7/4/97				0.13
		7/5/97				0.31
		7/6/97				0.00
		7/7/97				0.00
		7/8/97				1.43
		7/9/97				0.00
		7/10/97				0.00
		7/11/97				0.00
		7/12/97				0.00
		7/13/97				0.88
Lake Orono City Beach	City of Elk River	7/14/97	2,500	–		T[4]
		7/15/97				0.00
		7/16/97				0.00
Lake Orono City Beach	City of Elk River	7/17/97	1,600	–		0.14
		7/18/97				0.00
		7/19/97				0.00
		7/20/97				0.73
Lake Orono City Beach	City of Elk River	7/21/97	1,700	–		0.03
		7/22/97				1.24
		7/23/97				0.29
		7/24/97				0.00
		7/25/97				0.43
		7/26/97				0.00
		7/27/97				0.00
Lake Orono City Beach	City of Elk River	7/28/97	2,200	–		0.00
		7/29/97				0.00
		7/30/97				0.00
		7/31/97				0.00
		8/1/97				0.00
		8/2/97				0.00
		8/3/97				0.57
Lake Orono City Beach	City of Elk River	8/4/97	800	–		0.34
		8/5/97				0.00
		8/6/97				0.27
		8/7/97				0.00
		8/8/97				0.00
		8/9/97				0.00
		8/10/97				0.02
Lake Orono City Beach	City of Elk River	8/11/97	4,600	–		0.00
Elk River at Wapiti Campground	City of Elk River	8/11/97	1,400	–		0.00
		8/12/97				0.00
		8/13/97				0.01
		8/14/97				T
		8/15/97				0.15
		8/16/97				0.15
		8/17/97				0.00
Lake Orono City Beach	City of Elk River	8/18/97	200	–		0.02
Lake Orono City Beach	Wenck	8/19/97	70	60	1.17	0.80
Elk River Upstream of Wapiti Campground	Wenck	8/19/97	140	530	0.26	
Elk River Downstream of Wapiti Campground	Wenck	8/19/97	220	1,500	0.15	
Elk River Downstream of Camp Kozy	Wenck	8/19/97	150	1,200	0.13	
Inflow to Elk River at Wapiti Campground	Wenck	8/19/97	29,000	270,000	0.11	
Inflow to Lake Orono from Subdivision[3]	Wenck	8/19/97	≥200,000	70,000	≥2.86	
		8/20/97				1.53
		8/21/97				0.00
		8/22/97				0.00
		8/23/97				0.00
		8/24/97				0.04
Lake Orono City Beach	City of Elk River	8/25/97	400	–		0.00
		8/26/97				0.00
		8/27/97				0.00
		8/28/97				0.00
		8/29/97				M[5]
		8/30/97				M
		8/31/97				M
		9/1/97				M
Lake Orono City Beach	City of Elk River	9/2/97	400	–		0.29
		9/3/97				M
		9/4/97				M
		9/5/97				M
		9/6/97				M
		9/7/97				M
Lake Orono City Beach	City of Elk River	9/8/97	200	–		0.91

[1] National Public Health Association Guideline 200 org/100 ml as geometric mean of not less than 5 samples in any calendar month nor shall more than 10% of all samples taken during any calendar month individually exceed 2000 org/100 ml (March 1 - October 31). Minnesota Pollution Control Agency (MPCA) has adopted this standard for Class 2 waters.

[2] Precipitation readings submitted to the State Climatology Office by an observer at the Municipal Power Plant in Elk River.

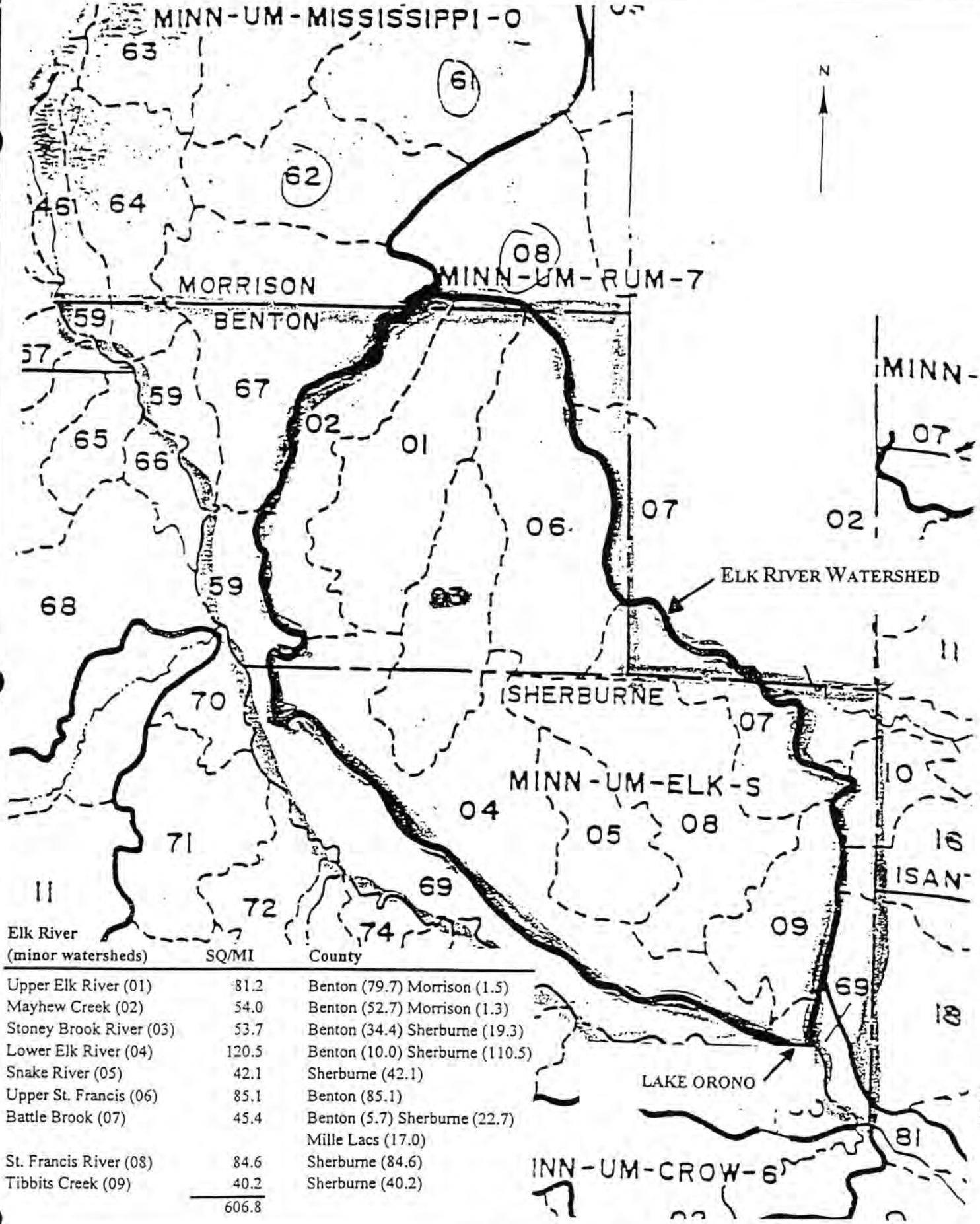
[3] Stormsewer inflow from subdivision sedimentation pond with adjacent lands containing recently spread manure.

[4] Trace.

[5] Data missing, not yet finalized

Table 2
Storm Event Monitoring Data
City of Elk River

Sample Site	Sample Date	Sample Time	Flow (cfs)	Total Phosphorus mg/l	Ortho- Phosphorus mg/l	Total Suspended Solids mg/l
Islandview Drive	10/17/96	12:50	3.60	0.078	0.056	5.9
	10/17/96	13:50	3.24	0.070	0.048	4.3
	10/17/96	14:30	3.24	0.071	0.048	4.5
	7/2/97	12:25	4.55	0.181	0.105	25.4
	7/2/97	14:25	4.50	0.159	0.100	20.2
Highway 10	10/17/96	14:00	<1	0.133	0.035	6.4
	10/17/96	14:45	<1	0.141	0.038	12.1
189th and Concord	10/17/96	12:30	trickle only	0.652	0.594	15
	7/2/97	12:40	1.08	0.065	0.045	<2
	7/2/97	14:45	1.00	0.069	0.044	<2
Orono Road and Mississippi Road	8/19/97	14:40	0.75	0.09	0.08	50
Orono Road at City Hall	8/19/97	14:45	0.79	0.07	0.02	48



Elk River (minor watersheds)	SQ/MI	County
Upper Elk River (01)	81.2	Benton (79.7) Morrison (1.5)
Mayhew Creek (02)	54.0	Benton (52.7) Morrison (1.3)
Stoney Brook River (03)	53.7	Benton (34.4) Sherburne (19.3)
Lower Elk River (04)	120.5	Benton (10.0) Sherburne (110.5)
Snake River (05)	42.1	Sherburne (42.1)
Upper St. Francis (06)	85.1	Benton (85.1)
Battle Brook (07)	45.4	Benton (5.7) Sherburne (22.7) Mille Lacs (17.0)
St. Francis River (08)	84.6	Sherburne (84.6)
Tibbits Creek (09)	40.2	Sherburne (40.2)
	606.8	

CITY OF ELK RIVER

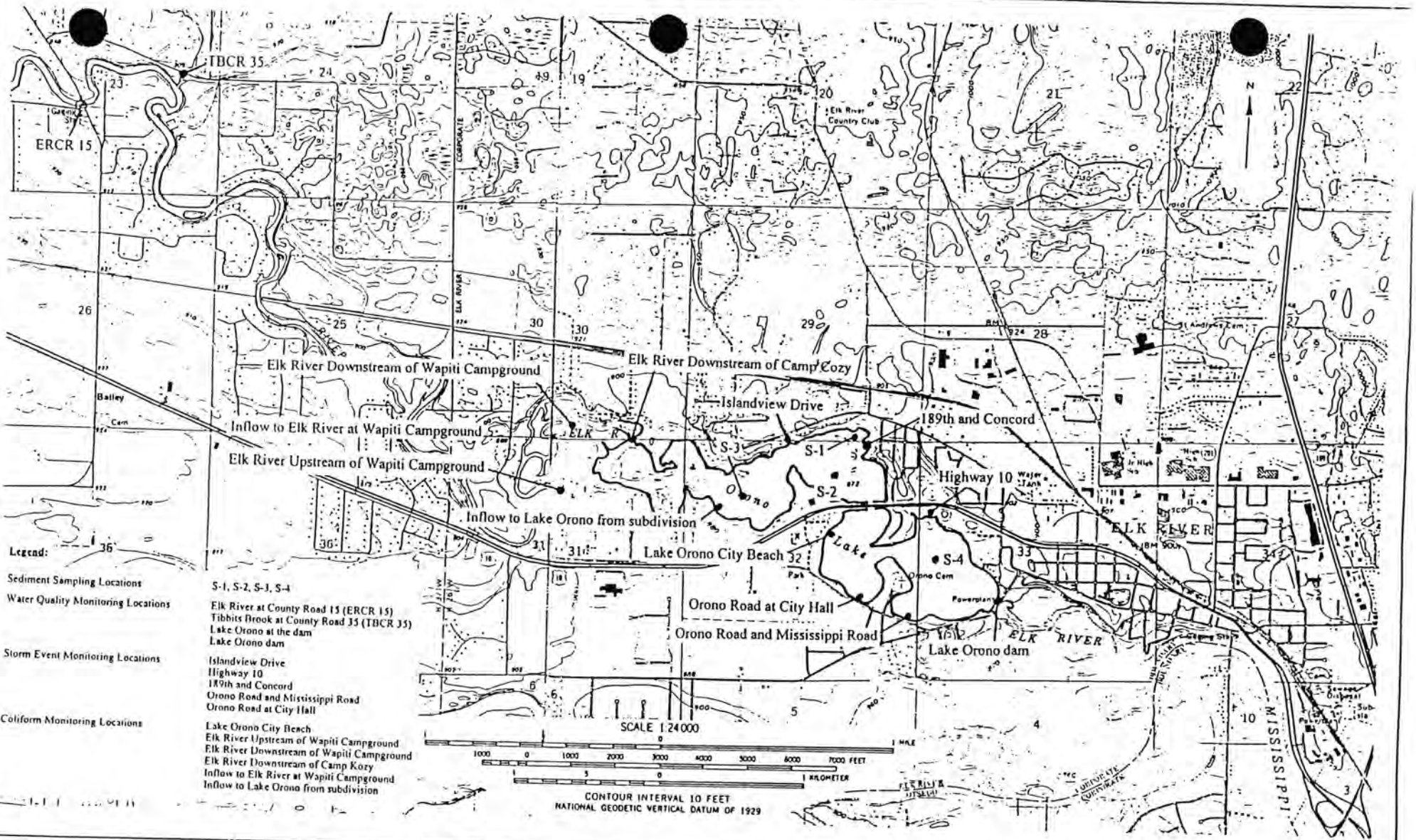
Elk River Watershed

Wenck

Wenck Associates, Inc. 1800 Pioneer Creek Ctr.
Environmental Engineers Maple Plain, MN 55359

OCT 1997

Figure 2



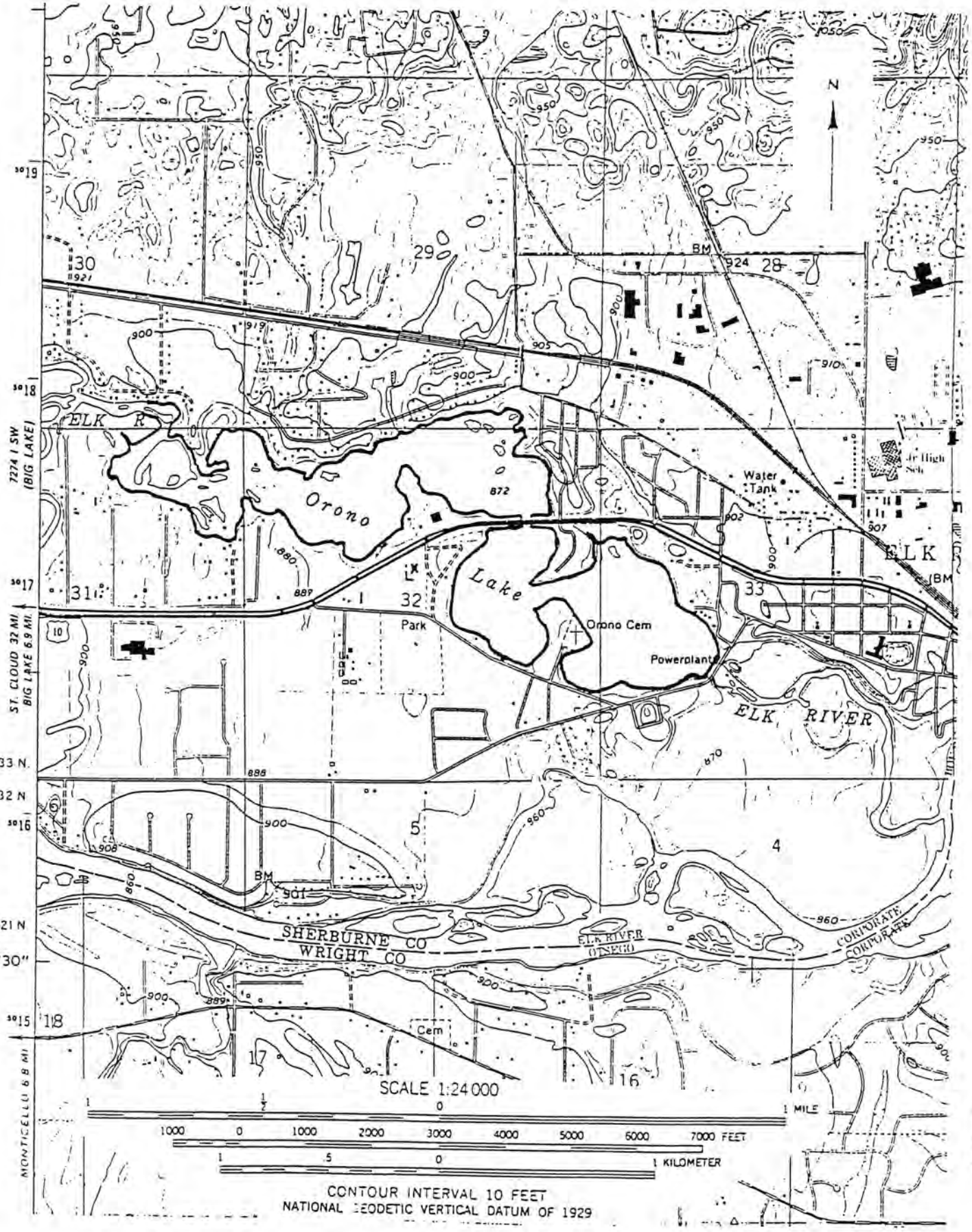
CITY OF ELK RIVER

Monitoring Station Location Map

Wenck Associates, Inc. Environmental Engineers

OCT 1997

Figure 3



CITY OF ELK RIVER	COPYRIGHT Wenck		OCT 1997
Site Location Map	Wenck Associates, Inc. 1800 Pioneer Creek Ctr. Environmental Engineers Maple Plain, MN 55359		Figure 1

ENVIRONMENTAL ASSESSMENT WORKSHEET (EAW)

NOTE TO PREPARERS

This worksheet is to be completed by the Responsible Governmental Unit (RGU) or its agents. The project proposer must supply any reasonably accessible data necessary for the worksheet, but is not to complete the final worksheet itself. If a complete answer does not fit in the space allotted, attach sheets as necessary.

For assistance with this worksheet contact the Minnesota Environmental Quality Board (EQB) at (612) 296-8253 or (toll-free) 1-800-652-9747 (ask operator for the EQB environmental review program) or consult " EAW Guidelines," a booklet available from the EQB.

NOTE TO REVIEWERS

Comments must be submitted to the RGU (see item 3) during the 30-day comment period following notice of the EAW in the EQB Monitor. (Contact the RGU or the EQB to learn when the comment period ends.) Comments should address the accuracy and completeness of the information, potential impacts that may warrant further investigation, and the need for an EIS. If the EAW has been prepared for the scoping of an EIS (see item 4), comments should address the accuracy and completeness of the information and suggest issues for investigation in the EIS.

1. Project Title **Lake Orono Improvement Project**

2. Proposer	City of Elk River	**3. RGU**	City of Elk River
Contact Person	Stephen Rohlf		Stephen Rohlf
Address	13065 Orono Parkway		13065 Orono Parkway
	P.O. Box 490		P.O. Box 490
	Elk River, MN 55330		Elk River, MN 55330
Phone	(612) 441-4904		(612) 441-4904

4. Reason for EAW

__EIS scoping _x_mandatory EAW __citizen petition __RGU discretion __Proposer volunteered
If EAW or EIS is mandatory give EQB rule category Number(s) - 4410.4300 Subpart 27 (A)

5. Project Location

Sediment removal from lake

Those parts of Lake Orono where sediment is proposed to be removed are located in portions of the following areas:

- SE ¼ of SE ¼, Sec. 29;
- NE ¼ of NE ¼, Sec. 31;
- NW ¼, Sec.32 ;
- SE ¼ of NE ¼, Sec. 32;

all in Township 33, Range 26, Sherburne Co., MN.

Sediment disposal

The sediment disposal sites are located in the following areas:

- SE ¼ of SE ¼, Sec. 29;
- S ½ of NE ¼, Sec. 31;
- SW ¼ of NW ¼, Sec. 32;
- NE ¼ of SE ¼, Sec 32;

All in Township 33, Range 26, Sherburne Co., MN.

Attach copies of the following to the EAW:

a. a county map showing the general location of the project

b. copy(ies) of USGS 7.5 minute, 1:24,000 scale map (photocopy is OK) indicating the project boundaries;

c. a site plan showing all significant project and natural features.

A county vicinity map, United States Geological Survey (USGS) map, and site plans for the sediment removal and disposal are attached.

6. Description Give a complete description of the proposed project and ancillary facilities (attach additional sheets as necessary). Emphasize construction and operation methods and features that will cause physical manipulation of the environment or produce wastes. Indicate the timing and duration of construction activities.

Background

Lake Orono is an impoundment of the Elk River total encompassed within the City limits of the City of Elk River. The Elk River empties into the Mississippi River approximately one mile down stream of the dam for Lake Orono.

The local lake owner's association, the "Lake Orono Improvement Association" is concerned about water quality in Lake Orono and areas of the lake that have recently become non-navigable due to sediment. This group convinced the Elk River City Council to conduct a study of these issues. The City of Elk River hired Wenck and Associates to conduct a detailed study on both issues. Sherburne County, the City of Elk River, the Sherburne County Soil and Water Conservation District (SWCD), the Lake Orono Improvement Association, the Elk River Lions Club and the Elk River American Legion all helped to fund the study.

The City of Elk River took great efforts to involve the Minnesota Department of Natural Resources (DNR), the Minnesota pollution Control Agency (MPCA), United States Army Corps of Engineers (USACE), and the Sherburne County SWCD in the study process to ensure all appropriate issued were addressed. The "Lake Orono Sedimentation and Water Quality Study" was published in October of 1997.

Study recommendations

The study made the following four recommendations to improve Lake Orono:

1. Develop a lake management plan, with rough cost estimates for dredging parts of the lake based on usage. The Lake Orono Improvement Association and the City of Elk River work jointly to develop a plan to remove sediment from the lake and restore the western most lobe to its original navigable depth. The sediment removal project that follows the plan is the reason for this EAW. Management of erosion upstream to slow future sedimentation is also included in the plan.

2. Dredge an in-lake sedimentation basin where the Elk River enters Lake Orono to provide a reservoir for coarser fraction of the river's sediment load to be deposited in. It was considered impractical to gain enough width or depth in the Elk River to provide a sedimentation basin prior to Lake Orono. In addition, the city is concern that creating a sedimentation basin in the river will disturb the equilibrium of the sediment upstream. It was decided that by excavating sediment from the western lobe of the lake that storage for future sedimentation would be provided in an area where sediment deposition occurs naturally.

3. Develop a local water quality plan to address:

- fecal coliform contamination in Lake Orono - The majority of the shoreline of the lake is served with city sewer. Capacity at the city's waste water treatment plant has been reserved and sewer trunk lines appropriately sized to serve the remainder of the lake's shoreline. Further, the city has began a program of weekly fecal coliform sampling during the swimming season to track this issue and eliminate potential sources.

- ongoing water quality monitoring - Routine secchi disk monitoring etc. will be conducted by volunteers from the Lake Orono Improvement Association. Periodic monitoring of a more detailed nature will be conducted by the city and compared to the base line established by the 1997 study to determine if additional actions are needed.

- best management practices within the City of Elk River - The city will continue to require best management practices and sedimentation prior to storm water discharging to the lake. In addition, the use of vegetative buffer strips will be encouraged and a citizen education program on issues like non-phosphorus fertilizer will be conducted.

4. Work with the watershed board and the comprehensive water plan committee to develop a water quality action plan to address:

- best management practices within the Elk River watershed - The sedimentation rate of the Elk River is very low when compared to other rivers monitored by the USGS in Minnesota. Much of the river is lined with natural buffers. However, the sedimentation rate could be reduced the natural buffers should be maintained.

- water quality goals for the Elk River watershed - A member of the Lake Orono Improvement Association has recently been appointed to the Sherburne County Water Plan Committee and will be acting as a liaison for the city.

Sediment removal

The removal of sediment from the lake described in study recommendation #2 is the issue that mandates the EAW process. The lake study found that there was no net deposition of suspended sediment in Lake Orono and the sedimentation that does exist consists of primarily the coarser bedload fraction of the Elk River's sediment load.

The city is proposing to remove 1 to 2 feet of sediment from the western most lobe of the lake (Area I, approximately 90,000 cu. yd.) to restore its original navigable depth. This lobe will again act as the sedimentation basin for bedload from the river in the future.

In addition, the city plans to remove sediment that poses a safety hazard to boating from two other areas of the lake (Areas II, 3,500 cu. yd. & Area IV, 13,500 cu. yd.). Approximately 2,000 cu. yd. is proposed to be removed from Area III to improve access and clean out an existing area where sediment currently deposits.

An optional area the city is considering involves the removal one foot of sediment from the top of four high spots that pose hazards to boating. The material removed from the high spots mentioned is proposed to be left on adjacent areas of the lake bed, away from the channel of the river through the lake. The location of this material precludes its removal without bridging the river channel through the lake or repeatedly cross it. It is our opinion that both of these options would have a negative effect on water quality. This work involves the moving of approximately 6,000 C.Y. of material.

A total of approximately 115,000 C.Y. of material are proposed to be removed and/or graded by the project. The total project area encompass 61.9 acres. For details on the locations, quantities, and depths see the attached sheet 1 of 2 of the attached Lake Orono Improvement Project Site Plan.

Life expectancy of the project

Besides the inlet and outlet sediment sampling done as part of the 1997 lake study, fourteen years of USGS data was available to determine the suspended sediment yield in the Elk River. Based on the above described monitoring, the estimated average bedload delivery rate to Lake Orono is 3,000 C.Y. per year. This is not a high rate of sedimentation compared with other rivers. However, combined with increased erosion control efforts upstream, the removal of 90,000 to 100,000 C.Y. of material from the western lobe of the lake should allow the project to last for 30 to 40 years. Implementation of erosion control measures adjacent to the areas of the lake proposed to be excavated for safety reasons should allow these portions of the project to last indefinitely.

The proposed project is not expected to affect the sedimentation rate of the Elk River. The western most lobe of the lake is where sediment from the river is naturally collecting now. The shallow nature of the excavation adjacent to the Elk River (1 to 2 feet gradually tapering up to the existing river bottom) should not upset the equilibrium of sediment upstream. In addition, areas with stabilizing vegetation will not be disturbed. The only vegetation proposed to be remove by the project are 2 or 3 small pockets of scrub willows (less than ½ inch diameter) that have colonized on deposition areas in the immediate mouth of the Elk River within the last four years.

Construction methods

The city is proposing to draw down the lake by gradually, over a four day period, from its normal level of approximately 872 MSL. The lake will be drawn down for approximately two week prior to excavation activities commencing to allow the sediment time to dry. The material will then be bulldozed into windrows, loaded into large tired off-road trucks and hauled to upland sites in the immediate vicinity of the lake for disposal. Water from the Elk River that passes through the lake during construction will be directed away from the work areas to avoid potential negative impacts. If areas need to be built-up to allow truck traffic, the lake sediment itself will be used.

The lake was drawn down twice in 1997. No negative impacts due to erosion or to fisheries or wildlife were observed during these draw downs. Additionally, during these draw downs it was observed that absolutely no vegetation exists on the lake bottom in any of the areas where work is proposed.

The city will require that the contractor doing the work has a spill prevention and counter control plan approved to ensure immediate clean-up of potential contaminates. Specific erosion control measures are identified on the construction plans and additional measures will be implemented if needed. Even when allowed to dry, the material proposed to be removed from the lake will have a high enough moisture content that dust will not be a problem. But, river water will be used to control dust, if needed.

Disposal sites

It is proposed that material removed from the lake be disposed of on upland sites in the immediate vicinity. This avoids having to reload the material into on-road trucks. The top soil will be removed from the disposal sites, the material will be spread and compacted by a bulldozer, the topsoil will be replaced and the sites will then be immediately seeded and mulched. So the sediment placed on the disposal sites does not impede future development, except for berms proposed as sound barrier from adjacent US Trunk Highway #10, the typical depth of the material deposited will only be approximately 3 feet. The city will contract the services of a geotechnical engineer during construction to verify and document the conditions of the disposal sites. Sheet 2 of 2 of the attached Lake Orono Improvement Project Site Plans shows the locations of the disposal sites, quantities, and details on erosion control measures.

Core samples of the sediment in the lake were taken and analyzed. The city worked with MPCA to identify the sampling locations and what parameters were tested for. The sediment was determined to be clean and MPCA has indicated they have no concerns with the quality of this material.

Duration of construction

The proposal is to draw the lake down in early August of 1998 and begin sediment removal in mid-August. The construction will be completed on or before October 31, 1998. At predicted flow rates, it is estimated that the lake can be brought back to its normal water levels within four days, prior to freeze-up.

The above time frame was selected to minimize impacts on fisheries, wildlife (especially waterfowl) and the summer recreational use of the lake. Further, the time period selected should be one of the driest of the year.

Beneficiaries of the project

The City of Elk River feels that the project described is imperative. Not only will the immediate lake owners benefit, but Lake Orono is a regional recreation facility enjoyed by thousands of non-lake owners each year. Further, because it draws people to Elk River, the lake is an economic resource for the community and Sherburne County.

Alternatives

Without a project the lake will continue to decline and pose additional safety hazard to boating. Due to the very low sedimentation yield in the Elk River, additional best management practices within the watershed will facilitate maintenance of the sediment yield, but can not be expected to significantly reduce it. No feasible alternative for keeping a reasonable water depth in the lake besides sediment removal has been

discovered. For example, raising the height of the dam to gain additional depth will flood numerous homes.

Other methods for removing sediment from the lake were explored; such as hydraulic dredging or bulldozing material from the lake in the winter when frozen. These methods were more costly and/or would create greater negative impacts. The project and methods proposed are the best option for restoring this resource.

Public Input

City staff has facilitated an average of more than one meeting per month since May of 1995 on the status of Lake Orono. These meeting have all been open to the public. A representative of the Sherburne County Soil and Water Conservation District has been routinely in attendance at these meetings and on several occasions staff from MPCA, DNR, Board of Soil and Water Resources (BSWR), and USACE have attended. The local paper, the Elk River Star News, has publish numerous articles regarding the proposed lake project and the monthly meetings.

The Elk River City Council held a public meeting regarding the proposed project on 12/15/97 and a public meeting specifically for the lake owners was held on 1/15/98. The response from the approximately 100 people in attendance at the lake owners meeting was very positive. This meeting will be aired on public access television.

The Lake Orono Improvement Association is also making personal contact with all lake owners who were not at the 1/15/98 meeting so they may attend an additional public hearing for the project, required through the city's conditional use process. The public hearing for the conditional use permit requires mailed notice as well as notice in the local paper. In addition there will be an assessment hearing for the project.

The results of the lake study were presented to the Sherburne County Board and the Elk River Watershed Board at public meetings. The recommended lake improvement will also be presented to these boards at public meetings.

Funding

The estimated cost of the lake improvement project described in this EAW is $750,000. It is proposed to be funded through special assessments against lakeshore owners and tax revenue.

7. Project Magnitude

Total Project Area (acres) ___61.9_____ or Length (miles) __N/A____

Number of Residential Units
Unattached ____N/A_____ Attached ____N/A_____

Commercial / Industrial / Institutional Building Area (gross floor space)
Total _____N/A_____ square feet;

Indicate area of specific uses:

Office	N/A	Manufacturing	N/A
Retail	N/A	Other Industrial	N/A
Warehouse	N/A	Institutional	N/A
Light Industrial	N/A	Agricultural	N/A
Other Commercial (specify)	N/A		
Building Height(s)	N/A		

8. Permits and Approvals Required List all known local, state, and federal permits, approvals, and funding required:

Unit of Government	Type of Application	Status
DNR	Protected Waters Permit	Pending
USACE	Individual Permit (404)	Pending
MPCA	Water Quality Certification (401)	Pending
MPCA	State Disposal System Permit	Pending
MPCA	National Pollutant Discharge Elimination System	Pending
City of Elk River	Conditional Use Permit	Pending

9. Land Use Describe current and recent past land use and development on the site and on adjacent lands. Discuss the compatibility of the project with adjacent and nearby land uses; indicate whether any potential conflicts involve environmental matters. Identify any potential environmental hazards due to past land uses, such as soil contamination or abandoned storage tanks.

Lake Orono is an impoundment of the Elk River, but it has been in its present configuration for nearly all of the last century. The vast majority of the land use surrounding the lake is residential. The improvement to the lake will be beneficial to these properties. Testing of lake sediment supports the fact that environmental hazards due to contaminates is not an issue.

The proposed sediment disposal sites are currently undeveloped with no evidence of past environmental hazards. Sediment disposal is proposed at a shallow enough depth (average of 3 ft.) that it will not hinder the sites future development. Topsoil from the disposal sites will be stripped and replaced and seeded after the sediment is put into place.

10. Cover Type Estimate the acreage of the site with each of the following cover types before and after development (before and after totals should be equal):

	Before	After		Before	After
Types 2 to 8 wetlands	_N/A_	_N/A_	Urban / Suburban Lawn	_.3_	_.3_
Wooded / Forest	_3.9_	_0___	Landscaping		
Brush/Grassland	_15.6_	_19.5_	Impervious Surface	_N/A_	_N/A_
Cropland	_10.1_	_10.1_	Other (describe) LAKE	_61.9_	_61.9_

The crop land is an alfalfa field.

11. Fish, Wildlife, and Ecologically Sensitive Resources

a. Describe fish and wildlife resources on or near the site and discuss how they would be affected by the project. Describe any measures to be taken to minimize or avoid adverse impacts.

The draw down of the lake for the project will be gradual to minimize impacts on aquatic wildlife. A similar draw down was done in 1997 without adverse impacts, as observed by the DNR. The project is also proposed to be done in the fall of the year eliminating concerns regarding nesting waterfowl. The project avoids vegetated areas. The lake is an impoundment of the Elk River, which will continue its normal flow through the lake during the project. Fish and wildlife will be temporarily displaced to the river, but normal lake water levels will be restored prior to freeze-up.

b. Are there any state listed endangered, threatened, or special-concern species; rare plant communities; colonial waterbird nesting colonies; native prairie or other rare habitat; or other sensitive ecological resources on or near the site? _x_ Yes __ No
If yes, describe the resource and how it would be affected by the project. Indicate if a site survey of the resources was conducted. Describe measures to be taken to minimize or avoid adverse impacts.

A search of the DNR Natural Heritage database was conducted and the following sensitive ecological resources were identified near the site:

Rare Community - Oak Forest (Central) Dry Subtype - This community was found in Section 20, Township 33, Range 26, Sherburne County , MN. It is located within one mile of the project, but not within the project boundaries and it will not be affected.

Plant Species of Special Concern - Juniperus Horizontalis - This species was not identified within the project boundaries and will not be affected.

Threatened Species - Blanding's Turtles - There have been four sightings of Blanding's within one mile of Lake Orono. The lake bottom lacks vegetation and the project area does not contain the protected bays where these turtles like to over winter. However, the city will strive to finish the project as soon as possible and bring the lake level back to normal as close to October 1st as possible (when the turtle start looking for winter habitat).

Physical Impacts on Water Resources Will the project involve the physical or hydrologic alteration (dredging, filling, stream diversion, outfall structure, diking, impoundment) of any surface water (lake, pond, wetland, stream, drainage ditch)? _x_ Yes __ No
If yes, identify the water resource to be affected and describe: the alteration, including the construction process; volumes of dredged or fill material; area affected; length of stream diversion; water surface area affected; timing and extent of fluctuations in the water surface elevations; spoils disposal sites; and proposed mitigation measures to minimize impacts.

Lake Orono is proposed to be dredged to restore its historic navigable depth. The lake will be restored to its pre-project boundaries and no wetlands are proposed to be impacted. For further details see #6 - "Description"

13. Water Use

a. Will the project involve the installation or abandonment of any wells? __ Yes _x_ No
For abandoned wells give the location and Unique well number. For new wells, or other previously unpermitted wells, give the location and purpose of the well and Unique well number (if known).

The project will not involve the abandonment of any wells.

b. Will the project require an appropriation of ground or surface water (Including dewatering)?
_x_ Yes __ No
If yes, indicate the source, quantity, duration, purpose of the appropriation, and DNR water appropriation permit number of any existing appropriations. Discuss the impact of the appropriation on ground water levels.

Lake Orono, an impoundment of the Elk River, will be dewatered from 8/1/98 to 10/31/98 to allow for the removal of sediment. The lake is approximately 1,270 ac. ft., but the Elk River will continue to flow through it during the project. The entire project, including the dewatering, will be covered under a single DNR Protected Waters Permit. The USACE and MPCA will also consider the dewatering in their permits.

The effects on ground water from the dewatering will be temporary and in the immediate vicinity of the lake shore. When the lake is brought back to its normal water level ground water levels will also be restored.

c. Will the project require connection to a public water supply? __ Yes _x_ No
If yes, identify the supply, the DNR water appropriation permit number of the supply, and the quantity to be used.

14. Water-related Land Use Management Districts Does any part of the project site involve a shoreland zoning district, a delineated 100-year flood plain, or a federally designated wild or scenic river land use district? _x_ Yes __ No
If yes, identify the district and discuss the compatibility of the project with the land use restrictions of the district.

All of the land adjacent to the lake is in the Shoreland Overlay District, because Lake Orono is a DNR Protected Water. The City of Elk River has adopted the DNR approved Shoreland Ordinance. No shoreland impact zones will be affect by the project and all other aspects of the project are compatible with the Shoreland District's restrictions.

Portions of the disposal sites include land designated as floodfringe. No fill will be placed in the floodway. The project will comply with all floodplain restrictions.

A conditional use permit with DNR review is required by both the City of Elk River's Shoreland and Floodplain Ordinances. An MPCA State Disposal System permit is also required. No land in a Wild and Scenic River District is involved with this project. _

15. Water Surface Use Will the project change the number or type of watercraft on any water body?
__ Yes _x_ No
If yes, indicate the current and projected watercraft usage and discuss any potential overcrowding or conflicts with other users or fish and wildlife resources.

It is not anticipated that as a result of the project the number of watercraft on Lake Orono will increase. However the project will increase the useable area of the lake dispersing the existing use.

16. Soils Approximate depth (in feet) to:
Ground water: minimum _____ average _____ Bedrock: minimum _____ average _____
Describe the soils on the site, giving SCS classifications, if known. (SCS interpretations and soil boring logs need not be attached.)

Disposal sites
Ground water: The minimum and average depth to ground water at the disposal site is greater than 6 feet.
Bedrock: minimum 60 feet average 70 feet.
Soil classifications: The majority of the soil at these sites have SCS Soil classifications of Hubbard loamy sand and Sandberg loamy coarse sand.

Lake
Ground water: The depth to ground water currently is 0 because it is a lake. When the lake is drawn down the depth of ground water will be the elevation of the river or probably lower. No signs of ground water seepage into the lake were observed during past draw downs.
Bedrock: minimum 50 feet average 60 feet
Soil classifications: No SCS classification exist for lake bottom, but the predominate engineering soil classifications are clayey sand with organic clay (SC - SM/SM) and sand with silt (SP-SM).

17. Erosion and Sedimentation Give the acreage to be graded or excavated and the cubic yards of soil to be moved: acres __61.9___ ; cubic yards _115,000_
Describe any steep slopes or highly erodible soils and identify them on the site map.
Describe the erosion and sedimentation measures to be used during and after construction of the project.

No steep slopes are associated with the project on the lake or disposal sites before or after the construction. The lake bottom in the locations of the proposed work is made up of mainly sand and is unlikely to be agitated into suspension. No flushing of sediment was observed during past draw downs of the lake. Best management practices will be adhered to, the details of which are incorporated into the construction plans.

18. Water Quality - Surface Water Runoff

a. Compare the quantity and quality of the site runoff befire and after the project. Describe methods to be used to manage and/or treat runoff.

Water quantity and quality will not change due to the project. Water from the Elk River will be directed away from work areas during construction to safeguard its quality, but it will continue to pass through the lake.

b. Identify the route(s) and receiving water bodies for runoff from the site. Estimate the impacts of the runoff an the quality of the receiving waters. (if the runoff may affect a lake consult "EAW Guidelines" about whether a nutrient budget analysis is needed.)

Lake Orono drains via the Elk River to the Mississippi River, which is approximately one mile away. A negligible increase in water quality may result from the project due to an increase in the lake's volume.

19. Water Quality - Wastewaters

a. Describe sources, quantities, and composition (except for normal domestic sewage) of all sanitary and industrial wastewaters produced or treated at the site.

N/A

b. Describe any waste treatment methods to be used and give estimates of the composition after treatment, or if the project involves on-site sewage systems, discuss the suitability of the site conditions for such systems. Identify receiving waters (including ground water) and estimate the impact of the discharge on the quality of the receiving waters. (if the discharge may affect a lake consult "EAW Guidelines" about whether a nutrient budget analysis is needed.)

N/A

c. If wastes will be discharged into a sewer system or pretreatment system, identify the system and discuss the ability of the system to accept the volume and composition of the wastes. Identify any improvements which will be necessary.
N/A

20. Ground Water - Potential for Contamination

a. Approximate depth (in feet) to ground water:_____ minimum; _____ average.

The minimum and average depth to groundwater at the disposal sites is greater than 6 feet. The depth to ground water for the lake is hard to ascertain because it is an impoundment of surface waters. No ground water seepage back into the lake has been observed during past draw downs so it can be assumed that the natural depth to ground water is the elevation of the Elk River or lower.

b. Describe any of the following site hazards to ground water and also identify them on the site map: sinkholes; shallow limestone formations/karst conditions; soils with high infiltration rates; abandoned or unused wells. Describe measures to avoid or minimize environmental problems due to any of these hazards.
None of the hazards described are of concern with this project.

c. Identify any toxic or hazardous materials to be used or present on the project site and identify measures to be used to prevent them from contaminating ground water.

Core samples, taken as directed by MPCA, indicated no hazardous substances present in the lake sediment. Typical fuels associated with construction equipment will be used. The contractor who is hired will be required to submit a spill prevention and counter control plan for approval.

21. Solid Wastes; Hazardous Wastes; Storage Tanks

a. Describe the types, amounts, and composition of solid or hazardous wastes to be generated, including animal manures, sludges and ashes. Identify the method and location of disposal. For projects generating municipal solid waste indicate if there will be a source separation plan; list type(s) and how the project will be modified to allow recycling.

N/A

b. Indicate the number, location, size, and use of any above or below ground tanks to be used for storage of petroleum products or other materials (except water).

The project does not involve the storage of any products.

22. Traffic

Parking spaces added _N/A__ Existing spaces (if project involves expansion) _N/A__ Estimated total Average Daily Traffic (ADT) generated __N/A_ Estimated maximum peak hour traffic generated (if known) and its timing _____N/A_____.
Provide an estimate of the impact on traffic congestion on the affected roads and describe any traffic improvements which will be necessary.

N/A

23. Vehicle-Related Air Emissions Provide an estimate of the effect of the project's traffic generated on air quality, including carbon monoxide levels. Discuss the effect of traffic improvements or other mitigation measures on air quality impacts. (if the project involves 500 or more parking spaces, consult "EAW Guidelines" about whether a detailed air quality analysis is needed.)

N/A

24. Stationary Source Air Emissions Will the project involve any stationary sources of air emissions (such as boiler or exhaust stacks)? ____ Yes __x__ No
If yes, describe the source, quantities, and composition of the emissions; the proposed air pollution control devices; the quantities and composition of the emissions after treatment; and the effects on air quality.

N/A

25. Will the project generate dust, odor, or noise during construction and/or operation? _x_Yes ___No

If yes, describe the sources, characteristics, duration, and quantities or intensity, and any proposed measures to mitigate adverse impacts. Also identify the locations of sensitive receptors in the vicinity and estimate the impacts on these receptors.

Noise: Typical construction noise is expected, but no sensitive receptors are in the immediate project area. The city will enforce its normal hours for construction of 7:00 a.m. to 7:00 p.m. Monday through Saturday.

Dust: Even with the lake dewatered there should be enough moisture content left in the sediment that dust will not be a problem. The city will include a clause in the specifications for the project that watering as needed is required to hold dust down. Water for this is readily available at the project site from the Elk River.

26. Are any of the following resources on or in proximity to the site:

a. archeological, historical, or architectural resources? _____ Yes __x__ No

b. prime or unique farmland? _____ Yes __x__ No

c. designated parks, recreation areas, or trails? __x__ Yes _____ No

d. scenic views and vistas? __x__ Yes _____ No

e. other unique resources _____ Yes __x__ No

If any items are answered **Yes**, describe the resource and identify any impacts on the resources due to the project. Describe any measures to be taken to minimize or avoid adverse impacts.

A query of the Minnesota State Historic Preservation Office revealed no archeological, historical, or architectural resources that will be affected by the project.

City owned Orono Beach Park is on Lake Orono, but it is not on a lobe of the lake where construction activities are proposed. The timing of the project, late in the swimming season, should help minimize the impact.

The lake itself could be considered a scenic view. However, the project is to benefit the lake and will not ultimately effect the aesthetics.

27. Will the project create adverse visual impacts? (Examples include: glare from intense lights; lights visible in wilderness areas; and large visible plumes from cooling towers or exhaust stacks.

___ Yes _x_ No

If yes, explain.

28. Compatibility with Plans Is the project subject to an adopted local comprehensive land use plan or any other applicable land use, water, or resource management plan of a local, regional, state, or federal agency? _x__ Yes ____ No

If yes, identify the applicable plan(s), discuss the compatibility of the project with the provisions of the plan(s), and explain how any conflicts between the project and the plan(s) will be resolved. If no, explain.

The City of Elk River's comprehensive plan, which includes a master park plan, recognizes the lake as a resource for the community both economically and recreationally. A project that improves the lake is compatible with these plans.

Lake Orono is also subject to Sherburne County's "Comprehensive Water Plan". A representative from the Sherburne County Soil and Water Conservation District has been involved with the project from the beginning and actually assisted in the Lake study that preceded the project. The project is consistent with the county's comprehensive water plan.

29. Impacts on Infrastructure and Public Services Will new or expanded utilities, roads, other infrastructure, or public services be required to serve the project? ____ Yes _x__ No
If yes, describe the new or additional infrastructure / services needed. (Any infrastructure that is a " connected action" with respect to the project must be assessed in this EAW; see "EAW Guideline" for details.)

N/A

30. Related Developments; Cumulative Impacts

a. Are future stages of this development planned or likely? ____ Yes _x__ No
If yes, briefly describe future stages, their timing, and plans for environmental review.

b. Is this project a subsequent stage of an earlier project? ____ Yes __x_ No
If yes, briefly describe the past development, its timing, and past environmental review.

c. Is other development anticipated on adjacent lands or outlots? __x_ Yes ____ No
If yes, briefly describe the development and its relationship to the present project.

d. If a, b, or c were marked **Yes**, discuss any cumulative environmental impacts resulting from this project and the other development.

The proposed lake improvement project is not a "phased action" or "connected action" with any other project or development. However, with or without the lake project, development of the few remaining vacant parcels adjacent to the lake is anticipated in the near future.

The shallow depth of sediment (3 foot average except for berms erected as sound barriers) should not hinder development on the disposal sites. The sediment to be disposed of has been analyzed for organic matter. Soils high in organic material will not be used in locations where footings are likely. The core samples taken indicate that hazardous substances in the sediment from the lake is not a concern.

31. Other Potential Environmental Impacts If the project may cause any adverse environmental impacts which were not addressed by items 1 to 28, identify and discuss them here, along with any proposed mitigation.

None

32. Summary of issues (This section need not be completed if the EAW is being done for EIS scoping; instead, address relevant issues in the draft Scoping Decisions document which must accompany the EAW.) List any impacts and issues identified above that may require further investigation before the project is commenced. Discuss any alternatives or mitigative measures that have been or may be considered for these impacts and issues, including those that have been or may be ordered as permit conditions.

The city is proposing to direct the flow of the Elk River through Lake Orono away from the construction activities. The specific of how this is accomplished will be reviewed and approved by the DNR through their Protected Waters Permit.

With the proposed draw down of the lake, it is anticipated that individuals will request permits for projects that fall below the Ordinary High Water mark. The DNR has requested the city's assistance in compiling and coordinating these individual projects.

A study of the wetland inventory map and aerial photos, site visits, and discussions with the property owners, do not reveal any wetlands on the sediment disposal sites. This will be field verified as soon as conditions permit in the spring. Under no circumstance will sediment be placed in a wetland.

CERTIFICATION BY THE RGU (all 3 certifications must be signed for EQB acceptance of the EAW for publication of notice in the EQB Monitor)

a. I hereby certify that the information contained in this document is accurate and complete to the best of my knowledge.

Signature Stephen Robb

b. I hereby certify that the project described in this EAW is the complete project and there are no other projects, project stages, or project components, other than those described in this document, which are related to the project as "connected actions" or "phased actions," as defined, respectively, at Minn. Rules, pts. 4410.0200, subp. 9b and subp. 60.

Signature Stephen Robb

c. I hereby certify that copies of the completed EAW are being sent to all points on the official EQB EAW distribution list.

Signature Stephen Robb

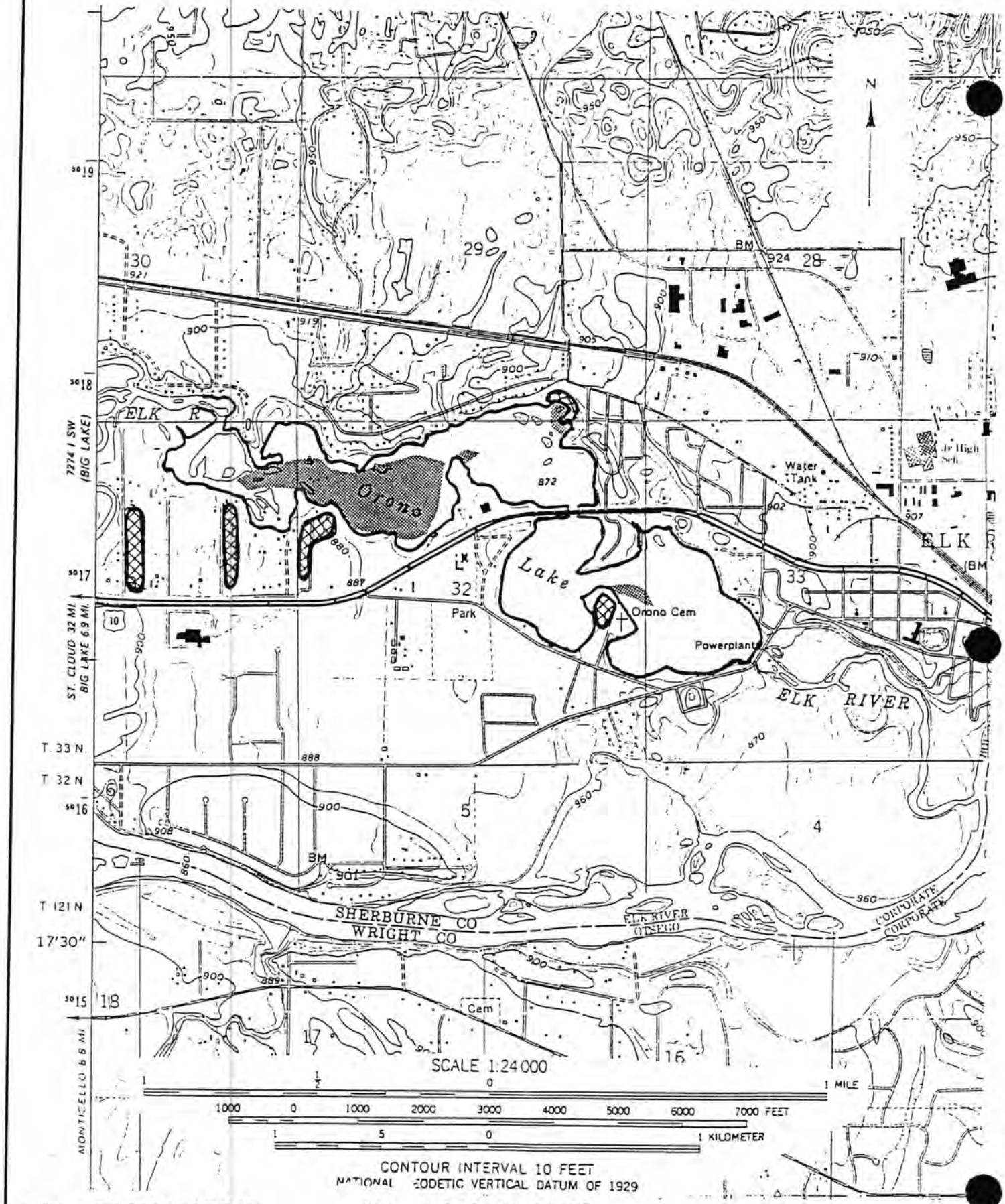
Title of signer BUILDING & ZONING ADM. CITY OF ELK RIVER Date 2/13/98

NORTH PART CITY OF

ELK RIVER

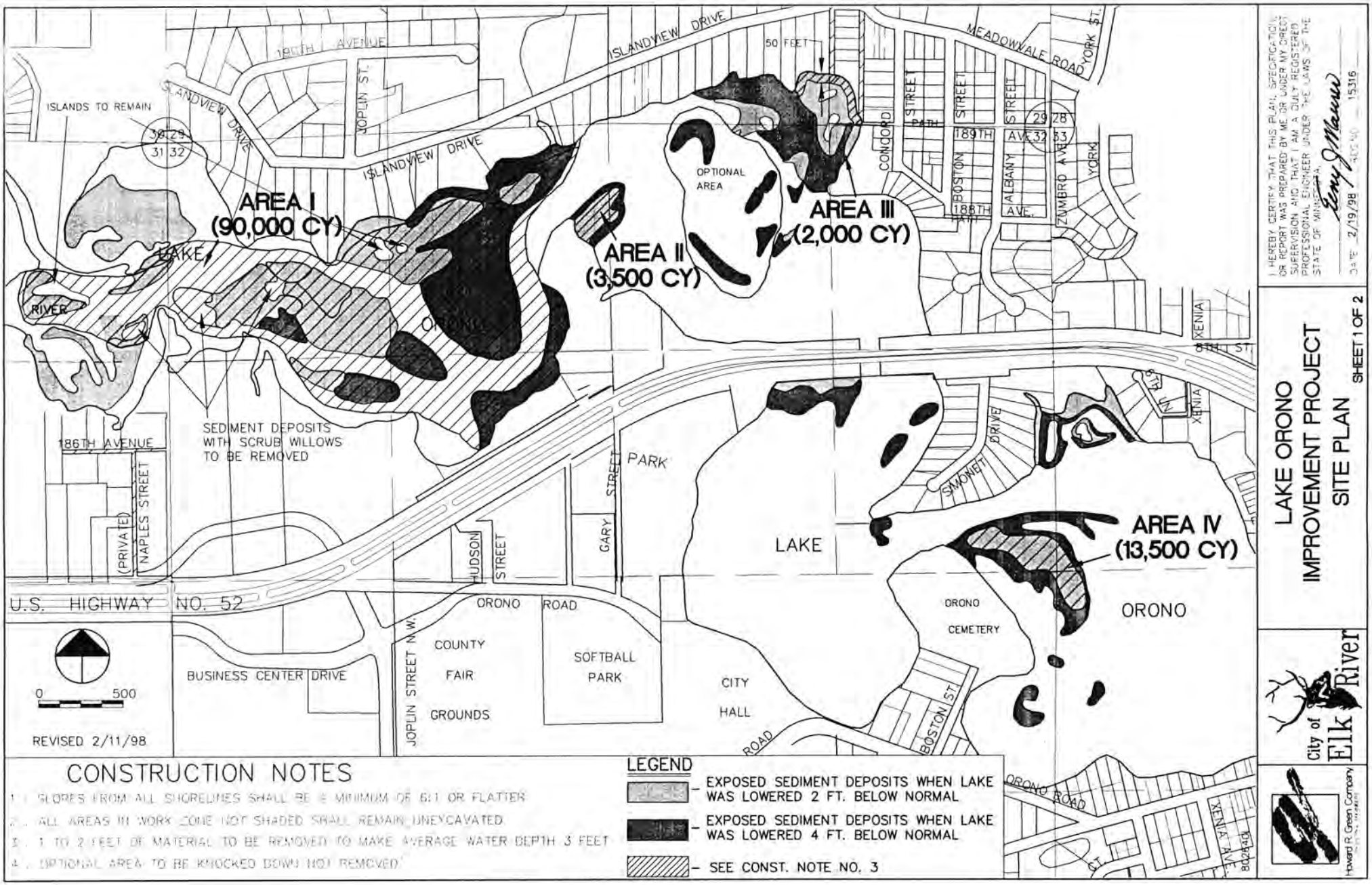
T.33N.–R.26W.

LAKE ORONO IMPROVEMENT PROJECT

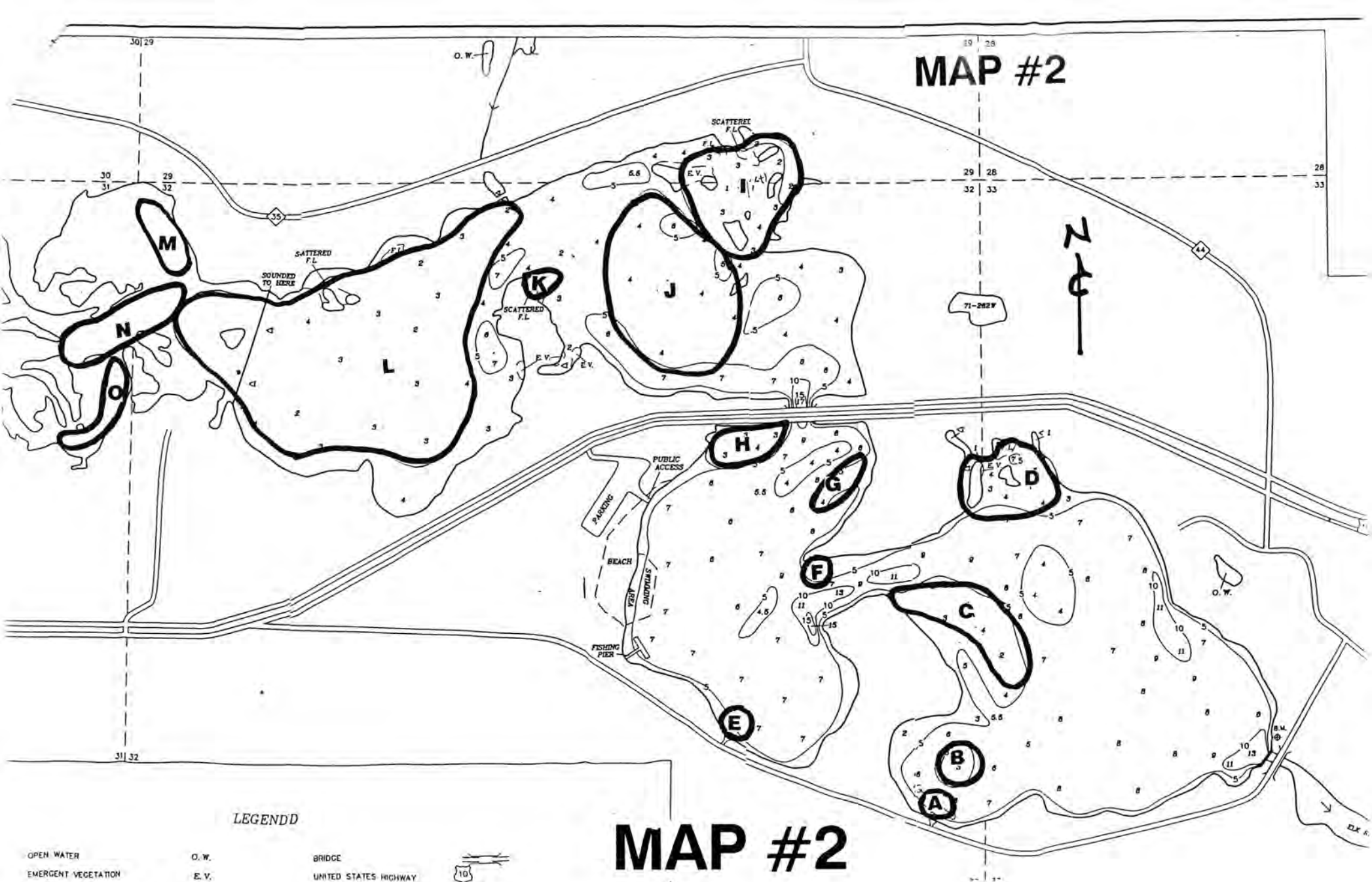


- DREDGE AREAS - DISPOSAL SITES

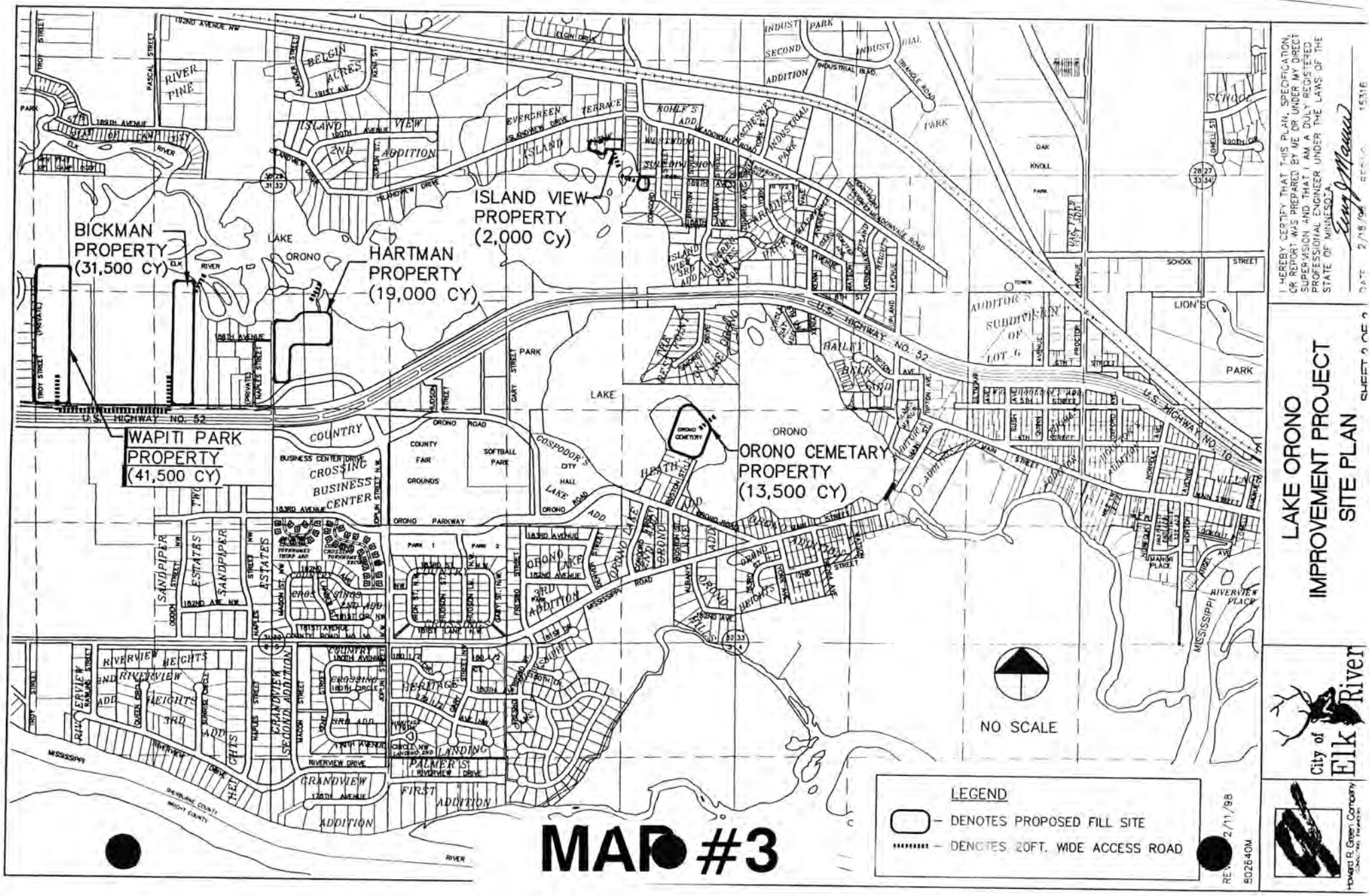
CITY OF ELK RIVER	Wenck Associates, Inc. 1800 Pioneer Creek Ctr. Environmental Engineers Maple Plain, MN 55359	OCT 1997
Site Location Map		Figure 1


ISLANDS TO REMAIN
ISLANDVIEW DRIVE
190TH AVENUE
JOPLIN ST.
50 FEET
MEADOWVALE ROAD
YORK ST.
CONCORD STREET
189TH STREET PATH
BOSTON STREET
ALBANY AVE.
ZUMBRO AVE.
YORK
188TH PATH
OPTIONAL AREA
AREA I
(90,000 CY)
AREA II
(3,500 CY)
AREA III
(2,000 CY)
AREA IV
(13,500 CY)
LAKE
RIVER
ORONO
XENIA
8TH ST.
SEDIMENT DEPOSITS
WITH SCRUB WILLOWS
TO BE REMOVED
186TH AVENUE
(PRIVATE)
NAPLES STREET
PARK
GARY STREET
HUDSON STREET
SIMONET DRIVE
8TH LN.
U.S. HIGHWAY NO. 52
ORONO ROAD
JOPLIN STREET N.W.
COUNTY FAIR GROUNDS
SOFTBALL PARK
CITY HALL
ORONO CEMETERY
BUSINESS CENTER DRIVE
BOSTON ST.
0
500
REVISED 2/11/98
CONSTRUCTION NOTES
1. SLOPES FROM ALL SHORELINES SHALL BE A MINIMUM OF 6:1 OR FLATTER
2. ALL AREAS IN WORK ZONE NOT SHADED SHALL REMAIN UNEXCAVATED
3. 1 TO 2 FEET OF MATERIAL TO BE REMOVED TO MAKE AVERAGE WATER DEPTH 3 FEET
4. OPTIONAL AREA TO BE KNOCKED DOWN NOT REMOVED
LEGEND
– EXPOSED SEDIMENT DEPOSITS WHEN LAKE WAS LOWERED 2 FT. BELOW NORMAL
– EXPOSED SEDIMENT DEPOSITS WHEN LAKE WAS LOWERED 4 FT. BELOW NORMAL
– SEE CONST. NOTE NO. 3
I HEREBY CERTIFY THAT THIS PLAN, SPECIFICATION, OR REPORT WAS PREPARED BY ME OR UNDER MY DIRECT SUPERVISION AND THAT I AM A DULY REGISTERED PROFESSIONAL ENGINEER UNDER THE LAWS OF THE STATE OF MINNESOTA.
Terry O'Marra
DATE 2/19/98 REG. NO. 15316
LAKE ORONO IMPROVEMENT PROJECT
SITE PLAN
SHEET 1 OF 2
City of Elk River
Howard R. Green Company

MAP #1


MAP #2
LEGENDD
OPEN WATER
O. W.
EMERGENT VEGETATION
E. V.
BRIDGE
UNITED STATES HIGHWAY
SCATTERED F.L.
SOUNDED TO HERE
PUBLIC ACCESS
PARKING
BEACH
FISHING PIER
71-2828
A
B
C
D
E
F
G
H
J
K
L
M
N
O

MAP #2



I HEREBY CERTIFY THAT THIS PLAN, SPECIFICATION, OR REPORT WAS PREPARED BY ME OR UNDER MY DIRECT SUPERVISION AND THAT I AM A DULY REGISTERED PROFESSIONAL ENGINEER UNDER THE LAWS OF THE STATE OF MINNESOTA

Gary J. Maus 15316

DATE 2/18/98

LAKE ORONO IMPROVEMENT PROJECT SITE PLAN

SHEET 2 OF 2

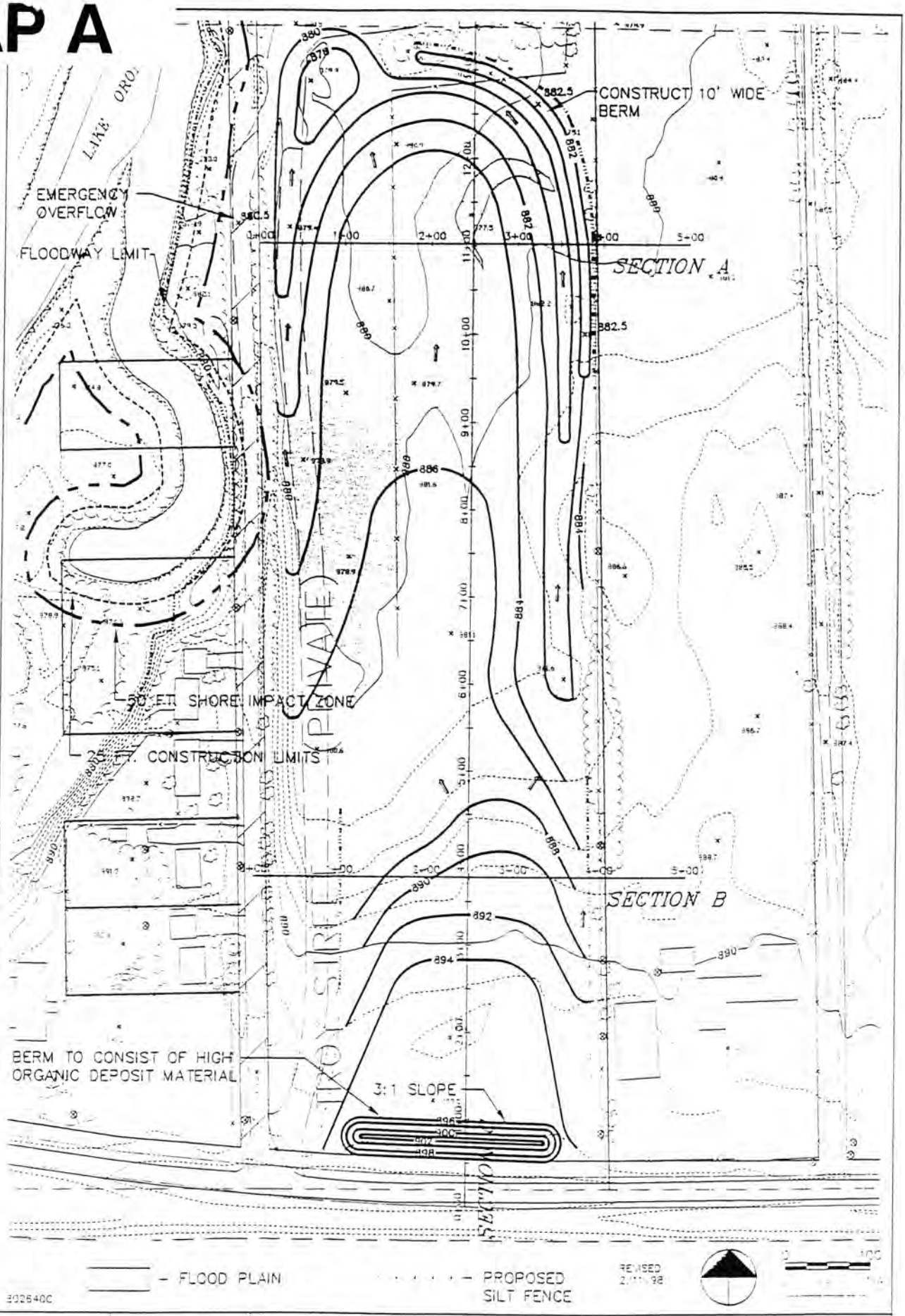
City of Elk River

Howard R. Green Company

REV. 2/11/98

902640M

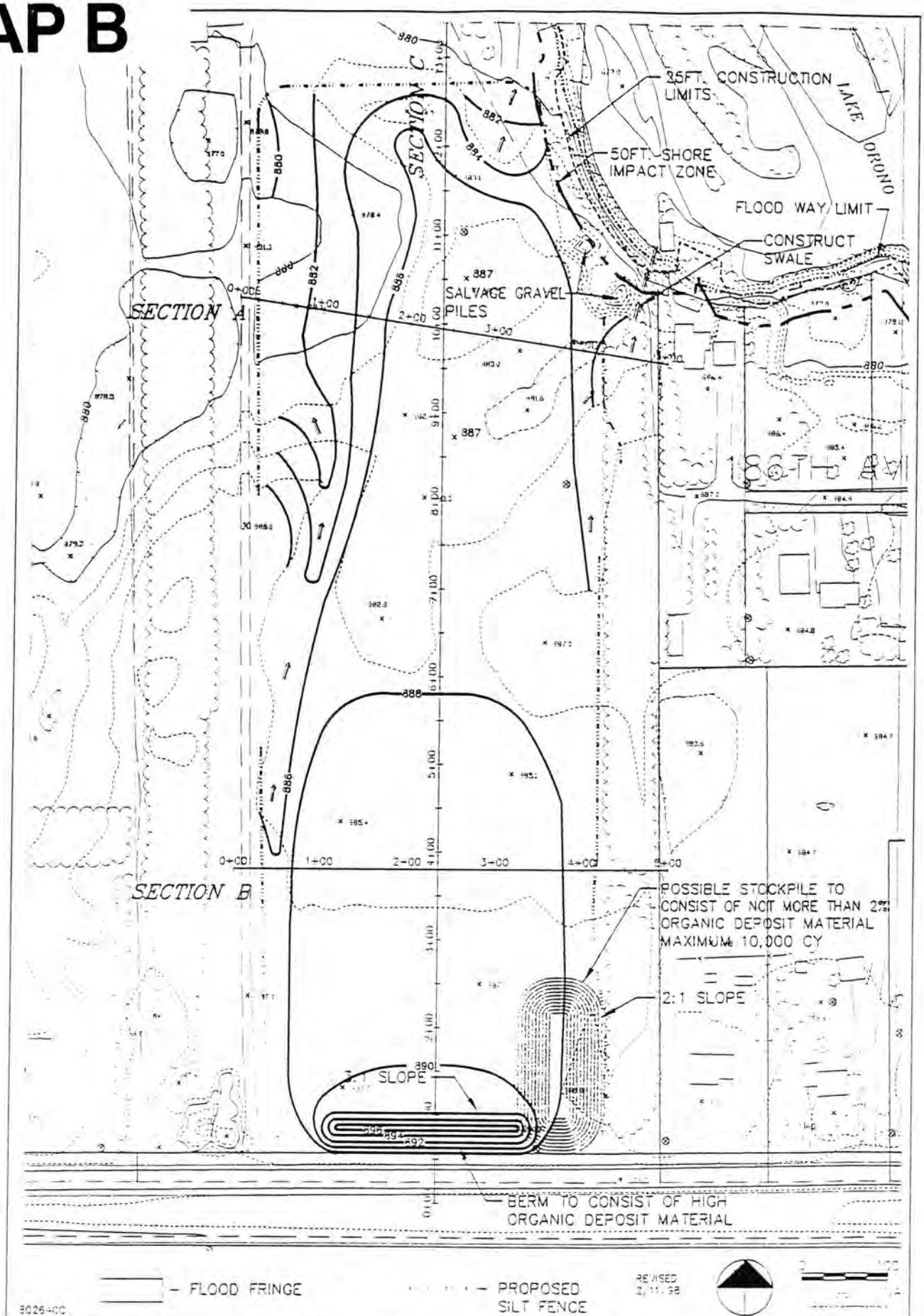
MAP A



City of Elk River

DREDGING DEPOSIT EXHIBIT
WAPITI PARK CAMP GROUND
1 OF 2

MAP B

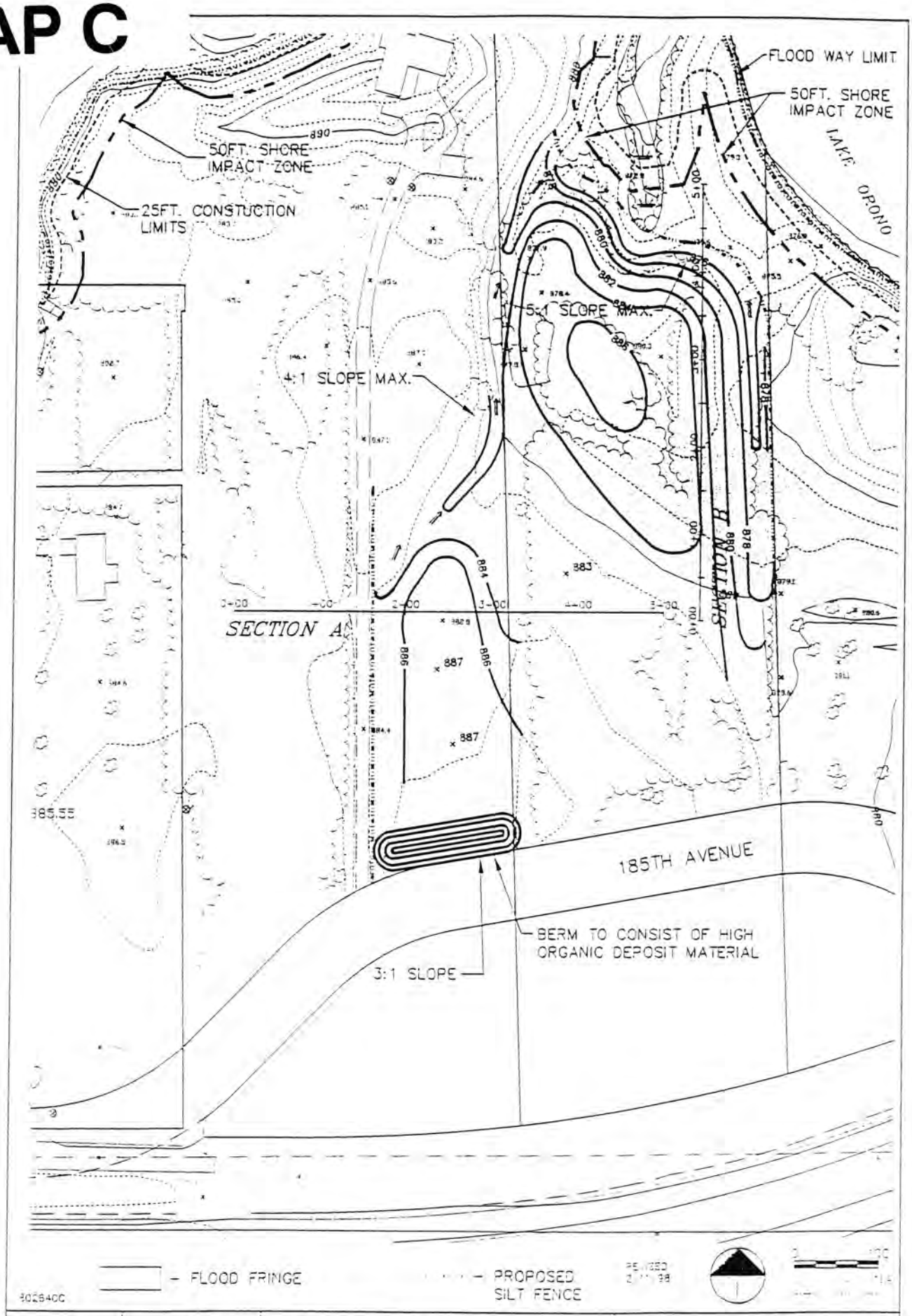


Howard R Green Company

City of Elk River

DREDGING DEPOSIT EXHIBIT
BICKMAN PROPERTY
1 OF 2

MAP C

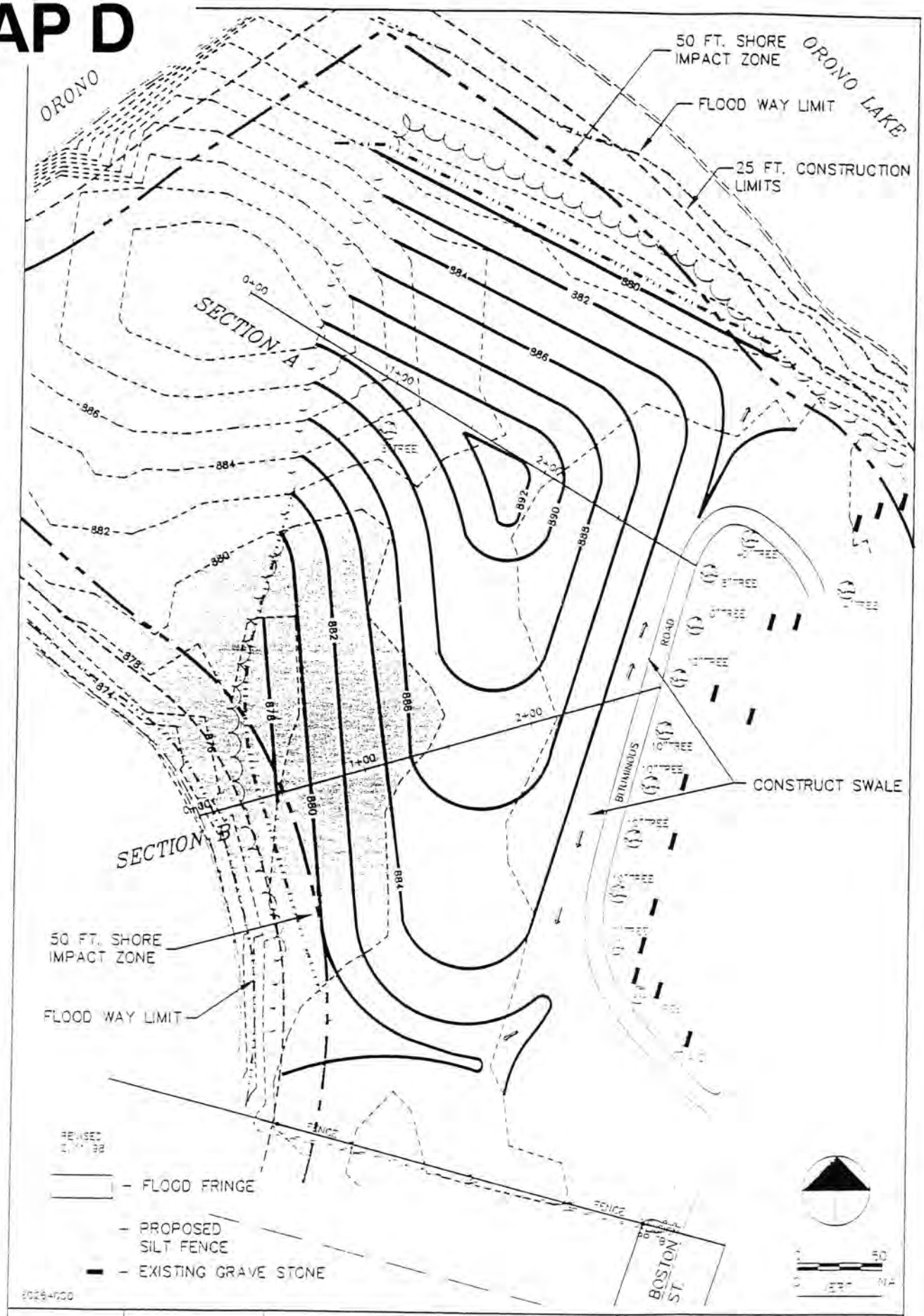


Howard R. Green Company

City of Elk River

DREDGING DEPOSIT EXHIBIT
HARTMAN PROPERTY
1 OF 2

MAP D



Howard R. Green Company

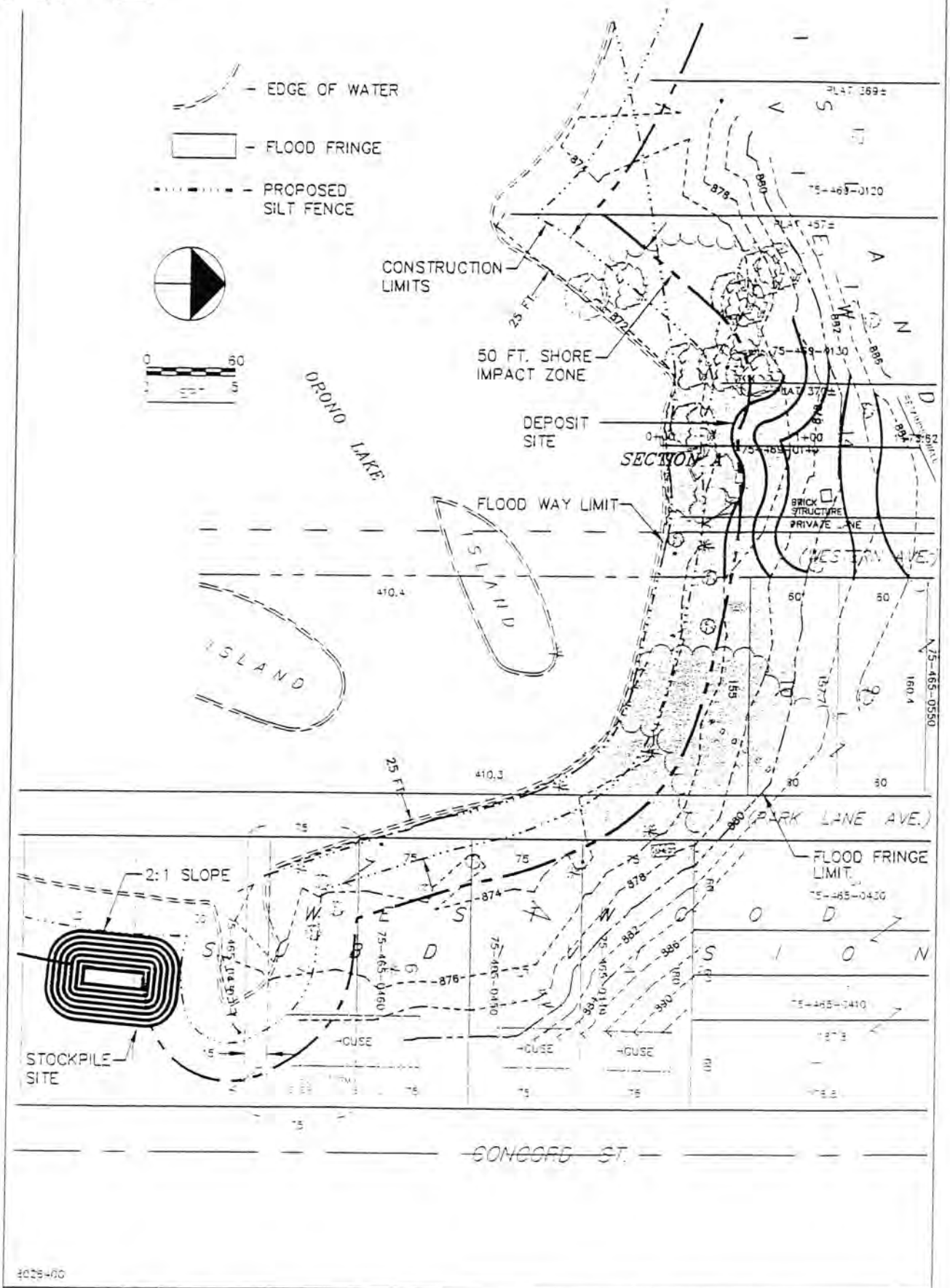
City of Elk River

DREDGING DEPOSIT EXHIBIT
ORONO CEMETARY
1 OF 2

I HEREBY CERTIFY THAT THIS PLAN, SPECIFICATION, OR REPORT WAS PREPARED BY ME OR UNDER MY DIRECT SUPERVISION AND THAT I AM A DULY REGISTERED PROFESSIONAL ENGINEER UNDER THE LAWS OF THE STATE OF MINNESOTA.

DATE 7-19-08 REG. NO. 15718

MAP E



3029400

Howard R. Green Company

City of Elk River

DREDGING DEPOSIT EXHIBIT
ISLAND VIEW PROPERTY
1 OF 2

FIGURE #1

ESTIMATED PROJECT COST

Excavate 90,000 CY from **Area L** making majority of this area between 3 and 4 feet deep.	$279,000
Excavate **Area K** to a minimum depth of 3 feet (3,500 CY)	$10,800
Excavate **Area C** to a minimum depth of 3 feet (13,500 CY)	$22,950
Excavate channel & sedimentation basin in **Area I** (2,000 CY trucked to a site away from the lake)	$18,800
Site preparation and disposal **Site #1** (25,000 CY)	$32,000
Site preparation and disposal **Site #2** (43,560 CY)	$57,545
Site preparation and disposal **Site #3** (14,500 CY)	$19,315
Site preparation and disposal **Site #4** (13,500 CY)	$18,090
Trucking to Site #1	$77,500
River diversion	$50,000
	$586,000
Plus 28% overhead	$164,080
	$750,080

This option should last for 30 years; a reasonable amount of time. In addition, it provides a direct benefit to all portions of the lake and addresses all of the areas recommended as priorities.

If Site #1 can be utilized without reloading material into on-road trucks, the total cost for this option can be reduced by approximately $100,000 including overhead. Staff feels overhead in general can be reduced.

FIGURE #2

LAKE ORONO IMPROVEMENT PROJECT TIME LINE

January 1998

- Determination of wetlands on disposal sites, with property owner's permission, by Natural Resources Conservation Service (NRCS).
- January 7 meeting with permitting governmental agencies.
- Preliminary assessment role (equivalency units) by January 15 meeting.
- State Disposal Systems permit (SDS) submitted to the Minnesota Pollution Control Agency (MPCA) - (180 days).
- Funding from Sherburne County sought.

February

- Protected Waters permit submitted to the Minnesota Department of Natural Resources (DNR) - (45 days).
- U.S. Army Corps of Engineer (USACE) permit submitted - (60 to 120 days).
- 401 Water Quality Certification submitted to MPCA - (60-120 days).
- Environmental Assessment Worksheet (EAW) submitted to appropriate agencies - (approximately 60 days).
- National Pollutant Discharge Elimination System
- +-+permit (NPDES) submitted to MPCA - (permit immediate after submittal).
- Feasibility Study ordered by the City Council on 2/16/98.

March

- Feasibility received by City Council and Public Hearing ordered on 3/2/98.

April

- Public Hearing held and plans and specifications ordered by City Council on 4/13/98.
- Special Projects and Challenge Grant applications to repair erosion at Orono Cemetery submitted.

May

- Plans and Specifications approved and bids authorized by the City Council on 5/4/98.
- Bids advertised for 21 days.
- EAW process is completed.

June

- USACE permit issued.
- MPCA 401 Water Quality Certification completed.
- Bids presented to City Council and Assessment Hearing ordered on 6/1/98.
- Assessment Hearing Held on 6/29/98 - (30 day appeal period).
- DNR Protected Waters permit issued

July

- MPCA SDS permit issued.
- Special Projects and Challenge Grants awarded.

August

- City Council awards contract on 8/3/98.
- Lake is drained early in the month.
- Start construction on 8/17/98.

September

October

- Project completed by 10/31/98.

June

- USACE permit issued.
- MPCA 401 Water Quality Certification completed.
- Bids presented to City Council and Assessment Hearing ordered on 6/1/98.
- Assessment Hearing Held on 6/29/98 - (30 day appeal period).
- DNR Protected Waters permit issued

July

- MPCA SDS permit issued.
- Special Projects and Challenge Grants awarded.

August

- City Council awards contract on 8/3/98.
- Lake is drained early in the month.
- Start construction on 8/17/98.

September

October

- Project completed by 10/31/98.

MINNESOTA HISTORICAL SOCIETY

March 6, 1998

City of Elk River
Attn: Stephen Rohlf
13065 Orono Parkway
P.O. Box 490
Elk River, MN 55330

Re: EAW; Lake Orono Improvement Project
Sherburne County
SHPO Number: 98-1491

Dear Mr. Rohlf:

Thank you for providing this office with a copy of the Environmental Assessment Worksheet for the above-referenced project. It has been reviewed pursuant to responsibilities given to the Minnesota Historical Society by the Minnesota Historic Sites Act and the Minnesota Field Archaeology Act and through the process outlined in Minnesota Rules 4410.1600.

The response to question 26a indicates that no cultural resources will be affected. Some clarification on this point is needed.

No previously identified archaeological sites are located in the area proposed for dredging. However, we believe that two of the areas proposed for placement of the dredge spoil (the areas identified in the SE quarter of Section 29 and the SE quarter of Section 32 as indicated on Figure 1 of the EAW) do have significant potential for archaeological sites. Therefore, we recommend that an archaeological survey of these areas be completed. The survey must meet the requirements of the Secretary of the Interior's Standards for Identification and Evaluation, and should include an evaluation of National Register eligibility for any properties which are identified. For your information, we have enclosed a list of consultants who have expressed an interest in undertaking such surveys.

If the areas can be documented as previously disturbed or previously surveyed, we will re-evaluate the need for survey. Previously disturbed areas are those where the naturally occurring post-glacial soils and sediments have been recently removed. Any previous survey work must meet contemporary standards.

If you have any questions on our review of this project, please contact me at 612-296-5462.

Sincerely,

Dennis A. Gimmestad
Government Programs and Compliance Officer

Enclosure: List of Consultants